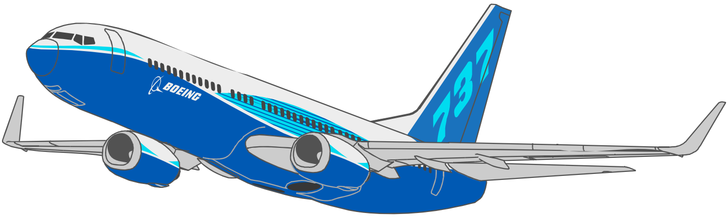
Control Number:
(受控号)



737-700/-800

Flight Crew Operations Manual

Xiamen Airlines

Volume 1
（第一册）

Document Number D6-27370-75C-XIA
Revision Number: 40b
Revision Date: March 20, 2018

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Volume 1

Volume 2

General

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

Configuration data reflects the airplane as delivered configuration and is updated for service bulletin incorporations in conformance with the policy stated in the introduction section of this chapter.

Serial and tabulation number are supplied by Boeing.

Registry Number	Serial Number	Tabulation Number
B-2998	29042	YA701
B-2999	29084	YA702
B-2991	29085	YA703
B-2992	29086	YA704
B-2658	30512	YA705
B-2659	30513	YA706
B-5029	30634	YA707
B-5028	30034	YA708
B-5038	30656	YA709
B-5039	28258	YA710
B-5552	37425	YF048
B-5551	36697	YF049
B-5511	37576	YF921
B-5512	37577	YF922
B-5528	37578	YF923
B-5529	37150	YF924
B-5532	37151	YF925
B-5533	37152	YF926

Registry Number	Serial Number	Tabulation Number
B-5535	37579	YF927
B-5566	37153	YF928
B-5151	34255	YK622
B-5152	34256	YK623
B-5308	32687	YK624
B-5309	32689	YK625
B-5382	36540	YK626
B-5383	35631	YK627
B-5386	35634	YK628
B-5385	35633	YK629
B-5388	35635	YK630
B-5159	35044	YK961
B-5160	35045	YK962
B-5161	35046	YK963
B-5162	35047	YK964
B-5301	35048	YK965
B-5302	35049	YK966
B-5318	30723	YK967
B-5303	35050	YK968
B-5305	35051	YK969
B-5306	35052	YK970
B-5307	35053	YK971
B-5459	35057	YK973
B-5458	35055	YK974
B-5476	35056	YK975
B-5488	37148	YK976
B-5489	37149	YK977

Registry Number	Serial Number	Tabulation Number
B-5487	35058	YK978
B-5498	37574	YK979
B-5499	37575	YK980
B-5319	35102	YL076
B-5355	35104	YL077
B-5389	35636	YL541
B-5432	35641	YL542
B-5433	35642	YL543
B-5435	35644	YL544
B-5563	38012	YL545
B-5565	38015	YL546
B-5595	38017	YL547
B-5603	38020	YL548
B-5605	38022	YL549
B-5602	36824	YL550
B-5601	36823	YL551
B-5216	34026	YM482
B-5218	34027	YM483
B-5219	34028	YM484
B-5277	38381	YN531
B-5279	38384	YN532
B-5278	38383	YN533
B-5280	38385	YN534
B-5630	38386	YS151
B-5631	38387	YS152
B-5632	38388	YS153
B-5633	38389	YS154

Registry Number	Serial Number	Tabulation Number
B-5635	38390	YS155
B-5653	38391	YS156
B-5655	38392	YS157
B-5656	38393	YS158
B-5657	38394	YS159
B-5659	38396	YS160
B-5658	38395	YS166
B-5706	38398	YS168
B-5708	38403	YS169
B-5707	38399	YS170
B-5751	38400	YS171
B-5752	38404	YS172
B-5750	38380	YS173
B-5788	38382	YS174
B-5789	38401	YS175
B-5790	38402	YS176
B-5791	39930	YS177
B-5845	39931	YS178
B-1911	39907	YS179
B-1912	39908	YS180
B-1913	39900	YS181
B-1915	39901	YS182
B-1970	39903	YS183
B-1969	39902	YS184
B-1971	39904	YS185
B-1706	39905	YS186
B-1708	39911	YS187

Registry Number	Serial Number	Tabulation Number
B-1707	39906	YS188
B-1709	39912	YS189
B-1749	39909	YS190
B-5792	41790	YS191
B-5846	41791	YS192
B-5688	41792	YS193
B-5847	41793	YS194
B-1966	39910	YT501
B-6485	39913	YT502
B-6483	39918	YT503
B-6482	41391	YT504
B-6487	39919	YT505
B-6486	41395	YT506
B-1964	39914	YT507
B-6489	39915	YT508
B-6490	41392	YT509
B-6488	41396	YT510
B-6818	39916	YT511
B-6819	39917	YT512
B-6849	40959	YT513
B-6842	40957	YT514
B-7176	41393	YT515
B-7177	41394	YT516
B-7179	40960	YT517
B-7178	40958	YT518
B-7195	43885	YT519
B-7196	43886	YT520

Registry Number	Serial Number	Tabulation Number
B-7560	43887	YT521
B-6887	43884	YV604
B-6889	43914	YV605
B-7197	42925	YV741
B-7557	42926	YV742
B-7558	42927	YV743
B-7559	42928	YV744
B-7847	42930	YV745
B-7846	42929	YV746
B-7848	42931	YV747
B-7849	42932	YV748
B-1557	42933	YV749
B-1550	42934	YV750
B-1558	42935	YV751
B-1579	42936	YV752
B-1580	42937	YV753
B-7816	42938	YV754

Preface Chapter 0

Introduction Section 2

General

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

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

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

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

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

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

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

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

Organization

The FCOM is organized in the following manner.

Volume 1

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

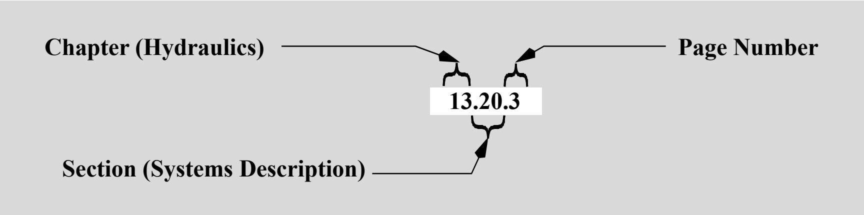
Volume 2 – Chapters 1 through 15 contain general airplane and systems information. These chapters are generally subdivided into sections covering controls and indicators and systems descriptions.

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

Page Numbering

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

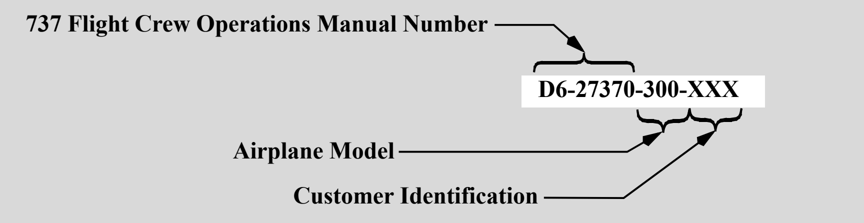
Example Page Number



Page Identification

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

Example Page Identification



Warnings, Cautions, and Notes

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

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

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

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

Flight Crew Operations Manual Configuration

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

Customer Configured Airplane Effectivity

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

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

Example (with subordinate items):

YZ008 - YZ014
Tail skid ....Check

Verify that the tail skid is not damaged.

Horizontal stabilizer and elevator ....Check

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

Example (without subordinate items):

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

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

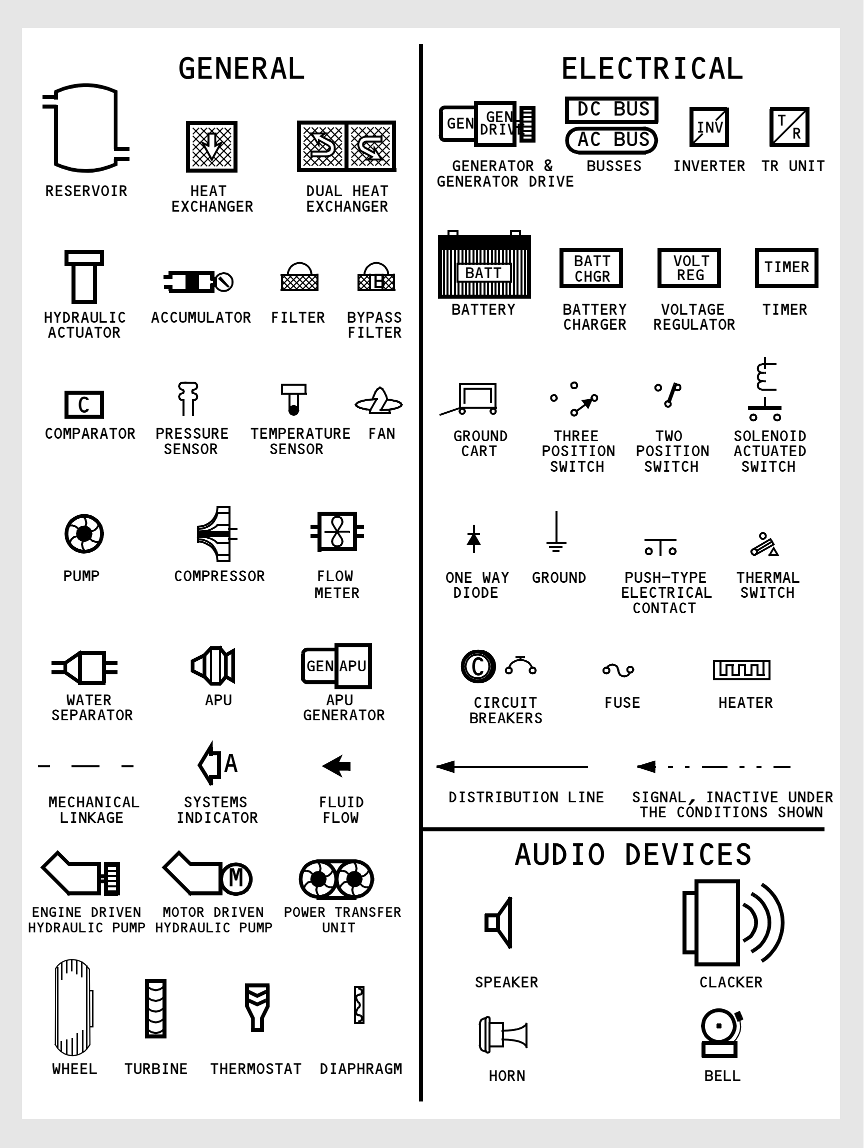
When airplane effectivities are centered immediately below a checklist title, the entire checklist applies to the listed airplanes. In the following example, the PACK checklist is applicable to YZ008 - YZ014 only:

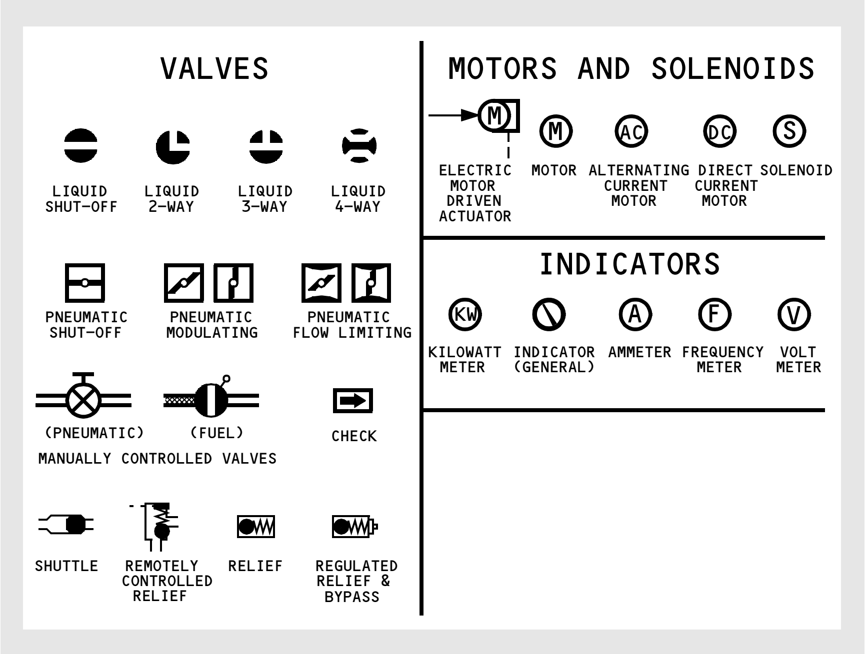
PACK

YZ008 - YZ014

Schematic Symbols

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




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

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General

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

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

BCRS	Back Course
BRT	Bright
BTL DISCH	Bottle Discharge (fire extinguishers)
C	
C	Captain Celsius Center
CAA/JAA	Civil Aviation Authority/Joint Aviation Authority
CANC/ RCL	Cancel/Recall
CB	Circuit Breaker
CDU	Control Display Unit
CG	Center of Gravity
CHKL	Checklist
CLB	Climb
COMM	Communication
CON	Continuous
CONFIG	Configuration
CRZ	Cruise
CTL	Control
D	
DC	Direct Current
DEP ARR	Departure Arrival
DES	Descent
DISC	Disconnect
DME	Distance Measuring Equipment
DPC	Display Processing Computer
DSPL	Display

E	
E/D	End of Descent
E/E	Electrical and Electronic
ECS	Environmental Control System
EEC	Electronic Engine Control
EFIS	Electronic Flight Instrument System
EGPWS	Enhanced Ground Proximity Warning System
EGT	Exhaust Gas Temperature
ELEC	Electrical
ELEV	Elevator
ENG	Engine
EXEC	Execute
EXT	Extend
F	
F	Fahrenheit
F/D or FLT DIR	Flight Director
F/O	First Officer
FAF	Final Approach Fix
FAP	Final Approach Point
FCTL	Flight Control
FCTM	Flight Crew Training Manual
FFM	Force Fight Monitor
FL	Flight Level
FMC	Flight Management Computer

FMS	Flight Management System
FPA	Flight Path Angle
FPV	Flight Path Vector
FSEU	Flap Slat Electronic Unit
G	
G/S	Glide Slope
GA	Go-Around
GEN	Generator
GPS	Global Positioning System
GPWS	Ground Proximity Warning System
H	
HDG	Heading
HDG REF	Heading Reference
HDG SEL	Heading Select
HPA	Hectopascals
HUD	Head-Up Display
HYD	Hydraulic
I	
IAN	Integrated Approach Navigation
IAS	Indicated Airspeed
IDENT	Identification
ILS	Instrument Landing System
IN	Inches
INBD	Inboard
IND LTS	Indicator Lights
INOP	Inoperative
INTC CRS	Intercept Course

ISFD	Integrated Standby Flight Display
ISLN	Isolation
K	
K	Knots
KGS	Kilograms
L	
L	Left
LAM	Landing Attitude Modifier
LAT	Latitude
LBS	Pounds
LDG ALT	Landing Altitude
LE	Leading Edge
LIM	Limit
LNAV	Lateral Navigation
LOM	Locator Outer Marker
LONG	Longitude
LVL CHG	Level Change
M	
MAG	Magnetic
MAN	Manual
MCAS	Maneuver Characteristics Augmentation System
MCP	Mode Control Panel
MDA	Minimum Descent Altitude
MDS	MAX Display System
MEL	Minimum Equipment List
MIN	Minimum
MKR	Marker

MLA	Maneuver Load Alleviation Augmentation System
MMO	Maximum Mach Operating Speed
MOD	Modify
MTRS	Meters
N	
N1	Low Pressure Rotor Speed
N2	High Pressure Rotor Speed
NAV RAD	Navigation Radio
ND	Navigation Display
NGS	Nitrogen Generation System
NM	Nautical Miles
NORM	Normal
NPS	Navigation Performance Scales
O	
OHU	Overhead Unit
OVHD	Overhead
OVRD	Override
P	
PASS	Passenger
PCU	Power Control Unit
PERF INIT	Performance Initialization
PF	Pilot Flying
PFC	Primary Flight Computers
PM	Pilot Monitoring

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

STAB	Stabilizer
STAT	Status
STD	Standard
STS	Speed Trim System
T	
T or TK or TRK	Track
T or TRU	True
T/D	Top of Descent
TA	Traffic Advisory
TAI	Thermal Anti-Ice
TAT	Total Air Temperature
TCAS	Traffic Alert and Collision Avoidance System
TDZE	Touch Down Zone Elevation
TE	Trailing Edge
TFC	Traffic
THR HOLD	Throttle Hold
TO	Takeoff
TO/GA	Takeoff/Go–Around
U	
UPR DSPL	Upper Display
UTC	Universal Time Coordinated
V	
V/S	Vertical Speed
V1	Takeoff Decision Speed
V2	Takeoff Safety Speed
VA	Design Maneuvering Speed
VHF	Very High Frequency
VMO	Maximum Operating Speed
VNAV	Vertical Navigation
VOR	VHF Omnidirectional Rang
VR	Rotation Speed
VREF	Reference Speed
VSD	Verical Situation Display
VTK	Vertical Track
W	
WPT	Waypoint
WXR	Weather Radar
X	
XTK	Cross Track

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Revision Transmittal Letter

To: All holders of Xiamen Airlines 737 Flight Crew Operations Manual (FCOM), Boeing Document Number D6-27370-75C-XIA.

Subject: Flight Crew Operations Manual Revision.

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

Revision Record

No. （更新号）	Revision Date （更新日期）	Filed by （换页人）	Date Filed （换页日期）	Remarks （备注）
40	September 15,2016			Revised information of R39 is also included.
40a	January 23,2018			Added SP.4.23-4.30 “LVO”.
40b	March 20,2018			Revised NP.21.49, SP.4.14, 4.20, 4.22, and SP-“LVO” on SP.4.23-4.30. Added notes on 1.40.41-48.

General

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

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

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

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

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

Filing Instructions

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

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

Chapter 0 - Preface

Section 1 - Model Identification

General

0.1.6 - Revised to add/change an airplane entry.

0.1.6 - Revised to add/change an airplane entry.

0.1.6 - Revised to add/change an airplane entry.

0.1.6 - Revised to add/change an airplane entry.

0.1.6 - Revised to add/change an airplane entry.

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0.1.6 - Revised to add/change an airplane entry.

0.1.6 - Revised to add/change an airplane entry.

0.1.6 - Revised to add/change an airplane entry.

Section 2 - Introduction

General

0.2.2 - Added correspondence for Service Request Applications.

Section 3 - Abbreviations

General

0.3.1 - Added new Abbreviation.

0.3.2 - Added new abbreviation and definition.

0.3.3 - Added new Abbreviation.

0.3.4 - Added new Abbreviation

Performance Package 5 737-800WSFP1 CFM56-7B26 C M KG FAA CATC/N (FMC Model 737-800W.1)

Section 6 - Bulletin Record

General

0.6.2 - Revised to reflect current bulletin status.

0.6.2 - Revised to reflect current bulletin status.

0.6.2 - Revised to reflect current bulletin status.

0.6.3 - Revised to reflect current bulletin status.

Chapter L - Limitations

Section 10 - Operating Limitations

Airplane General

L.10.3 - Removed maximum demonstrated takeoff and landing crosswind 33 knots as a limit. Limit was removed to coincide with AFM.

L.10.3 - Removed maximum demonstrated takeoff and landing crosswind 36 knots as a limit. Limit was removed to coincide with AFM.

L.10.3 - Added a note pointing out that the maximum weight values can be further limited per the AFM.

Air Systems

L.10.5 - Specify limit applies when either one or both engine bleed switches are ON.

Autopilot/Flight Director System

L.10.6 - Added HUD limitation to accommodate airplanes not equipped with polar navigation.

L.10.6 - Deleted HUD limitation no longer applies. Limitation was applicable to airplanes equipped with polar navigation.

Chapter NP - Normal Procedures

Section 21 - Amplified Procedures

Preliminary Preflight Procedure – Captain or First Officer

NP.21.1 -

NP.21.1 -

CDU Preflight Procedure - Captain and First Officer

NP.21.4 - Added "as needed" for correctness. Verfying the RNP is not needed it the departure is not an RNP procedure. This makes the step standard with other steps in the normal procedures to verify RNP.

Exterior Inspection

NP.21.6 - Added note to provide guidance that fluid leaks are allowed provided the leaks are less than a continuous stream.

Pushback or Towing Procedure

NP.21.29 - Revised the normal procedures to comply with FAA SAFO 15006 that requires the use of a regular transponder setting when taxiing at all airports.

Engine Start Procedure

NP.21.30 - Added bullet to provide guidance that fluid leaks are allowed provided the leaks are less than a continuous stream, and the leaks stop within 5 minutes after engine start.

NP.21.30 - Deleted bullet allowing the engine to be run at idle for up to 5 minutes in case of a leak from the engine drain during engine start.

Before Taxi Procedure

NP.21.32 - Revised the normal procedures to comply with FAA SAFO 15006 that requires the use of a regular transponder setting when taxiing at all airports.

Takeoff Procedure

NP.21.33 -

Approach Procedure

NP.21.43 -

NP.21.43 - Changed to “When descending below” from “At the” transition level to clarify what altimeter setting to use if given a clearance to level off at the transition level.

Landing Procedure - GLS

NP.21.45 -

Landing Procedure - Instrument Approach using VNAV

NP.21.49 - Deleted the guidance to use the autopilot during the approach. The Normal Procedure Philosophy and Assumptions assume autopilot use. And the normal takeoff procedure has the crew engage the autopilot. The autopilot is normally used per Boeing procedures, and so recommending autopilot use is redundant. The reasons to use the autopilot during a VVAV approach is being moved to the Flight Crew Training Manual.

NP.21.50 - Deleted the guidance to use the autopilot during the approach. The Normal Procedure Philosophy and Assumptions assume autopilot use. And the normal takeoff procedure has the crew engage the autopilot. The autopilot is normally used per Boeing procedures, and so recommending autopilot use is redundant. The reasons to use the autopilot during a VVAV approach is being moved to the Flight Crew Training Manual.

NP.21.51 - Added “Verify they agree within 100 feet” to the step to crosscheck the altimeters at the final approach fix. This is needed for Performance Based Navigation (PBN) approaches. Also reformatted for easier reading.

NP.21.51 - Added “Verify they agree within 100 feet” to the step to crosscheck the altimeters at the final approach fix. This is needed for Performance Based Navigation (PBN) approaches. Also reformatted for easier reading.

After Landing Procedure

NP.21.55 - Revised the normal procedures to comply with FAA SAFO 15006 that requires the use of a regular transponder setting when taxiing at all airports.

Chapter SP - Supplementary Procedures

Section 4 - Automatic Flight

Instrument Approach using Vertical Speed (V/S)

SP.4.4 - Deleted “Note: Autopilot use is recommended until suitable visual reference is established.” The Normal Procedure Philosophy and Assumptions assume autopilot use. And the normal takeoff procedure has the crew engage the autopilot. The autopilot is normally used per Boeing procedures, and so recommending autopilot use is redundant.

SP.4.6 - Added “At the final approach fix, crosscheck the altimeters. Verify they agree within 100 feet.” This is needed for Performance Based Navigation (PBN) approaches.

Circling Approach

SP.4.6 - Deleted “Note: Autopilot use is recommended until suitable visual reference is established.” The Normal Procedure Philosophy and Assumptions assume autopilot use. And the normal takeoff procedure has the crew engage the autopilot. The autopilot is normally used per Boeing procedures, and so recommending autopilot use is redundant.

Instrument Approach - RNAV (RNP) AR

SP.4.7 - Added Note saying operators need approval for RNAV (RNP) AR approaches.

Section 6 - Electrical

Standby Power Test

SP.6.4 - Changed the step selecting the AC and DC meter selectors to clarify that the step refers to two separate selectors, an AC selector and a DC selector.

Standby Power Test

SP.6.5 - Changed the step selecting the AC and DC meter selectors to clarify that the step refers to two separate selectors, an AC selector and a DC selector.

Section 7 - Engines, APU

Battery Start

SP.7.3 -

SP.7.4 -

Engine Crossbleed Start

SP.7.5 - Added a step “Do not accomplish a crossbleed start during pushback.” to the Crossbleed Start SP. The thrust asymmetry from a crossbleed start can interfere with the tug operation.

Section 16 - Adverse Weather

Cold Weather Operations

SP.16.11 - Changed “may” to “can” for Boeing standardization.

SP.16.11 - Changed “may” to “can” for Boeing standardization.

SP.16.11 - Changed “may” to “can” for Boeing standardization.

SP.16.11 - Changed “prior to” to “before” for Boeing standardization.

SP.16.11 - Changed the step that directs the flight crew to do the Engine High Vibration checklist by changing the title so that it corresponds with the title in the QRH. Also changed the direction to the crew from “do the procedure” to accomplish the checklist.

SP.16.12 - Revised the overly broad instruction “ATC assigned altitudes or flight levels should not be adjusted for temperature when under radar control”. Replaced with the more specific “No altitude adjustment due to cold temperature is needed for the following conditions: ‘When maintaining an ATC assigned flight level (FL)’ and ‘While under ATC radar vectors’”. Also re-organized for better clarity.

SP.16.12 - Revised the overly broad instruction “ATC assigned altitudes or flight levels should not be adjusted for temperature when under radar control”. Replaced with the more specific “No altitude adjustment due to cold temperature is needed for the following conditions: ‘When maintaining an ATC assigned flight level (FL)’ and ‘While under ATC radar vectors’”. Also re-organized for better clarity.

SP.16.12 - Revised the overly broad instruction “ATC assigned altitudes or flight levels should not be adjusted for temperature when under radar control”. Replaced with the more specific “No altitude adjustment due to cold temperature is needed for the following conditions: ‘When maintaining an ATC assigned flight level (FL)’ and ‘While under ATC radar vectors’”. Also re-organized for better clarity.

SP.16.12 - Revised the overly broad instruction “ATC assigned altitudes or flight levels should not be adjusted for temperature when under radar control”. Replaced with the more specific “No altitude adjustment due to cold temperature is needed for the following conditions: ‘When maintaining an ATC assigned flight level (FL)’ and ‘While under ATC radar vectors’”. Also re-organized for better clarity.

SP.16.13 - Revised the overly broad instruction “ATC assigned altitudes or flight levels should not be adjusted for temperature when under radar control”. Replaced with the more specific “No altitude adjustment due to cold temperature is needed for the following conditions: ‘When maintaining an ATC assigned flight level (FL)’ and ‘While under ATC radar vectors’”. Also re-organized for better clarity.

SP.16.13 - Revised the overly broad instruction “ATC assigned altitudes or flight levels should not be adjusted for temperature when under radar control”. Replaced with the more specific “No altitude adjustment due to cold temperature is needed for the following conditions: ‘When maintaining an ATC assigned flight level (FL)’ and ‘While under ATC radar vectors’”. Also re-organized for better clarity.

SP.16.13 - Revised the overly broad instruction “ATC assigned altitudes or flight levels should not be adjusted for temperature when under radar control”. Replaced with the more specific “No altitude adjustment due to cold temperature is needed for the following conditions: ‘When maintaining an ATC assigned flight level (FL)’ and ‘While under ATC radar vectors’”. Also re-organized for better clarity.

Ice Crystal Icing (ICI)

SP.16.29 - Added ICI acronym.

SP.16.29 - Added engine-specific information describing the effects of flight in ICI conditions.

SP.16.29 - Added additional information to further define ICI conditions.

SP.16.29 - Added information to emphasize the importance in avoiding ICI conditions.

SP.16.29 - Added additional information to assist in recognizing ICI conditions.

SP.16.29 - Edited sub-section title for cross-model standardization.

SP.16.29 - Added additional information to assist in recognizing ICI conditions.

SP.16.29 - Added additional information to assist in recognizing ICI conditions.

SP.16.29 - Added additional information to assist in recognizing ICI conditions.

SP.16.29 - Added additional information to assist in recognizing ICI conditions.

SP.16.30 - Edited sub-section title for cross-model standardization.

SP.16.30 - Added information regarding High Ice Water Content (HIWC) information that is available to help avoid ICI conditions.

Performance Package 10
737-700 CFM56-7B22 KG M FAA CATA

Section 14 - Text

Enroute

PD.14.4 - Updated text to clarify oxygen system type.

Landing

PD.14.5 - Updated structure in publishing system.

Performance Package 20
737-700 CFM56-7B22 KG M FAA CATF/M

Section 20 - Pkg Model Identification

737-700 CFM56-7B22 KG M FAA CATF/M was added as Section 20.

Section 20 - Takeoff

737-700 CFM56-7B22 KG M FAA CATF/M was added as Section 20.

Section 21 - Enroute

Added section "21".

Section 22 - Landing

Added section "22".

Section 23 - Gear Down

Added section "23".

Section 24 - Text

Added section "24".

Landing

PD.24.5 - Updated structure in publishing system.

Performance Package 30
737-700W CFM56-7B22 KG FAA CATA

Section 30 - Pkg Model Identification

737-700W CFM56-7B22 KG FAA CATA moved from Section 20 to 30.

Section 30 - Takeoff

737-700W CFM56-7B22 KG FAA CATA moved from Section 20 to 30.

Section 31 - Enroute

Section "21" moved to "31".

Section 32 - Landing

Section "22" moved to "32".

Section 33 - Gear Down Planning

Section "23" moved to "33".

Section 34 - Text

Section "24" moved to "34".

Landing

PD.34.5 - Updated structure in publishing system.

Performance Package 40
737-700W CFM56-7B22 KG FAA CATF/M

Section 40 - Pkg Model Identification

737-700W CFM56-7B22 C KG M FAA CATF/M was added as Section 40.

Section 40 - Takeoff

737-700W CFM56-7B22 C KG M FAA CATF/M was added as Section 40.

Updated package title description to 737-700W CFM56-7B22 C KG M FAA CATF/M .

Section 41 - Enroute

Added section "41".

Section 42 - Landing

Added section "42".

Section 43 - Gear Down Planning

Added section "43".

Section 44 - Text

Added section "44".

Performance Package 50
737-700W CFM56-7B24A+26B2_BUMP C M KG FAA CATF/M HIGH_ALT PAX GAS

Section 50 - Pkg Model Identification

737-700W CFM56-7B24A+26B2_BUMP C M KG FAA CATF/M HIGH_ALT PAX GAS was added as Section 50.

737-700W CFM56-7B24A+26B2_BUMP C M KG FAA CATF/M HIGH_ALT PAX GAS was added as Section 50.

Section 51 - Enroute

Added section "51".

Section 52 - Landing

Added section "52".

Section 53 - Gear Down Planning

Added section "53".

Section 54 - Text

Added section "54".

Performance Package 60
737-800W CFM56-7B24 KG M FAA CATC/N

Section 60 - Pkg Model Identification

737-800W CFM56-7B24 KG M FAA CATC/N moved from Section 40 to 60.

General

PD.60.1 - Revised to add/change an airplane entry.

PD.60.1 - Revised to add/change an airplane entry.

PD.60.4 - Revised to add/change an airplane entry.

PD.60.4 - Revised to add/change an airplane entry.

PD.60.4 - Revised to add/change an airplane entry.

PD.60.4 - Revised to add/change an airplane entry.

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PD.60.4 - Revised to add/change an airplane entry.

PD.60.4 - Revised to add/change an airplane entry.

Section 60 - Takeoff

737-800W CFM56-7B24 KG M FAA CATC/N moved from Section 40 to 60.

Section 61 - Enroute

Section "41" moved to "61".

Section 62 - Landing

Section "42" moved to "62".

Section 63 - Gear Down

Section "43" moved to "63".

Section 64 - Text

Section "44" moved to "64".

Performance Package 70
737-800W CFM56-7B26 KG M FAA CATC/N

Section 70 - Pkg Model Identification

737-800W CFM56-7B26 KG M FAA CATC/N moved from Section 50 to 70.

Section 70 - Takeoff

737-800W CFM56-7B26 KG M FAA CATC/N moved from Section 50 to 70.

Section 71 - Enroute

Section "51" moved to "71".

Section 72 - Landing

Section "52" moved to "72".

Section 73 - Gear Down

Section "53" moved to "73".

Section 74 - Text

Section "54" moved to "74".

Performance Package 80
737-800WSFP1 CFM56-7B26 C M KG FAA CATC/N (FMC Model 737-800W.1)

Section 80 - Pkg Model Identification

737-800WSFP1 CFM56-7B26 C M KG FAA CATC/N (FMC Model 737-800W.1) was added as Section 80.

Section 80 - Takeoff

737-800WSFP1 CFM56-7B26 C M KG FAA CATC/N (FMC Model 737-800W.1) was added as Section 80.

Section 81 - Enroute

Added section "81".

Section 82 - Landing

Added section "82".

Section 83 - Gear Down

Added section "83".

Section 84 - Text

Added section "84".

Performance Package 10
737-700 CFM56-7B22 KG M FAA CATA

Section 10 - General

file Highlight

PI.10.54 - Updated Flight with Unreliable Airspeed Holding table to include KIAS and to add high altitude holding data. Flaps Up data was added to Terminal Area Table. Consolidated and restructured data in publishing system.

Flight With Unreliable Airspeed / Turbulent Air Penetration

PI.10.55 - Consolidated and restructured data in publishing system.

Section 12 - Advisory Information

Non-Normal Configuration Landing Distance

PI.12.4 - Updated Non-Normal Landing Distances to add data for Airspeed Unreliable.

Performance Package 20
737-700 CFM56-7B22 KG M FAA CATF/M

Section 20 - Pkg Model Identification

737-700 CFM56-7B22 KG M FAA CATF/M was added as Section 20.

Section 20 - General

737-700 CFM56-7B22 KG M FAA CATF/M was added as Section 20.

Section 20 - General

file Highlight

PI.20.57 - Updated Flight with Unreliable Airspeed Holding table to include KIAS and to add high altitude holding data. Flaps Up data was added to Terminal Area Table. Consolidated and restructured data in publishing system.

Section 21 - All Engine

Added section "21".

Section 22 - Advisory Information

Added section "22".

Non-Normal Configuration Landing Distance

PI.22.4 - Added Airspeed Unreliable data plus updates for some individual data sets.

Section 23 - Engine Inoperative

Added section "23".

Section 24 - Gear Down

Added section "24".

Section 25 - Gear Down, Engine Inop

Added section "25".

Section 26 - Text

Added section "26".

Performance Package 30
737-700W CFM56-7B22 KG FAA CATA

Section 30 - Pkg Model Identification

737-700W CFM56-7B22 KG FAA CATA moved from Section 20 to 30.

Section 30 - General

737-700W CFM56-7B22 KG FAA CATA moved from Section 20 to 30.

Section 30 - General

file Highlight

PI.30.56 - Updated Flight with Unreliable Airspeed Holding table to include KIAS and to add high altitude holding data. Flaps Up data was added to Terminal Area Table. Consolidated and restructured data in publishing system.

Flight With Unreliable Airspeed/Turbulent Air Penetration

PI.30.57 - Consolidated and restructured data in publishing system.

Section 31 - All Engine

Section "21" moved to "31".

Section 32 - Advisory Information

Section "22" moved to "32".

Section 33 - Engine Inoperative

Section "23" moved to "33".

Section 34 - Gear Down

Section "24" moved to "34".

Section 35 - Gear Down, Engine Inop

Section "25" moved to "35".

Section 36 - Text

Section "26" moved to "36".

Performance Package 40
737-700W CFM56-7B22 C KG M FAA CATF/M

Section 40 - Pkg Model Identification

737-700W CFM56-7B22 C KG M FAA CATF/M was added as Section 40.

Section 40 - General

737-700W CFM56-7B22 C KG M FAA CATF/M was added as Section 40.

Updated package title description to 737-700W CFM56-7B22 C KG M FAA CATF/M .

Section 41 - All Engine

Added section "41".

Section 42 - Advisory Information

Added section "42".

Section 43 - Engine Inoperative

Added section "43".

Section 44 - Gear Down

Added section "44".

Section 45 - Gear Down, Engine Inop

Added section "45".

Section 46 - Text

Added section "46".

Performance Package 50
737-700W CFM56-7B24A+26B2_BUMP C M KG FAA CATF/M HIGH_ALT PAX GAS

Section 50 - Pkg Model Identification

737-700W CFM56-7B24A+26B2_BUMP C M KG FAA CATF/M HIGH_ALT PAX GAS was added as Section 50.

Section 50 - General

737-700W CFM56-7B24A+26B2_BUMP C M KG FAA CATF/M HIGH_ALT PAX GAS was added as Section 50.

Section 51 - All Engine

Added section "51".

Section 52 - Advisory Information

Added section "52".

Section 53 - Engine Inoperative

Added section "53".

Section 54 - Gear Down

Added section "54".

Section 55 - Gear Down, Engine Inop

Added section "55".

Section 56 - Text

Added section "56".

Performance Package 60
737-800W CFM56-7B24 KG M FAA CATC/N

Section 60 - Pkg Model Identification

737-800W CFM56-7B24 KG M FAA CATC/N moved from Section 40 to 60.

General

PI.60.1 - Revised to add/change an airplane entry.

PI.60.1 - Revised to add/change an airplane entry.

PI.60.4 - Revised to add/change an airplane entry.

PI.60.4 - Revised to add/change an airplane entry.

PI.60.4 - Revised to add/change an airplane entry.

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PI.60.4 - Revised to add/change an airplane entry.

PI.60.4 - Revised to add/change an airplane entry.

Section 60 - General

737-800W CFM56-7B24 KG M FAA CATC/N moved from Section 40 to 60.

file Highlight

PI.60.34 - Updated Flight with Unreliable Airspeed Holding table to include KIAS and to add high altitude holding data. Flaps Up data was added to Terminal Area Table. Consolidated and restructured data in publishing system.

Section 61 - All Engine

Section "41" moved to "61".

Section 62 - Advisory Information

Section "42" moved to "62".

Section 63 - Engine Inoperative

Section "43" moved to "63".

Section 64 - Gear Down

Section "44" moved to "64".

Section 65 - Gear Down, Engine Inop

Section "45" moved to "65".

Section 66 - Text

Section "46" moved to "66".

Performance Package 70
737-800W CFM56-7B26 KG M FAA CATC/N

Section 70 - Pkg Model Identification

737-800W CFM56-7B26 KG M FAA CATC/N moved from Section 50 to 70.

Section 70 - General

737-800W CFM56-7B26 KG M FAA CATC/N moved from Section 50 to 70.

file Highlight

PI.70.48 - Updated Flight with Unreliable Airspeed Holding table to include KIAS and to add high altitude holding data. Flaps Up data was added to Terminal Area Table. Consolidated and restructured data in publishing system.

Section 71 - All Engine

Section "51" moved to "71".

Section 72 - Advisory Information

Section "52" moved to "72".

Non-Normal Configuration Landing Distance

PI.72.4 - Updated Non-Normal Landing Distances to add data for Airspeed Unreliable.

Section 73 - Engine Inoperative

Section "53" moved to "73".

Section 74 - Alternate Mode EEC

Section "54" moved to "74".

Section 75 - Gear Down

Section "55" moved to "75".

Section 76 - Gear Down, Engine Inop

Section "56" moved to "76".

Section 77 - Text

Section "57" moved to "77".

Performance Package 80 737-800WSFP1 CFM56-7B26 C M KG FAA CATC/N (FMC Model 737-800W.1)

Section 80 - Pkg Model Identification

737-800WSFP1 CFM56-7B26 C M KG FAA CATC/N (FMC Model 737-800W.1) was added as Section 80.

Section 80 - General

737-800WSFP1 CFM56-7B26 C M KG FAA CATC/N (FMC Model 737-800W.1) was added as Section 80.

Section 81 - All Engine

Added section "81".

Section 82 - Advisory Information

Added section "82".

Section 83 - Engine Inoperative

Added section "83".

Section 84 - Alternate Mode EEC

Added section "84".

Section 85 - Gear Down

Added section "85".

Section 86 - Gear Down, Engine Inop

Added section "86".

Section 87 - Text

Added section "87".

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

Section 10 - Dimensions

Turning Radius

1.10.4 - Updated dimensions and radii.

1.10.5 - Updated dimensions and radii.

1.10.6 - Updated dimensions and radii.

Section 30 - Controls and Indicators

Exterior Lighting

1.30.7 - Added a graphic depicting the Landing, Runway Turnoff and Taxi Lights.

1.30.7 - Added a callout describing the Landing Light switch.

Oxygen

1.30.26 - Added text and graphics depicting the Eros Full Face Oxygen Mask and Regulator.

1.30.27 - Deleted text and graphics depicting the Eros Full Face Oxygen Mask and Regulator with electrostatic film.

Section 40 - Systems Description

Lighting Systems

1.40.2 - Added text which describes the Alternating Flash Landing Lights.

Oxygen Systems

1.40.27 - Deleted duplicate oxygen system schematic graphic.

1.40.27 - Added a graphics depicting the Oxygen System Schematic.

Chapter 4 - Automatic Flight

Section 10 - Controls and Indicators

Lateral Navigation

4.10.14 - Added FCC P8.0 or greater software.

Flight Mode Annunciations (FMAs)

4.10.26 - Added Block Point 15 software configuration.

Chapter 5 - Communications

Section 10 - Controls and Indicators

Audio Control Panel (ACP)

5.10.4 - Deleted ruggedized Audio Control Panel to reflect airplane configuration.

5.10.5 - Added an audio control panel showing HF2 INOP.

5.10.5 - Added a ruggedized audio control panel with SATCOM INOP.

5.10.6 - Added a ruggedized audio control panel.

5.10.7 - Deleted Callout for aircraft with SELCAL light on Audio Selector Panel.

5.10.8 - Added call out for updated airplane configuration.

5.10.8 - Deleted Callout for Receiver Switches on Audio Selector Panel.

5.10.8 - Deleted Callout for Push-to-Talk Switches on Audio Selector Panel.

5.10.9 - Deleted Callout for Filter Switch on Audio Selector Panel.

5.10.9 - Deleted Callout for Ground Crew Call Light on Audio Selector Panel.

5.10.9 - Deleted Callout for Cabin Call Light on Audio Selector Panel.

5.10.9 - Deleted Callout describing Alternate-Normal (ALT-NORM) Switch operation.

5.10.9 - Deleted Callout for Speaker Switch on Audio Selector Panel.

5.10.9 - Deleted Callout for Alternate-Normal Switch on Audio Selector Panel.

Chapter 7 - Engines, APU

Section 20 - Engine System Description

Electronic Engine Control (EEC)

7.20.4 - Added takeoff bump thrust.

Chapter 9 - Flight Controls

Section 10 - Controls and Indicators

Stabilizer

9.10.5 - Corrected location of STAB OUT OF TRIM light from CENTER FORWARD PANEL to LEFT FORWARD PANEL.

Speed Brakes

9.10.11 - Added text in graphic to identify control stand for aircraft with post-production winglets and speed brake load alleviation system.

Section 20 - System Description

Pitch Control

9.20.13 - Added text to clarify that the speed trim system is enabled above stickshaker AOA.

Flaps and Slats

9.20.26 - Changed sentence from Wing LE and TE position indications come from the FSEU to Wing TE position indications come from the FSEU.

9.20.26 - Added sentence to paragraph. Wing LE position indications come from the FSEU.

Chapter 10 - Flight Instruments, Displays

Section 11 - PFD/ND – Displays

PFD Airspeed Indications

10.11.14 - Added CDS BP 2015 software configuration.

PFD – Attitude Indications

10.11.17 - Added bullet for GNSS Landing System (GLS).

10.11.18 - Added CDS Block point 2015 software configuration.

10.11.18 - Added CDS Block point 2015 software configuration.

10.11.20 - Added illustration for aircraft equipped with IAN, integrated cue command bar, and rising runway.

10.11.21 - Added paragraph for distance and source annunciation for aircraft equipped with GLS.

10.11.21 - Added paragraph for GNSS Landing System (GLS) disagree indication.

PFD Failure Flags

10.11.34 - Added illustration of PFD failure flags when RA is below ADI and CDS Block Point 2015 with Navigation Performance Scales.

PFD Annunciations and Alerts

10.11.37 - Added CDS Block point 15 software configuration.

10.11.41 - Added RCAS Roll/Asymmetry alert configuration option.

10.11.42 - Added Roll authority alert configuration option.

Section 16 - PFD/ND – Controls and Indicators

EFIS Control Panel (PFD/ND Display)

10.16.3 - Added bullet for GLS receiver, channel and distance for aircraft equipped with GLS.

10.16.4 - Added CDS Block point 2015 software configuration.

10.16.4 - Deleted sentence describing the "DATA" display for aircraft without VSD and which have U11.0 or later.

10.16.4 - Added DATA sentence for aircraft which have the VSD option, but don't have U11.0 or later.

10.16.5 - Added DATA sentence for aircraft which have the VSD option, and U11.0 or later.

Section 21 - PFD/ND – System Description

Display Selection and Control Examples

10.21.11 - Added paragraph for CDS programmed as an over/under engine display.

Standby Flight Instruments

10.21.16 - Added ISFD paragraph for aircraft with GLS capability.

Section 41 - PFD/ND – Navigation Displays

ND Symbology

10.41.7 - Added symbology for system source annunciation for aircraft equipped with GLS.

Chapter 11 - Flight Management, Navigation

Section 10 - Controls and Indicators

Landing System Lights

11.10.11 - Added ADIRS 69-73713-20 with GLS and ILS Lights.

Inertial System

11.10.15 - Added ADIRS 69-73713-20 with GLS and ILS Lights.

Radio Navigation Systems

11.10.21 - Added Gables G7501-01 multi-mode navigation control panel.

11.10.23 - Added description with GLS configuration.

Section 20 - Navigation Systems Description

Radio Navigation Systems

11.20.8 - Added description with GLS option.

Section 32 - Flight Management Computer

FMC Failure

11.32.6 - Deleted U10.5 and earlier FMC Alerting Message.

Section 40 - FMC Preflight

Preflight Pages

11.40.14 - Revised “Route 2 Feature” section for clarity no content change.

11.40.14 - Added AOC data link option.

11.40.22 - Revised callout for clarity no content change.

Section 41 - FMC Takeoff and Climb

Climb Phase

11.41.32 - Revised paragraph to standardize description.

Section 42 - FMC Cruise

Navigation Data

11.42.48 - Added dual FMC with GPS and GLS.

11.42.49 - Added FMC Update U10.4 or later with GLS.

Section 43 - FMC Descent and Approach

Early Descent

11.43.1 - Revised paragraph wording no content change.

Approach

11.43.23 - Added FMC Update U10.5 and later with GLS.

Holding

11.43.25 - Revised paragraph wording no content change.

Section 60 - FMC Messages

FMC Alerting Messages

11.60.3 - Deleted U10.5A and earlier FMC Alerting Message.

11.60.5 - Revised to include FMC U10.8A and later.

11.60.9 - Added FMC U12.0 or later description.

11.60.12 - Added FMC U12.0 or later description.

Chapter 12 - Fuel

Section 10 - Controls and Indicators

Fuel Alert Indications

12.10.5 - Added for Block Point 2015 CDS software update.

Chapter 14 - Landing Gear

Section 10 - Controls and Indicators

Parking Brake

14.10.5 - Added new Parking Brake for control stand with engine start levers.

Section 20 - System Description

Brake System

14.20.6 - Deleted text referencing the takeoff configuration warning horn with the TAKEOFF CONFIG lights not installed.

Chapter 15 - Warning Systems

Section 10 - Controls and Indicators

Ground Proximity Warning System (GPWS)

15.10.7 - Added EBAW/ROLL AUTHORITY aural alert description.

Section 20 - System Description

Warning Systems

15.20.6 - Deleted paragraph describing takeoff configuration warning for airplanes with aural annunciation only; no longer applies.

15.20.6 - Deleted paragraph describing cabin altitude warning for airplanes with aural annunciation only; no longer applies.

Intentionally
Blank

Volume 1

*	Title Page 1-2	March 20, 2018
	0.TOC.1-2	March 27, 2014

Model Identification

	0.1.1-6	September 15, 2016

Introduction

	0.2.1-8	September 15, 2016

Abbreviations

	0.3.1-6	September 15, 2016

Revision Record (tab)

*	0.4.1-2	March 20, 2018

Revision Highlights

	0.4.3-26	September 15, 2016

V1V2 List of Effective Pages

*	0.5.1-4	March 20, 2018

Bulletin Record (tab)

	0.6.1-4	September 15, 2016

Limitations (tab)

	L.TOC.1-2	March 31, 2016
	L.10.1-10	September 15, 2016

Normal Procedures (tab)

	NP.TOC.1-2	September 15, 2016
	NP.11.1-8	March 27, 2014
*	NP.21.1-56	March 20, 2018

Supplementary Procedures (tab)

*	SP.TOC.1-8	March 20, 2018
	SP.05.1-2	September 18, 2008
	SP.1.1-6	September 15, 2016
	SP.2.1-10	September 15, 2016
	SP.3.1-6	September 15, 2016
*	SP.4.1-30	March 20, 2018
	SP.5.1-2	September 26, 2013
	SP.6.1-6	September 15, 2016
	SP.7.1-6	September 15, 2016
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	SP.10.1-18	September 15, 2016
	SP.11.1-22	September 15, 2016
	SP.12.1-6	September 15, 2016
	SP.15.1-2	September 25, 2014
	SP.16.1-32	September 15, 2016

Performance Dispatch (tab)

	PD.0.1-2	March 16, 2017

737-700 CFM56-7B22 KG M FAA CATA

	PD.TOC.10.1-2	March 31, 2016
	PD.ModID.10.1-2	March 31, 2016
	PD.10.1-10	September 25, 2014
	PD.11.1-8	March 16, 2017
	PD.12.1-8	September 15, 2016
	PD.13.1-8	March 31, 2016
	PD.14.1-6	March 16, 2017

737-700W CFM56-7B22 KG FAA CATA

	PD.TOC.20.1-2	March 16, 2017
	PD.ModID.20.1-2	March 16, 2017
	PD.20.1-10	March 16, 2017
	PD.21.1-8	March 16, 2017
	PD.22.1-8	March 16, 2017
	PD.23.1-8	March 16, 2017
	PD.24.1-6	March 16, 2017

737-700W CFM56-7B24A+26B2_BUMP KG FAA CATA PAX OXY

	PD.TOC.30.1-2	December 15, 2016
	PD.ModID.30.1-2	December 15, 2016
	PD.30.1-16	December 15, 2016
	PD.31.1-12	December 15, 2016
	PD.32.1-16	December 15, 2016
	PD.33.1-8	December 15, 2016
	PD.34.1-8	December 15, 2016

737-800W CFM56-7B24 KG M FAA CATC/N

	PD.TOC.40.1-2	December 15, 2016
	PD.ModID.40.1-6	March 16, 2017
	PD.40.1-12	March 16, 2017

* = Revised, Added, or Deleted

PD.41.1-8	March 16, 2017
PD.42.1-8	March 16, 2017
PD.43.1-10	March 16, 2017
PD.44.1-6	March 16, 2017

737-800W CFM56-7B26 KG M FAA CATC/N

PD.TOC.50.1-2	March 26, 2015
PD.ModID.50.1-2	March 16, 2017
PD.50.1-12	March 16, 2017
PD.51.1-8	March 16, 2017
PD.52.1-8	March 16, 2017
PD.53.1-10	March 26, 2015
PD.54.1-6	March 16, 2017

737-800WSFP1 CFM56-7B26 KG M FAA CATC/N (FMC Model 737-800W.1)

PD.TOC.60.1-2	December 15, 2016
PD.ModID.60.1-2	December 15, 2016
PD.60.1-12	December 15, 2016
PD.61.1-8	December 15, 2016
PD.62.1-8	March 16, 2017
PD.63.1-10	December 15, 2016
PD.64.1-6	December 15, 2016

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737-700 CFM56-7B22 KG M FAA CATA

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PI.10.1-56	March 31, 2016
PI.11.1-10	March 31, 2016
PI.12.1-30	December 15, 2016
PI.13.1-12	March 31, 2016
PI.14.1-6	September 25, 2014
PI.15.1-4	March 31, 2016
PI.16.1-14	March 31, 2016

737-700W CFM56-7B22 KG FAA CATA

PI.TOC.20.1-4	September 15, 2016
PI.ModID.20.1-2	December 15, 2016
PI.20.1-58	September 15, 2016
PI.21.1-10	September 15, 2016
PI.22.1-30	December 15, 2016
PI.23.1-12	September 15, 2016
PI.24.1-6	September 15, 2016
PI.25.1-4	September 15, 2016
PI.26.1-14	September 15, 2016

737-700W CFM56-7B24A+26B2_BUMP KG FAA CATA PAX OXY

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PI.ModID.30.1-2	December 15, 2016
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PI.32.1-32	December 15, 2016
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PI.34.1-6	December 15, 2016
PI.35.1-4	December 15, 2016
PI.36.1-14	December 15, 2016

737-800W CFM56-7B24 KG M FAA CATC/N

PI.TOC.40.1-4	December 15, 2016
PI.ModID.40.1-6	December 15, 2016
PI.40.1-36	December 15, 2016
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PI.42.1-30	December 15, 2016
PI.43.1-12	December 15, 2016
PI.44.1-6	December 15, 2016
PI.45.1-4	December 15, 2016
PI.46.1-14	December 15, 2016

737-800W CFM56-7B26 KG M FAA CATC/N

PI.TOC.50.1-4	December 15, 2016
PI.ModID.50.1-2	December 15, 2016
PI.50.1-50	December 15, 2016
PI.51.1-10	December 15, 2016
PI.52.1-30	December 15, 2016
PI.53.1-12	December 15, 2016
PI.54.1-2	December 15, 2016
PI.55.1-6	December 15, 2016
PI.56.1-4	December 15, 2016
PI.57.1-14	December 15, 2016

737-800WSFP1 CFM56-7B26 KG M FAA CATC/N (FMC Model 737-800W.1)

PI.TOC.60.1-4	December 15, 2016
PI.ModID.60.1-2	December 15, 2016
PI.60.1-48	December 15, 2016
PI.61.1-10	December 15, 2016
PI.62.1-30	December 15, 2016

* = Revised, Added, or Deleted

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	1.40.49-68	September 15, 2016

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10.41.1-24	September 15, 2016
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* = Revised, Added, or Deleted

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Preface — Chapter 0

Bulletin Record — Section 6

General

The Boeing Company issues Flight Crew Operations Manual Bulletins to provide important information to flight crews prior to the next formal revision of the Flight Crew Operations Manual. The transmitted information may be of interest to only specific Operators or may apply to all Operators of this model airplane. Each bulletin will vary.*(Note: Additional Bulletins issued by Xiamen Airlines concerning flight operations may also be listed here below.)*

Bulletins are dated and numbered sequentially for each operator. Each new bulletin is recorded in this record when received and filed as instructed. The next formal FCOM revision will include an updated bulletin record page to reflect current bulletin status.

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

Bulletin status is defined as follows:

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

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

Number	Subject	Date	Status
XIA-5 R1	Window Overheat	November 15, 2000	IE
XIA-9	Possible Autopilot Low Frequency Pitch Oscillation During Flap Extension While in a Turn	July 20, 1998	IE
XIA-13 R1	Inadvertent RTO Autobraking During Landing	September 6, 1999	IE
XIA-44 R1	Nuisance Stall Warning Stick Shaker Events	April 15, 2005	IE
XIA-46 R1	Master Caution System Anomaly	July 25, 2008	IE
XIA-53	Head-Up Display (HUD) Software Anomaly	August 4, 2006	IE
XIA-68 R1	Cabin Altitude Warning Indications and Procedures Briefing	June 8, 2009	CANC
XIA-73	Inflight Elevator Tab Vibration	March 26, 2010	IE
XIA-77	Impact of Arming VNAV on the Ground on the Windshear Escape Maneuver (FMC Update 10.8 and 10.8A)	January 10, 2011	IE
XIA-80 R1	Reduced Engine Response Times	January 9, 2015	IE
2013-01	*Experiencing TCAS FAIL Message on Some Aircraft When Operating on the Ground*	*/*	*IE*
XIA-81	U10.8A FMC Restarts from ATS (Air Traffic Services) or AOC (Aeronautical Operational Control) Datalink issues	June 5, 2013	IE
XIA-83	Airspeed Low Aural Alert Anomaly	April 1, 2014	IE
XIA-89 R2	Window Heat Control Unit (WHCU) Initialization Indications	September 19, 2016	IE
XIA-90	NPS Scales Mask ILS/GLS Localizer and Glideslope Fail Flags	April 28, 2016	IE

Number	Subject	Date	Status
XIA-91	Incorrect FMC Speed/Altitude Constraints following a runway change with a Standard Terminal Arrival (STAR) and the previous runway already executed in the FMC	July 1, 2016	IE
XIA-92	NAV Display Blanking/Blinking After Installation of Common Display System (CDS) BP15	October 17, 2016	IE
XIA-93 R1	Cabin Pressurization Panel Blanking/Dimming Issues	December 19, 2016	IE
XIA-94	Incorrect FMC Constraint Altitude on a Standard Terminal Arrival Route (STAR) with a Common Waypoint, after Selection of another Approach	December 15, 2016	IE
XIA-96	Engine Start Levers	April 21, 2017	IE
XIA-97	ADIRU P/N HG2050BC02 Position Drift and Ground Speed Errors	July 17, 2017	IE
XIA-98	Descent Below Glide Slope During Approach on 737NG Airplanes With Rockwell Collins Flight Control Computer (FCC) software Version P8.0 or P9.0 Installed	April 20, 2018	IE

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Flight Crew Operations Manual Bulletin
for
Xiamen Airlines

The Boeing Company
Seattle, Washington 98124-2207

737

Number: XIA-5 R1

IssueDate: November 15, 2000

Subject: Window Overheat

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

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

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

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

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

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

Operating Instructions

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

Administrative Information

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

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

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

Flight Crew Operations Manual Bulletin
for
Xiamen Airlines

The Boeing Company
Seattle, Washington 98124-2207

Number: XIA-9

IssueDate: July 20, 1998

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

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

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

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

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

Operating Instructions

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

Administrative Information

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

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

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

Flight Crew Operations Manual Bulletin
for
Xiamen Airlines

The Boeing Company
Seattle, Washington 98124-2207

Number: XIA-13 R1

IssueDate: September 6, 1999

Subject: Inadvertent RTO Autobraking During Landing

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

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

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

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

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

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

Operating Instructions

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

Administrative Information

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

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

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

Flight Crew Operations Manual Bulletin
for
Xiamen Airlines

The Boeing Company
Seattle, Washington 98124-2207

737

Number: XIA-44 R1

IssueDate: April 15, 2005

Subject: Nuisance Stall Warning Stick Shaker Events

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

The purpose of this reissue is to revise the crew action when maneuvering during flap retraction from Flaps 1 to Flaps Up with anti-ice selected ON.

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

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

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

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

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

Operating Instructions

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

Crew Action:

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

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

Crew Action:

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

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

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

Crew Action:

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

Administrative Information

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

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

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

Flight Crew Operations Manual Bulletin
for
Xiamen Airlines

The Boeing Company
Seattle, Washington 98124-2207

737

Number: XIA-46 R1

IssueDate: July 25, 2008

Subject: Master Caution System Anomaly

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

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

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

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

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

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

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

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

Administrative Information

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

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

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

Flight Crew Operations Manual Bulletin
for
Xiamen Airlines

The Boeing Company
Seattle, Washington 98124-2207

Number:	XIA-53
IssueDate:	August 4, 2006

Subject: Head-Up Display (HUD) Software Anomaly

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

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

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

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

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

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

Operating Instructions

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

Administrative Information

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

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

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

Flight Crew Operations Manual Bulletin
for
Xiamen Airlines

The Boeing Company
Seattle, Washington 98124-2207

Number: XIA-73

IssueDate: March 26, 2010

Subject: Inflight Elevator Tab Vibration

Reason: This bulletin informs 737NG flight crews of the potential for elevator tab vibration that may lead to significant structural damage.

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

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Boeing has recently received a report from an operator that the failure of the aft attach lugs on the left elevator tab control mechanism resulted in unwanted elevator vibration during flight. The flight crew diverted from the intended route and made an uneventful landing.

Investigation revealed that the fractured aft attach lugs on the elevator tab control mechanism allowed free-play of the aft end of the mechanism, which in turn allowed movement of the forward end of the elevator tab control rods. The result of this condition was unexpected vibration of the elevator during flight.

Flight crews should be aware that there are many causes of airframe vibration, including free-play in movable surfaces, system or engine malfunctions, and environmental factors. Elevator tab vibration can occur during any phase of flight and is characterized as a clearly noticeable moderate to severe vertical motion in the flight deck and aft cabin. This vibration is characterized as a low frequency vertical vibration in which motion of items attached to airplane structure, such as sun visors, may be noticeable. In some cases, pilots have reported feeling vibration in the control column and rudder pedals as this vertical motion is transmitted through the structure and cables to the controls. If the cause of the vibration is suspected to be due to empennage control surfaces, the discrepancy should be corrected prior to further revenue flight.

Boeing recommends that operators aggressively investigate, identify, and correct the cause of the vibration prior to returning the airplane to revenue service. If exposed to recurrent or chronic vibration, control surfaces can experience significant structural damage.

Operating Instructions

If vibration is suspected due to the elevator tab, reduce airspeed smoothly until the vibration stops, using the thrust levers and pitch attitude. Do not use speed brakes or change airplane configuration to reduce airspeed. Do not reduce airspeed below the minimum speed for the existing flap setting and gross weight. Consider landing at the nearest suitable airport.

Stay at or below the reduced airspeed at which the vibration stopped for the rest of the flight. Limit bank angle to 15° until below 20,000 feet.

Do not deploy the speedbrakes for the remainder of the flight.

Flaps and landing gear can be extended normally during the approach and landing. The speedbrake can be armed for landing.

The vibration occurrence should be reported to maintenance for resolution before further flight. The logbook entry should emphasize that the vibration is suspected to be in the area of the elevator tab and tab control system.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin XIA-73 "In Effect" (IE).

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

Flight Crew Operations Manual Bulletin
for
Xiamen Airlines

The Boeing Company
Seattle, Washington 98124-2207

Number: XIA-77

IssueDate: January 10, 2011

Subject: Impact of Arming VNAV on the Ground on the Windshear Escape Maneuver (FMC Update 10.8 and 10.8A)

Reason: This bulletin informs 737NG flight crews of the need to revise the windshear escape maneuver if VNAV has been armed on the ground for takeoff (FMC Update 10.8 and 10.8A).

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

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

During airline simulator evaluations of FMC Update 10.8A, an unintended consequence of arming VNAV for takeoff was discovered with respect to the windshear escape maneuver. If VNAV is armed on the ground, it will remain armed even if TO/GA is pressed below 400 feet AFE in accordance with the windshear escape maneuver. At 400 feet AFE, VNAV will engage and windshear guidance will be lost. TO/GA must be pressed a second time when above 400 feet AFE in order to regain the appropriate windshear guidance.

This condition exists on FMC Update 10.7, 10.8 and 10.8A. Arming VNAV on the ground is not permitted prior to Update 10.8, however.

Boeing and GE are discussing a potential fix for this anomaly in a future FMC software update.

Operating Instructions

Arming VNAV on the ground is not permitted with FMC Update 10.7 or earlier.

With U10.8 or 10.8A installed, if unstable weather conditions are present prior to takeoff, consider not arming VNAV for takeoff.

If VNAV has been armed for takeoff and windshear is encountered, press either TO/GA switch and accomplish the Windshear Escape Maneuver. If windshear conditions continue above 400 feet AFE, press either TO/GA switch a second time when above 400 feet AFE. Verify TO/GA engagement and continue the Windshear Escape Maneuver.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin XIA-77 "In Effect" (IE).

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

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

Flight Crew Operations Manual Bulletin
for
Xiamen Airlines

The Boeing Company
Seattle, Washington 98124-2207

737

Number: XIA-80 R1

IssueDate: January 9, 2015

Subject: Reduced Engine Response Times

Reason: This bulletin informs 737NG flight crews of slow engine acceleration following thrust reduction at cruise altitude due to a recent EEC software update. The bulletin provides suggested techniques to help prevent excessive airspeed loss.

This bulletin has been revised to provide CFMI Service Bulletin information for EEC software version 7.B.W.

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

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Boeing has received pilot reports of slow engine acceleration at high altitudes (above FL300) which have resulted in airspeed losses as high as 20 to 30 knots. These reports indicate the events have occurred after thrust is reduced and immediately re-applied. When an airplane experiences an abrupt airspeed increase at high altitude, as might be experienced when encountering a mountain wave, the engine will decelerate to a lower N1 and take longer to accelerate back to full or normal power than is desired.

Analysis of these reports indicates that this is related to the Electronic Engine Control (EEC) software revisions 7.B.U1 and 7.B.V2. Revision 7.B.U1 reduced the engine deceleration and acceleration rates for specific thrust lever transients at high altitude. Revision 7.B.V2 returned the deceleration rate back to normal but retained the reduced acceleration rate. Both versions of the EEC software reduce engine acceleration rate if the throttles are in idle for less than 60 seconds. Slowing the acceleration rate of a heat soaked engine improves engine operability (stall margin) characteristics.

The first software revision was introduced into the 737NG fleet in July 2009 and affects all 737NG airplanes with EEC software version 7.B.U1 or 7.B.V2.

EEC software version 7.B.W is now available from CFMI. When both engines are providing ECS bleed air to the airplane, 7.B.W restores the high altitude accelerations rates to the same rates that were present prior to the reduction introduced in 7.B.U1.

Operating Instructions

Until 7.B.W software is installed, pilots may want to use the following techniques to avoid excessive speed loss due to slow engine acceleration:

1. Use the autopilot and autothrottle as much as possible.
2. When established at cruise altitude, manually select either CLB or CONT on the FMC N1 Limit page. This will ensure maximum available thrust.
3. If the airplane experiences a sudden increase in airspeed that causes the autothrottle to reduce thrust, manually guard the thrust levers to maintain a minimum of 60% N1, if possible. If thrust is reduced below 60% N1, a significantly longer time will be required for the engines to spool up if the time at idle thrust is less than 60 seconds.
4. If the airplane experiences a sudden increase in airspeed, consider using smooth extension of the speed brakes to increase drag and to avoid large thrust reductions.
5. No specific crew actions are needed if the thrust remains at idle for longer than 60 seconds or if the descent is to an altitude below FL300. Normal engine acceleration can be expected in these cases.

Administrative Information

This bulletin replaces bulletin XIA-80 , dated October 1, 2012. Revise the Flight Crew Operations Manual Bulletin Record Page to show bulletin XIA-80 as “CANCELLED” (CANC).

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin XIA-80 R1 "In Effect" (IE).

This FCOM bulletin will be cancelled when an operator reports EEC software version 7.B.W has been installed via the applicable CFMI Service Bulletins on all 737NGs in their fleet.

The applicable CFMI Service Bulletins are:

·CFM56-7B S/B 73-0204 “ENGINE FUEL AND CONTROL - Electronic Control Unit (73-21-60) - New Software Versions 7.B.WF3 for SAC and DAC Engines and 7.B.WF2 for SAC Engines” or

·CFM56-7B S/B 73-0203 “ENGINE FUEL AND CONTROL - Electronic Control Unit (73-21-60) - New Software Version 7.B.WF2 for DAC Engines”

Boeing Service Letter 737-73-013-U provides additional information.

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

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Flight Crew Operations Manual Bulletin
for
Xiamen Airlines

Number: 2013-01

IssueDate: 2013/01

Airplane Effectivity:B737-7/800

Subject: Experiencing TCAS FAIL Message on Some Aircraft When Operating on the Ground

From: Maintenance Bulletin MB-201133R4（Flight Technical Operations Bulletin 2013-01）

Background Information

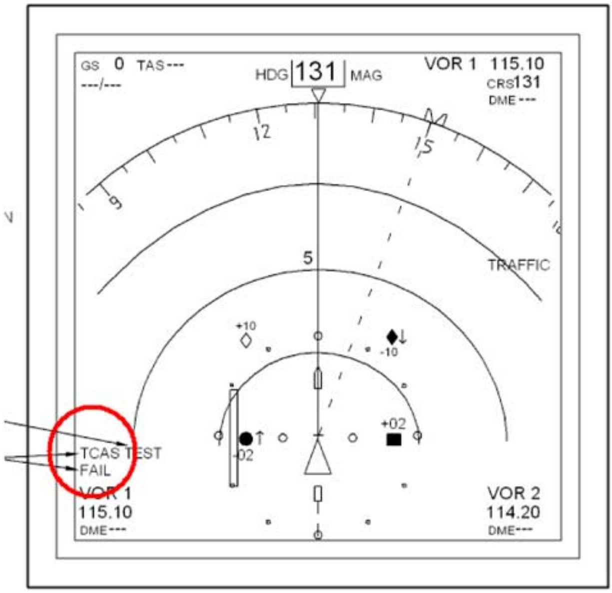
According to HONEYWELL SIL D201212000028, the four highhot aircrafts (B-5277, B-5278, B-5279, B-5280) and 737-800 after B-5630 (included) experience TCAS FAIL when operating on the ground. The reason is the TCAS fail message can get latched to the fail condition after a self test is run on aircraft with the air data inertial reference unit (ADIRU) not aligned.

According to HONEYWELL SIL and the maintenance experience, in general condition, the TCAS will operate normally after doing one of the following two works:

1: Do the TCAS operational test (Push the TEST switch on the control panel, a "SYSTEM TEST OK" synthesized voice announcement comes on at the end of the test if the test passes.) while in the TA/RA position on the control panel.

2: Reset the TCAS (Open and close the circuit breaker "TCAS" on the P18-1 panel B6 location).

Regarding this condition, we are searching a solution with Boeing and Honeywell. Before the final solution comes out, if the certain airplanes experience TCAS FAIL when operating on the ground. we suggest flight crew connect the AOC or Line Maintenance Department first before turn backbit is easy to resolve the problem when airplane is on the ground but it will be difficult when airplane is in the air. So, please try to find the problem on the ground. We advise to observe if TCAS FAIL message is appeared in the ND display when turning the control knob from STANDBY to ON or AUTO position while in the TA/RA position on the control panel (Refer to the figure below).


GS 0 TAS---
---/---
HDG 131 MAG
VOR 1 115.10
CRS131
DME ---
12
15
9
5
TRAFFIC
+10
-10
+02
-02
TCAS TEST
FAIL
VOR 1
115.10
DME---
VOR 2
114.20
DME---

Flight Crew Operations Manual Bulletin
for
Xiamen Airlines

The Boeing Company
Seattle, Washington 98124-2207

Number: XIA-81

IssueDate: June 5, 2013

Subject: U10.8A FMC Restarts from ATS (Air Traffic Services) or AOC (Aeronautical Operational Control) Datalink issues

Reason: This bulletin informs 737NG/BBJ flight crews of the possibility of the FMC resetting or of the FMC prompt on the MCDU Menu page flashing when using ATS or AOC Datalink.

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

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

ATS Datalink issue:

A condition present in the Update 10.8A FMC software may cause any of the following anomalies:

- FMC software to perform a restart
- Flashing of the FMC prompt on the MCDU Menu page when using ADS
- Significant slowdown of FMC operation.

The condition is due to the FMC retaining unused ADS downlink messages in its Air Traffic message queue. These messages can be erroneously retained in the FMC queue after an unexpected loss of the HF or SATCOM data link between the airplane and the ground.

This condition has been reported to occur during operation of the FMC FANS-1 ATS data link.

The following is required for the condition to occur:

The airplane is equipped with an FMC that has ATS data link functionality enabled in its OPC (Operational Program Configuration) software. If the airplane has logged onto an Air Traffic Services (ATS) connection, the FMC attempts to send an ADS downlink via HF or SATCOM. If the data link transmission medium (either HF or SATCOM) is interrupted and the FMC message is not cleared by the FMC (due to transmission interruption or data conflict between the airplane and ground station) it can remain in the FMC message queue. This can result in very sluggish FMC operation and can possibly result in the FMC performing a software restart.

AOC Datalink issue:

On airplanes with ACARS Management Unit (MU) or Communications Management Unit (CMU), if the VHF radio is used in DATA mode when the airplane is not within the range of the service provider, the automatic ACARS service provider sign-in message will not be acknowledged. The sign-in message will also not be acknowledged when the operator does not have a subscription to an ACARS service provider.

The lack of acknowledgement causes the message to be retained in the FMC queue which may result in flashing of the FMC prompt on the MCDU Menu page or slowdown of FMC operation.

A correction to the software to provide a fix for both conditions is planned for FMC Update U11.

Operating Instructions

To avoid the ATS Datalink condition, do not log onto ATS.

To avoid the AOC Datalink condition, do not use the VHF radio in DATA mode when outside the service range of the ACARS service provider, or if the airline does not have a subscription to an ACARS service provider.

On the ground:

After power up, switch the VHF radio to VOICE mode from DATA mode.

If either problem occurs in flight:

1. Select the VHF radio to VOICE mode from DATA mode
2. Set the FMC Source Select switch to BOTH ON R (if dual FMC installed). This facilitates logging off SATCOM (if installed). The switch can be set back to NORMAL after logging off
3. Logoff the SATCOM system (if installed)
4. If HF datalink is present, select the HF radio to VOICE mode from DATA mode
5. Do not use ATS or AOC Datalink for the rest of the flight

6. Record the event in the logbook for maintenance action prior to next flight to prevent reoccurrence.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record Page to show bulletin XIA-81 "In Effect" (IE).

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

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

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Flight Crew Operations Manual Bulletin
for
Xiamen Airlines

The Boeing Company
Seattle, Washington 98124-2207

Number: XIA-83

IssueDate: April 1, 2014

Subject: Airspeed Low Aural Alert Anomaly

Reason: This bulletin informs 737NG flight crews of the possibility that the Airspeed Low aural alert may not sound even though airspeed has decreased into the amber band.

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

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

On the 737NG, the airspeed readout box surrounding the current airspeed changes to amber and flashes for 10 seconds when current airspeed decreases 30% or more into the minimum maneuver speed amber band. If the condition persists after ten seconds, the readout box changes color to solid amber until the airspeed is greater than the top of the amber band. On airplanes equipped with the Airspeed Low aural alert, the voice alert annunciates “Airspeed Low, Airspeed Low” at the onset of the condition.

Flight testing has shown that on those airplanes equipped with the Honeywell Mark V-A (MKV-A) EGPWS Software Part Number 69000940-101, the Airspeed Low aural alert may not sound even though airspeed has decreased into the amber band. The airspeed box turns amber reflecting a drop in airspeed 30% or more into the amber band with no corresponding aural alert.

This anomaly can only be present if the airspeed decreases into the amber band while the amber band is rising, e.g., during flap/slat retraction, turbulence, change in load factor, etc. The crew may not receive the Airspeed Low aural alert although the current speed is below the threshold for the alert.

The Honeywell Mark V-A (MKV-A) EGPWS Software Part Number 69000940-101 was installed on Production Line Number 4763 (delivered January 2014), and on Production Line Number 4777 and on. Honeywell plans to issue EGPWS Software Part Number 69000940-102 to correct this condition.

Operating Instructions

Flight crews should monitor airspeed during all phases of flight and call out deviations or changes to instruments during all conditions. If installed, the Air Speed Low aural is a supplemental means of awareness to the visual indication represented to the flight crew on the primary flight display. With or without the Airspeed Low aural, flight crews are expected to monitor the airspeed and call out any unplanned or unexpected deviations in accordance with the Stabilized Approach Criteria and Recommended Callouts listed in the Flight Crew Training Manual.

Crew response to an airspeed low condition will be same with or without the aural alert. At the onset of this condition, flight crews are expected to promptly correct the airspeed to increase the speed above the amber band as indicated on the Primary Flight Display.

Crews should be especially observant of airspeed when operating near or in the amber minimum maneuver speed band.

Administrative Information

Insert this bulletin behind the FCOM Bulletin Record Page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record Page to show bulletin XIA-83 "In Effect" (IE).

This FCOM bulletin will be cancelled when an operator reports to Boeing that the Honeywell EGPWS Software Part Number 69000940-102 has been installed on all affected 737NGs in their fleet.

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

Flight Crew Operations Manual Bulletin
for
Xiamen Airlines

The Boeing Company
Seattle, Washington 98124-2207

Number: XIA-87

IssueDate: March 31, 2016

Subject: GPWS Minimums Voice Callout Anomaly

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

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

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

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

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

Operating Instructions

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

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin XIA-87 "In Effect" (IE).

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

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

Flight Crew Operations Manual Bulletin
for
Xiamen Airlines

The Boeing Company
Seattle, Washington 98124-2207

737

Number: XIA-88

IssueDate: March 31, 2016

Subject: Look-Ahead Terrain Alerting Display Anomalies

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

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

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

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

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

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

Operating Instructions

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

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

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin XIA-88 "In Effect" (IE).

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

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

Flight Crew Operations Manual Bulletin
for
Xiamen Airlines

The Boeing Company
Seattle, Washington 98124-2207

737

Number: XIA-89 R2

IssueDate: September 19, 2016

Subject: Window Heat Control Unit (WHCU) Initialization Indications

Reason: A new WHCU will be installed on 737NG airplanes at line number 5830 and on. This new WHCU goes through an initialization process when the WINDOW HEAT switches are selected to ON. The initialization process produces indications that could be misinterpreted as abnormal.

This bulletin is being revised to update the functionality of the WHCU during electrical power transfers, and to update the affected line numbers.

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

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Selection of the WINDOW HEAT switches to the ON position places the new WHCU into an initialization process. The amber window OVERHEAT lights illuminate along with the two master caution lights and the amber ANTI-ICE light on the system annunciator panel because during the initialization process electrical power is not being applied to the windows.

After the initialization process completes, in approximately 3 seconds, the amber window OVERHEAT lights, the two master caution lights, and the amber ANTI-ICE light on the system annunciator panel extinguish. The green window heat ON lights also illuminate.

The illumination of these amber lights during the initialization process does not change the function of the OVERHEAT light during an overheat or loss of electrical power.

Additionally, selecting a different source of electrical power with the WINDOW HEAT switches in the ON position can potentially illuminate the amber window OVERHEAT lights due to electrical current spikes.

The affected WHCU, Boeing Part # 10-61833-8, will be installed on 737NG airplanes from line numbers 5830 to 6029. Airplanes from line number 6030 and on will be delivered with an updated WHCU, Boeing Part # 10-61833-9.

Operating Instructions

The functionality of the new WHCU will affect the following procedures:

Normal Procedures - NP.21

- Preflight Procedures - First Officer

Supplementary Procedures - SP.3

- Window Heat System Tests

Quick Reference Handbook - QRH 3

- WINDOW OVERHEAT

If the window OVERHEAT lights extinguish within 5 seconds of turning the window heat ON, the WHCU is operating normally.

In order to make it easier to differentiate the temporary differences in these procedures, a revision bar has been used.

The above procedures are amended as follows until the WHCU is updated with Boeing Part # 10-61833-9.

NP.21 - PREFLIGHT PROCEDURE - FIRST OFFICER

WINDOW HEAT switches .... ON

Position switches ON at least 10 minutes before takeoff.

Verify the OVERHEAT lights extinguish within 5 seconds.

Note: The master caution and ANTI-ICE system annunciator lights can illuminate.

Verify that the ON lights are illuminated (except at high ambient temperatures).

SP.3 - WINDOW HEAT SYSTEM TESTS

Overheat Test

The overheat test simulates an overheat condition to check the overheat warning function of the window heat system.

WINDOW HEAT switches .... ON

Verify the OVERHEAT lights extinguish within 5 seconds.

Note: The master caution and ANTI-ICE system annunciator lights can illuminate.

WINDOW HEAT TEST switch .... OVHT

OVERHEAT lights - ON

On lights - Extinguish

Lights extinguish after approximately 1 minute.

MASTER CAUTION - ON

ANTI-ICE system annunciator - ON

WINDOW HEAT switches .... Reset

Position the WINDOW HEAT switches OFF, then ON.

Verify the OVERHEAT lights extinguish within 5 seconds.

Note: The master caution and ANTI-ICE system annunciator lights can illuminate.

Power Test

The power test verifies operation of the window heat system. The test may be accomplished when any of the window heat ON lights are extinguished and the associated WINDOW HEAT switch is ON.

WINDOW HEAT switches .... ON

Verify the OVERHEAT lights extinguish within 5 seconds.

Note: The master caution and ANTI-ICE system annunciator lights can illuminate.

Note: Do not perform the power test when all ON lights are illuminated.

WINDOW HEAT TEST switch .... PWR

The controller is forced to full power, bypassing normal temperature control. Overheat protection is still available.

WINDOW HEAT ON lights .... Illuminated

If any ON light remains extinguished, the window heat system is inoperative. Observe the maximum airspeed limit of 250 kts below 10,000 feet.

QRH 3 - WINDOW OVERHEAT

Condition: A window overheat occurs.

1. WINDOW HEAT switch (affected window) .... OFF
2. **Wait** 2 - 5 minutes.
3. WINDOW HEAT switch (affected window) ....ON
4. **Wait** 5 seconds

   Note: The master caution and ANTI-ICE system annunciator lights can illuminate.

5. Choose one:

   Window OVERHEAT light **stays extinguished:**

   Continue normal operation.

   (End of Checklist)

   Window OVERHEAT light **illuminates again:**

   Go to step 6

6. WINDOW HEAT switch (affected window) .... OFF

   Limit airspeed to 250 knots maximum below 10,000 feet.

7. Pull both WINDSHIELD AIR controls. This vents conditioned air to the inside of the windshield for defogging.

   (End of Checklist)

For illumination of the amber window OVERHEAT lights following electrical power transfers, the crew should cycle electrical power to the affected window by completing the above WINDOW OVERHEAT non-normal checklist.

Administrative Information

This bulletin replaces bulletin XIA-89 R1 , dated April 4, 2016. Revise the Flight Crew Operations Manual Bulletin Record Page to show bulletin XIA-89 R1 as “CANCELLED” (CANC).

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin XIA-89 R2 "In Effect" (IE).

This FCOM bulletin will be cancelled when the operator reports to Boeing that all the airplanes in their fleet between line numbers 5830 and 6029 have been retrofitted with the updated WHCU, Boeing Part # 10-61833-9.

Airplanes from line number 6030 and on will be delivered with an updated WHCU, Boeing Part # 10-61833-9. These WHCUs will not necessitate the use of the procedures outlined in this bulletin.

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

Note: ***The above temporary procedures are applicable to the following airplanes: B-7557 (YV742), B-7558 (YV743), B-7559 (YV744), B-7560 (YT521), B-7846 (YV746), B-7847 (YV745), B-7848 (YV747),B-7849 (YV748).***

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Flight Crew Operations Manual Bulletin
for
Xiamen Airlines

The Boeing Company
Seattle, Washington 98124-2207

Number: XIA-90

IssueDate: April 28, 2016

Subject: NPS Scales Mask ILS/GLS Localizer and Glideslope Fail Flags

Reason: This bulletin informs 737NG flight crews that the ILS/GLS Localilizer (LOC) and Glideslope (GS) fail flags are masked by the Navigation Performance Scales.

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

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Operators with the Navigation Performance Scales (NPS) option need to be aware that if there is an internal failure of the ILS or GLS component of the Multi Mode Receiver (MMR), the LOC and/or G/S flags are masked by the NPS scales on the failed side Primary Flight Display (PFD).

There are some failures in the ILS /GLS component of the MMR, that cause the station identifier or ILS frequency/GLS channel to remain displayed in the approach reference section of the PFD despite the failure. The aural identifier may or may not be available. However, the anticipation cues (ghost pointers) are not displayed with any type of failure of the ILS/GLS component in the MMR. The approach mode (APP) is still capable of being armed, although it does not capture if the master flight director is on the failed side.

Operating Instructions

Operators with the NPS option should emphasize to their flight crews, the importance of confirming that the localizer and glideslope pointers are shown when preparing to execute an ILS/GLS approach, in accordance with ILS or GLS Landing Procedure in the FCOM. In addition, the anticipation cues should be confirmed to be in view as well. If an MMR failure is suspected, set the EFIS mode selector to APP to confirm the LOC and/or G/S fail flags are shown on the Navigation Display (ND). When a failure of the ILS or GLS component of the MMR is confirmed, select an approach other than an ILS or GLS.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin XIA-90 "In Effect" (IE).

This anomaly will be corrected with CDS BP15, currently scheduled for release in mid 2016.

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

Flight Crew Operations Manual Bulletin
for
Xiamen Airlines

The Boeing Company
Seattle, Washington 98124-2207

Number: XIA-91

IssueDate: July 1, 2016

Airplane Effectivity: 737-600/700/800/900 and BBJ Airplanes with U10.2 through U12 FMC Operational Software.

Subject: Incorrect FMC Speed/Altitude Constraints following a runway change with a Standard Terminal Arrival (STAR) and the previous runway already executed in the FMC

Reason: To inform crews on this subject and to provide guidance.

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

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

An operator reported that during an arrival with a valid STAR and runway active in the FMC flight plan, the landing runway was changed by Air Traffic Control (ATC). After the runway change was made in the FMC, the crew noticed that the waypoint constraints associated with the new RWY selection were incorrect. The FMC software did not automatically update the speed and altitude constraints associated with the new RWY selection in the FMC, with a valid STAR/RWY combination active in the FMC flight plan. The speed/altitude constraints associated with the initial STAR and previous runway assignment remained in the active flight plan.

This results with incorrect waypoint constraints in the FMC flight plan for the STAR with the selection of a new RWY.

This condition was introduced in U10.2 and is present in all versions of FMC software from U10.2 through U12.

Operating Instructions

This condition can be resolved by re-selecting and executing the existing STAR, after the new RWY has been selected in the FMC. This method is less of a workload than manually inserting each waypoint speed/altitude constraint into the FMC. In the event it is not possible to re-enter the STAR, because the airplane is already established on a segment of the ATC-issued STAR, manual entry of each waypoint speed/altitude constraint into the FMC may be necessary. Regardless of which method is used to overcome this situation, it is critical that the pilots carefully review all airspeed and altitude constraints associated with a STAR and RWY, when either are entered or changed in the FMC flight plan.

This anomaly will be corrected in FMC software update U13.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record Page to show bulletin XIA-91 "In Effect" (IE).

This anomaly will be corrected in FMC software update U13.

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

Note: This bulletin applies to all B737 aircraft in Xiamen Airlines at present (U10.8 A FMC on most of the B737 aircraft and U12 FMC on the newly introduced B737 aircraft).

Flight Crew Operations Manual Bulletin
for
Xiamen Airlines

The Boeing Company
Seattle, Washington 98124-2207

Number: XIA-92

IssueDate: October 17, 2016

Subject: NAV Display Blanking/Blinking After Installation of Common Display System (CDS) BP15

Reason: To Make Flight Crews Aware of Potential NAV Display Blanking/ Blinking with the Installation of Common Display System (CDS) BP15.

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

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

During bench testing of the Common Display System (CDS) software BP15, a combination of conditions were discovered which may cause some Display Units (DUs) to blank or blink.

This situation may manifest itself when all of the following conditions are met:

1. Two (2) functioning Display Electronics Units (DEUs).
2. DISPLAY SOURCE selector is set to AUTO.
3. Six (6) functioning Display Units (DUs).
4. Captain's ND shows MAP with Vertical Situation Display (VSD) selected on the Left Inboard DU.
5. Captain's MAIN PANEL DU and LOWER DU Display selector set to NORM.
6. First Officer's ND shows MAP with VSD selected on the Right Inboard DU.
7. First Officer's MAIN PANEL DU selector set to NORM and LOWER DU Display selector set to ND.

If all of the conditions above are met, and depending on the DEU equipment installed, one of the following anomalies may result:

A. The First Officer's Right Inboard DU and Lower Center DU will blank or blink, or

B. The First Officer's Right Inboard DU and Lower DU map background data will freeze or not appear, and the MAP fail flag will appear if the problem persists for more than 30 seconds.

If any of the seven (7) conditions is not met, the Display Units (DUs) will stabilize and the anomaly will stop.

Operating Instructions

On airplanes with CDS BP15 and VSD selected on the inboard DUs by both pilots, the First Officer should not select ND on the lower center display unit to avoid this situation.

Research is being conducted to confirm the root cause of this anomaly. Once the root cause is confirmed, this bulletin will be updated as necessary.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual. Amend the Bulletin Record to show bulletin XIA-92 "In Effect" (IE).

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

Note: The current airplane effectivity: YV751 (B-1558), YV752 (B-1579) and YV753 (B-1580).

Flight Crew Operations Manual Bulletin
for
Xiamen Airlines

The Boeing Company
Seattle, Washington 98124-2207

Number: XIA-93 R1

IssueDate: December 19, 2016

Subject: Cabin Pressurization Panel Blanking/Dimming Issues

Reason: To inform the crew of failures of the Cabin Pressurization Panel where the indications flicker, become too dim to read, or completely blank.

This bulletin is being revised to update the flight crew procedure in the event the FLT ALT needs to be changed to a higher altitude than the current setting due to a change in cruise altitude.

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

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

The Cabin Pressurization Panel was redesigned to replace obsolete components and was introduced on the 737NG in April 2013 beginning with line number 4413. Similar to the previous panels, it includes three displays: the FLT ALT indicator, LAND ALT indicator, and the outflow Valve Position Indicator, all of which now use LED lighting technology.

Several operators have reported occurrences where the new LED display indications either flicker, become too dim to read, or completely blank. Most of the blanking reports indicate a self-recovery of the panel after a short duration of time. The duration of the effects can vary but it is typically momentary.

The cause of these occurrences is still under investigation by the manufacturer of the Cabin Pressurization Panel but early testing points to possible Electromagnetic Interference (EMI).

The Cabin Pressurization Panel is supplied by United Technologies (UTAS) and is P/N 1019439-1-001, equivalent Boeing P/N is 10-62231-31.

Boeing is working with UTAS to determine the cause of the Cabin Pressurization Panel failures. Once the cause of the problem and the appropriate fix is confirmed it will be introduced at the factory for new airplanes. For airplanes already in service Boeing will communicate appropriate fix instructions.

Currently only the first line number is known for the affected airplanes, 4413. Once the line number for the last affected airplane is determined this FCOM bulletin will be revised. Also included in the revision will be confirmation of the cause of the Cabin Pressurization Panel failures and a time line for the fix.

Operating Instructions

If the Cabin Pressurization Panel display indications flicker, become too dim to read, or completely blank, it is important to note that the pressurization system will function as initially set by the crew. Cabin Pressurization Panel changes do not need to be made if a failure occurs and crew action is not needed or recommended.

If a Cabin Pressurization Panel failure occurs the crew should follow operator specific procedures or policies for reporting the failure.

The following action should be taken:

> **On the ground:**
>
> Do not takeoff.
>
> **In flight:**
>
> The Cabin Pressurization Panel failure should be momentary. Allow the Cabin Pressurization Panel to self-recover.
>
> > If the Cabin Pressurization Panel self-recovers, continue normal operation.
> >
> > If the Cabin Pressurization Panel does not self-recover, avoid flight plan amendments requiring a change to the FLT ALT or LAND ALT on the Cabin Pressurization Panel.
> >
> > > If a situation requires a change on the Cabin Pressurization Panel to FLT ALT and the display is not visible:
> > >
> > > > Do not attempt to change the FLT ALT.
> > > >
> > > > If the FLT ALT needs to be changed to a lower altitude than the current setting due to a change in cruise altitude:
> > > >
> > > > > No crew action is required. Operate the airplane at the new lower cruise altitude.

If the FLT ALT needs to be changed to a higher altitude than the current setting due to a change in cruise altitude:

No crew action is required. Operate the airplane at the new higher cruise altitude.

Note: Flying above the selected FLT ALT will drive the cabin to the maximum differential pressure. When the maximum cabin differential pressure is reached, the automatic control system will prioritize limiting differential pressure and will stop controlling cabin rate. If the airplane climbs after the maximum differential pressure is reached, the cabin rate will equal the airplane rate.

If a situation requires a change on the Cabin Pressurization Panel to LAND ALT and the display is not visible:

Do not attempt to change the LAND ALT.

Manually control cabin altitude when below 10,000 feet MSL or 3,000 feet above airport elevation, whichever is higher.

Landing must be accomplished with the airplane unpressurized.

Follow guidance provided in the Supplementary Procedures chapter of the Flight Crew Operations Manual (FCOM). Refer to SP.2, Air Systems, Manual Mode Operation.

Note: Verify desired outflow valve movement with changes on the cabin altimeter/differential pressure indicator and the cabin rate of climb indicator.

Administrative Information

This bulletin replaces bulletin XIA-93 , dated October 21, 2016. Revise the Flight Crew Operations Manual Bulletin Record Page to show bulletin XIA-93 as “CANCELLED” (CANC).

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin XIA-93 R1 "In Effect" (IE).

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

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Flight Crew Operations Manual Bulletin
for
Xiamen Airlines

The Boeing Company
Seattle, Washington 98124-2207

Number: XIA-94

IssueDate: December 15, 2016

Airplane Effectivity: B737-600/700/800/900 and BBJ Airplanes with existing FMC Software including Update U13 (scheduled to be released April 2017).

Subject: Incorrect FMC Constraint Altitude on a Standard Terminal Arrival Route (STAR) with a Common Waypoint, after Selection of another Approach

Reason: To inform crews about the incorrect FMC Constraint Altitude, when selecting another approach that has a common waypoint with the original STAR in the active flight plan.

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

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

For airplanes with the existing FMC Software, including Update 13, when a selected approach is changed to another approach that has a common waypoint with the original STAR, the FMC will use the higher constraint altitude for the common waypoint.

Operating Instructions

When a selected approach is changed for another approach that has a common waypoint with the original STAR, verify the waypoint constraint altitude after changing the selected approach.

This anomaly will be corrected in FMC software update U14.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin XIA-94 as "In Effect" (IE).

This anomaly will be corrected in FMC software update U14.

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

Flight Crew Operations Manual Bulletin
for
Xiamen Airlines

The Boeing Company
Seattle, Washington 98124-2207

Number: XIA-96

IssueDate: April 21, 2017

Subject: Engine Start Levers

Reason: To inform the flight crew that a rotational force should not be applied to the engine start levers.

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

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Certification flights on the 737-8 revealed that the locking tabs on the engine start levers can be rotated when moving in either direction between the CUTOFF and IDLE detents. A rotation of the locking tabs can cause the engine start lever to fail to lock in position which can lead to engine start lever movement.

Boeing issued a Multi Operator Message (MOM-16-0226-01B) in March of 2016. The MOM requested operators perform a visual inspection of the engine start levers and report findings back to Boeing. Boeing received five reported incidences where the locking tabs were found to be rotated. A Fleet Team Digest (737NG-FTD-76-16001) was issued to provide additional information.

The manufacturer of the engine start levers, Honeywell, is working on a redesign to prevent rotation of the locking tabs. Once the redesigned engine start levers become available, all future 737NGs and 737MAXs will be delivered with the redesigned engine start levers. For those airplanes already delivered, the redesigned engine start levers will be replaced via spares attrition.

The 737NG affected by this bulletin is line number 5477, then 737NGs with line number 5605 and on. *

Operating Instructions

In order to prevent rotation of the locking tabs, flight crews are instructed to not apply rotational force when moving the engine start lever.

A caution will be added to the following procedures:

- Normal Procedures
    - Engine Start Procedure
    - Shutdown Procedure
- Supplementary Procedures
    - Operation in a Sandy or Dusty Environment
        - Engine Start Procedure

The caution will be added immediately above the engine start lever step and will read:

CAUTION: Do not apply rotational force when moving the engine start lever.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin XIA-96 as "In Effect" (IE).

The caution will be added to the above procedures in a future revision of the FCOM. This bulletin will be canceled once the caution has been added.

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

**** Note: The current airplane effectivity: B-6819 (YT512) and on.***

Flight Crew Operations Manual Bulletin
for
Xiamen Airlines

The Boeing Company
Seattle, Washington 98124-2207

Number: XIA-97

IssueDate: July 17, 2017

Airplane Effectivity: B737-600/700/800/900/BBJ Airplanes

Subject: ADIRU P/N HG2050BC02 Position Drift and Ground Speed Errors

Reason: To inform flight crews of potential ADIRU position drift and ground speed errors when ADIRU P/N HG2050BC02 is installed.

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

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Boeing has received reports from several 737NG operators of ADIRU position drift and ground speed errors in airplanes equipped with ADIRU P/N HG2050BC02. The root cause of these drift and groundspeed errors has been identified as a reduced accuracy performance caused by a software error in the ADIRU P/N HG2050BC02. The reduced accuracy performance errors are cumulative and increase if the ADIRU goes through a full alignment multiple times during the course of daily operations. The following FMC Alerting messages can be experienced as the drift and ground speed errors increase:

Airplanes with FMC update U10.0 to U10.6:

- “VERIFY POSITION”, or
- “UNABLE REQD NAV PERF – RNP”,

Airplanes with FMC update U10.7 to U10.8A:

- “VERIFY POSITION”,
- “UNABLE REQD NAV PERF – RNP”,
- “IRS POS/ORIGIN DISAGREE”,
- “VERIFY POS: IRS-FMC”,
- “VERIFY POS: IRS-IRS”.

Airplanes with FMC update U11 and onwards:

- “VERIFY POSITION”,
- “UNABLE REQD NAV PERF – RNP”,
- “IRS-L DRIFT”,
- “IRS-R DRIFT”,
- “IRS POS/ORIGIN DISAGREE”,
- “VERIFY POS: IRS-FMC”,
- “VERIFY POS: IRS-IRS”.

Operating Instructions

The following procedure is recommended for B737NG airplanes with at least one HG2050BC02 ADIRU installed.

During the Preliminary Preflight Procedure perform a full IRS alignment for one or more of the following:

- On the first flight of the day
- If continuous AC electrical power is not available to the airplane during ground stops
- If 18 hours have elapsed since the last full alignment
- If before the start of a flight, 18 hours will be exceeded since the last full alignment, during the course of the next flight leg.

After alignment is complete, remain in NAV mode as long as possible.

A Fast Realignment, as described in the FCOM SP.11, Supplementary Procedures, may be performed between successive flight legs. This will reset the accumulated position and groundspeed error from the previous flight.

1. Boeing recommends checking the residual ground speed error at the end of each flight and within five (5) minutes of reaching the final parking position. The serviceable limits are:
    a. If operating two consecutive flights: less than fifteen (15) knots at the end of each flight.
    b. If operating a single flight: less than twenty one (21) knots at the end of the flight.
2. This is done by taking the following steps:
    - On the CDU select POS REF page 2/3
    - Note the residual groundspeed on IRS L and IRS R
3. If the residual ground speed error of either IRS is in excess of the serviceable limits in 1 a) and b), record in the appropriate Maintenance Document for maintenance action.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin XIA-97 as "In Effect" (IE).

Boeing and Honeywell are in the process of finalizing the solution for ADIRU P/N HG2050BC02. When the solution is determined, a Service Bulletin will be issued on the fix to correct this anomaly for ADIRU P/N HG2050BC02.

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

This FCOM Bulletin will be cancelled after Boeing is advised that all airplanes in your fleet have been modified, per the subject Service Bulletin.

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

** **Note: The current airplane effectivity: YT511 (B-6818) and on.***

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Flight Crew Operations Manual Bulletin
for
Xiamen Airlines

The Boeing Company
Seattle, Washington 98124-2207

737

Number: XIA-98

IssueDate: April 20, 2018

Airplane Effectivity: B737-600/700/800/900/BBJ Airplanes with Rockwell Collins FCC Software Version P8.0 or P9.0 installed

Subject: Descent Below Glide Slope During Approach on 737NG Airplanes With Rockwell Collins Flight Control Computer (FCC) software Version P8.0 or P9.0 Installed

Reason: This bulletin informs flight crews operating 737NG airplanes equipped with Rockwell Collins FCC software P8.0 or P9.0 of the potential to descend below the glideslope during approach.

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

THE FOLLOWING PROCEDURE AND/OR INFORMATION IS EFFECTIVE UPON RECEIPT

Background Information

Boeing has received reports from 737NG operators that when conducting an ILS approach with the autopilot engaged, APP mode selected on the MCP, and G/S annunciated in green on the Flight Mode Annunciation (FMA), the autopilot did not properly acquire the glideslope. As the airplane descended away from the glideslope centerline the Flight Director (F/D) indicated close to the centered position and the glideslope pointer indicated the airplane below glideslope on the deviation scale.

These events occurred with the autopilot engaged while capturing the glideslope from above with high descent rates (approximately greater than 2000 feet per minute) and late arming of the APP mode. The high descent rate is maintained by the autopilot and can result in the airplane descending below the glideslope requiring flight crew intervention to return to the glideslope centerline.

Boeing has determined that the condition was introduced in FCC software versions P8.0 and P9.0 when a change was incorporated to reduce aggressive pitch-up maneuvers at glideslope capture. The result of the design change is that, following a high descent rate capture, the autopilot may not provide sufficient pitch-up command to reduce the descent rate and acquire the glideslope.

The described descents below glideslope can occur when all of the following conditions are met:

- Glideslope capture above approximately 2500 feet AGL.
- Glideslope capture from above with a descent rate in excess of approximately 2000 fpm.
- Arming the APP mode late, i.e., arming when descending through the glideslope centerline.
- Autopilot engaged (glideslope captures using F/D only are not affected)

It is important to note that even though the reported events occurred during an ILS approach, this anomaly can also occur during a GLS approach or when conducting an instrument approach using IAN.

This anomaly affects 737NG airplanes with the following FCC Operational Program Software (OPS):

P8.0 FCC OPS (227A-COL-AC1-09)

- Boeing Part Number S241A100-509
- Rockwell Collins Part Number 831-5854-180

P9.0 FCC OPS (2272-COL-AC1-10)

- Boeing Part Number S241A100-510
- Rockwell Collins Part Number 831-5854-190

Operating Instructions

Normally the glideslope is captured from below while in level flight. In the event the glideslope needs to be captured from above with the autopilot engaged, use the following recommended techniques and considerations as paraphrased from the Flight Crew Training Manual (FCTM):

- attempt to capture the glideslope prior to the Final Approach Fix (FAF)
- verify the localizer is captured before descending below the cleared altitude or the FAF altitude
- select APP on the MCP and verify that the glideslope is armed
- establish final landing configuration and set the MCP altitude no lower than 1,000 feet AFE
- select the V/S mode and set -1000 to -1500 fpm to achieve glideslope capture and be stabilized for the approach by 1,000 feet AFE. Use of the VSD (as installed) or the green altitude range arc may assist in establishing the correct rate of descent.

- monitor rate of descent and airspeed
- verify correct Flight Mode Annunciations and monitor glideslope deviations.

Note: If the glideslope is not captured or the approach is not stabilized by 1,000 feet AFE, initiate a go-around.

For complete recommended techniques and considerations refer to “Intercepting Glide Slope from Above” in the FCTM found in Chapter 5.

Administrative Information

Insert this bulletin behind the Bulletin Record page in Volume 1 of your Flight Crew Operations Manual (FCOM). Amend the FCOM Bulletin Record page to show bulletin XIA-98 as "In Effect" (IE).

This anomaly will be corrected with the following FCC OPS update which is expected to be available in 3Q2018:

P11.1 FCC OPS (2270-COL-AC2-22)

- Boeing Part Number S241A100-521
- Rockwell Collins Part Number 831-5854-211

This FCOM Bulletin will be canceled after Boeing is notified that all of the affected airplanes in your fleet have been retrofitted with FCC OPS P11.1 or newer.

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

**** Note: The current airplane effectivity:***

P8.0 FCC OPS (227A-COL-AC1-09)

Registry Number	Serial Number	Tabulation Number
B-1749	39909	YS190
B-1966	39910	YT501
B-6485	39913	YT502
B-6483	39918	YT503
B-6482	41391	YT504
B-6487	39919	YT505
B-6486	41395	YT506
B-1964	39914	YT507

Registry Number	Serial Number	Tabulation Number
B-6489	39915	YT508
B-6490	41392	YT509
B-6488	41396	YT510
B-6818	39916	YT511
B-6819	39917	YT512
B-6849	40959	YT513
B-6842	40957	YT514
B-7176	41393	YT515
B-7177	41394	YT516
B-7179	40960	YT517
B-7178	40958	YT518
B-7195	43885	YT519
B-7196	43886	YT520
B-7560	43887	YT521
B-6887	43884	YV604
B-6889	43914	YV605
B-7197	42925	YV741
B-7557	42926	YV742
B-7558	42927	YV743
B-7559	42928	YV744
B-7847	42930	YV745
B-7846	42929	YV746
B-7848	42931	YV747
B-7849	42932	YV748
B-1550	42934	YV750

P9.0 FCC OPS (2272-COL-AC1-10)

Registry Number	Serial Number	Tabulation Number
B-1579	42936	YV752
B-1580	42937	YV753
B-7816	42938	YV754
B-7826	42939	YV755
B-7819	42945	YV756
B-7821	42946	YV757
B-7823	42947	YV758
B-7831	42949	YV759
B-7818	42941	YV760
B-7825	42948	YV761
B-1455	42950	YV762
B-1457	63682	YV763
B-1456	42951	YV764
B-1302	63683	YV765
B-1301	42944	YV766
B-1300	42940	YV767
B-1303	42943	YV768
B-1305	63684	YV770
B-1352	63686	YV772
B-1353	42952	YV773
B-1355	42953	YV774
B-1371	63687	YV775
B-1370	42955	YV776
B-1369	42954	YV777

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Limitations — Chapter L

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Limitations Chapter L

Operating Limitations Section 10

Introduction

This chapter contains:

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

Information is included if it is:

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

Information is not included if it is:

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

Operational information listed in this chapter that must be memorized (memory items) are marked with a (#) symbol. They meet the following criterion - flight crew access by reference can not assure timely compliance, e.g., Maximum Takeoff and Landing Tailwind Component. They need only be memorized to the extent that compliance is assured. Knowing the exact wording of the limitation is not required.

Assuming that the remaining items are available to the flight crew by reference, they do not need to be memorized.

Airplane General

Operational Limitations

Runway slope	+/– 2%
# Maximum Takeoff and Landing Tailwind Component **YF048 - YL551, YN531 - YV754** **Note:** The capability of the airplane(s) has been satisfactorily demonstrated for takeoff and manual landing with tailwinds up to 15 knots. **YF048 - YL551, YN531 - YV605** **Note:** Airplanes operating under FAA Rules: This finding does not constitute operational approval to conduct takeoffs or landings with tailwind components greater than 10 knots.	**YF048 - YL551, YN531 - YV754** 15 knots (see note(s)) **YA701 - YA710, YM482 - YM484** 10 knots
Maximum speeds	Observe gear and flap placards
Maximum Operating Altitude	41,000 ft
Maximum Takeoff and Landing Altitude	**YA701 - YM484, YS151 - YV754** 8,400 ft **YN531 - YN534** 14,500 ft

YA701 - YS179, YS191 - YS194, YV604 - YV754
Maximum flight operating latitude – 82° North and 82° South, except for the region between 80° West and 130 ° West longitude, the maximum flight operating latitude is 70° North, and the region between 120° East and 160° East longitude, the maximum flight operating latitude is 60° South.

YS180 - YS190, YT501 - YT521
Maximum flight operating latitude – 82° North and 82° South, except for the region between 80° West and 170 ° West longitude, the maximum flight operating latitude is 73° North, and the region between 120° East and 160° East longitude, the maximum flight operating latitude is 60° South.

Installation of handle covers on the overwing exits must be verified prior to departure whenever passengers are carried.

Verify that an operational check of the flight deck door access system has been accomplished according to approved procedures once each flight day.

Non–AFM Operational Information

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

On revenue flights, the escape slide retention bar (girt bar) must be installed during taxi, takeoff and landing.

Do not operate HF radios during refueling operations.

Altitude Display Limits for RVSM Operations

Standby altimeters do not meet altimeter accuracy requirements of RVSM airspace.

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

The maximum allowable on-the-ground altitude display differences for RVSM operations are:

Field Elevation	Max Difference Between Captain & F/O	Max Difference Between Captain or F/O & Field Elevation
Sea Level to 5,000 feet	50 feet	75 feet
5,001 to 10,000 feet	60 feet	75 feet

Weight Limitations

Note: The maximum weight limitations can be further limited as referenced in the WEIGHT LIMITATIONS section of the CERTIFICATE LIMITATIONS chapter of the AFM.

Maximum Taxi Weight

YA701 - YA710, YM482 - YM484

67,358 Kilograms

YN531 - YN534

70,080 Kilograms

Maximum Taxi Weight

YF048 - YL551, YS151 - YV754

78,017 Kilograms

Maximum Takeoff Weight

YA701 - YA710, YM482 - YM484

67,131 Kilograms

YN531 - YN534

69,853 Kilograms

YF048 - YL551, YS151 - YV754

77,791 Kilograms

Maximum Landing Weight

YA701 - YA710, YM482 - YM484

58,059 Kilograms

YN531 - YN534

58,604 Kilograms

YF921 - YF928, YK961 - YK966, YK968 - YK980, YS151 - YS190, YT501 - YT518, YV741 - YV754

65,317 Kilograms

YF048, YF049, YK622 - YK630, YK967, YL076 - YL551, YS191 - YS194, YT519 - YV605

66,224 Kilograms

Maximum Zero Fuel Weight

YA701 - YA710, YM482 - YM484

54,657 Kilograms

YN531 - YN534

55,202 Kilograms

Maximum Zero Fuel Weight

YF921 - YF928, YK961 - YK966, YK968 - YK980, YS151 - YS190, YT501 - YT518, YV741 - YV754

61,688 Kilograms

YF048, YF049, YK622 - YK630, YK967, YL076 - YL551, YS191 - YS194, YT519 - YV605

62,731 Kilograms

Air Systems

Pressurization

The maximum cabin differential pressure (relief valves) is 9.1 psi.

Non–AFM Operational Information

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

With either one or both engine bleed air switches ON, do not operate the air conditioning packs in HIGH for takeoff, approach or landing.

Note: The fire protection Non-Normal procedures takes precedence over the statement regarding no air conditioning pack in HIGH during takeoff, approach, or landing. The CARGO FIRE and SMOKE/ FUMES REMOVAL checklists require the Operating PACK switch(es) HIGH. Switch(es) need to be placed in HIGH in order to increase ventilation for smoke removal.

Autopilot/Flight Director System

Use of aileron trim with the autopilot engaged is prohibited.

Do not engage the autopilot for takeoff below 400 feet AGL.

YA701 - YV605
Airplanes operating under FAA Rules:

YA701 - YV605
For single channel operation during approach, the autopilot shall not remain engaged below 50 feet AGL.

YN531 - YN534
Do not use the autopilot below 100 feet radio altitude at airport pressure altitudes above 8,400 feet.

YA701 - YV605
Airplanes operating with FAA Rules: Maximum allowable wind speeds when landing weather minima are predicated on autoland operations:

- Headwind 25 knots
- Crosswind 20 knots

  YA701 - YA710, YM482 - YM484
- Tailwind 10 knots.

  YF048 - YL551, YN531 - YV605
- Tailwind 15 knots.

Maximum and minimum glideslope angles for autoland are 3.25 degrees and 2.5 degrees respectively.

Autoland capability may only be used with flaps 30 or 40 and both engines operative.

YN531 - YN534
Autoland capability may only be used to runways at or below 8,400 ft pressure altitude.

Non–AFM Operational Information

Note: The following item is not an AFM limitation, but is provided for flight crew information.

Do not use LVL CHG on final approach below 1000 feet AFE.

HUD System

YK622 - YK625

Do not use the HUD System at latitudes greater than 85 degrees latitude .

Note: Limitation is not applicable to the Model 4000 HUD system following the incorporation of Phase 4 (or later) software.

Communications

YA704, YF048 - YM484
Do not use VHF–3 (if installed for voice communication) for ATC communications with ACARS operational.

YA701 - YA710, YK622 - YK973, YL076 - YL544, YM482 - YM484
Flights predicated on the use of the following HF frequencies are prohibited: 29.489 and 29.490 (MHz).

Aircraft Communications Addressing and Reporting System

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

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

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

Non–AFM Operational Information

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

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

Engines and APU

Engine Limit Display Markings

Maximum and minimum limits are red.

Caution limits are amber.

Engine Ignition

Engine ignition must be on for:

- takeoff
- landing
- operation in heavy rain
- anti-ice operation.

Reverse Thrust

Intentional selection of reverse thrust in flight is prohibited.

APU

YA701 - YV605
Airplanes operating under FAA Rules: Inflight - APU bleed + electrical load: max alt 10,000 ft.

YA701 - YV605
Airplanes operating under FAA Rules: Ground only - APU bleed + electrical load: max alt 15,000 ft.

APU bleed: max alt 17,000 ft.

APU electrical load: max alt 41,000 ft.

Non–AFM Operational Information

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

APU bleed valve must be closed when:

- ground air connected and isolation valve open
- engine no. 1 bleed valve open
- isolation and engine no. 2 bleed valves open.

APU bleed valve may be open during engine start, but avoid engine power above idle.

After three consecutive aborted start attempts, a fifteen minute cooling period is required.

Flight Controls

The maximum altitude with flaps extended is 20,000 ft.

Holding in icing conditions with flaps extended is prohibited.

In flight, do not extend the SPEED BRAKE lever beyond the FLIGHT DETENT.

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

Non–AFM Operational Information

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

Do not deploy the speedbrakes in flight at radio altitudes less than 1,000 feet.

Alternate flap duty cycle:

- When extending or retracting flaps with the ALTERNATE FLAPS position switch, allow 15 seconds after releasing the ALTERNATE FLAPS position switch before moving the switch again to avoid damage to the alternate flap motor clutch
- After a complete extend/retract cycle, i.e., 0 to 15 and back to 0, allow 5 minutes cooling before attempting another extension.

Flight Management, Navigation

Air Data Inertial Reference Unit (ADIRU)

ADIRU alignment must not be attempted at latitudes greater than 78 degrees 15 minutes.

QFE Selection

The use of VNAV or LNAV with the altimeters referenced to QFE is prohibited.

YF048 - YF928, YK624 - YK630, YK966 - YL551, YN531 - YV754
The use of the Vertical Situation Display (VSD) with the altimeters referenced to QFE is prohibited.

A QFE altitude reference for the PFDs must be selected in the FMS whenever QFE is used instead of QNH.

Look-Ahead Terrain Alerting (GPWS)

Do not use the terrain display for navigation.

Do not use the look-ahead terrain alerting and terrain display functions:

- within 15 nm of takeoff, approach or landing at an airport not contained in the GPWS terrain database.

Note: Refer to Honeywell Document 060-4267-000 for airports and runways contained in the installed GPWS terrain database.

Non-AFM Operational Information

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

Avoid weather radar operation in a hangar, or within 50 feet (15.25 meters) of fueling operations or a fuel spill.

Avoid weather radar operation when personnel are within the area normally enclosed by the aircraft nose radome.

Note: The hangar recommendation does not apply to the weather radar test mode.

Fuel System

Maximum tank fuel temperature is 49°C.

Minimum tank fuel temperature prior to takeoff and inflight is - 43°C, or 3°C above the fuel freezing point temperature, whichever is higher.

Note: The use of Fuel System Icing Inhibitor additives does not change the minimum fuel tank temperature limit.

Intentional dry running of a center tank fuel pump (low pressure light illuminated) is prohibited.

Fuel Balance

Lateral imbalance between main tanks 1 and 2 must be scheduled to be zero. Random fuel imbalance must not exceed 453 kgs for taxi, takeoff, flight or landing.

Fuel Loading

Main tanks 1 and 2 must be full if center tank contains more than 453 kgs.

Landing Gear

Operation with assumed temperature reduced takeoff thrust is not permitted with anti-skid inoperative.

Non–AFM Operational Information

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

Do not apply brakes until after touchdown.

Normal Procedures Chapter NP

Table of Contents Section TOC

Normal Procedures — Chapter NP

Introduction — Section 11

General

This chapter gives:

- an introduction to the normal procedures philosophy and assumptions
- step by step normal procedures.

Normal Procedures Philosophy and Assumptions

Normal procedures verify for each phase of flight that:

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

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

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

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

Normal procedures also assume coordination with the ground crew before:

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

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

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

Configuration Check

It is the crew member’s responsibility to verify correct system response. Before engine start, use system lights to verify each system's condition or configuration. After engine start, the master caution system alerts the crew to warnings or cautions away from the normal field of view.

If there is an incorrect configuration or response:

- verify that the system controls are set correctly
- check the respective circuit breaker as needed. Maintenance must first determine that it is safe to reset a tripped circuit breaker on the ground
- test the respective system light as needed

Before engine start, use individual system lights to verify the system status. If an individual system light indicates an improper condition:

- check the *Minimum Equipment List (MEL)* or the operator equivalent to decide if the condition has a dispatch effect
- decide if maintenance is needed

If, during or after engine start, a red warning or amber caution light illuminates:

- do the respective non-normal checklist (NNC)
- on the ground, check the *MEL* or the operator equivalent

If, during recall, an amber caution illuminates and then extinguishes after a master caution reset:

- check the *MEL* or the operator equivalent
- the respective non-normal checklist is not needed

Crew Duties

Preflight and postflight crew duties are divided between the captain and first officer. Phase of flight duties are divided between the Pilot Flying (PF) and the Pilot Monitoring (PM.)

Each crewmember is responsible for moving the controls and switches in their area of responsibility:

- the phase of flight areas of responsibility for both normal and non-normal procedures are shown in the Area of Responsibility illustrations in this section. Typical panel locations are shown
- the preflight and postflight areas of responsibility are defined by the “Preflight Procedure - Captain” and “Preflight Procedure - First Officer.”

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

The general PF phase of flight responsibilities are:

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

The general PM phase of flight responsibilities are:

- checklist reading
- communications

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

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

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

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

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

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

Control Display Unit (CDU) Procedures

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

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

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

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

Autopilot Flight Director System (AFDS) Procedures

The crew must always monitor:

- airplane course
- vertical path
- speed

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

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

- autopilot
- flight director
- autothrottle

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

- course
- vertical path
- thrust
- speed

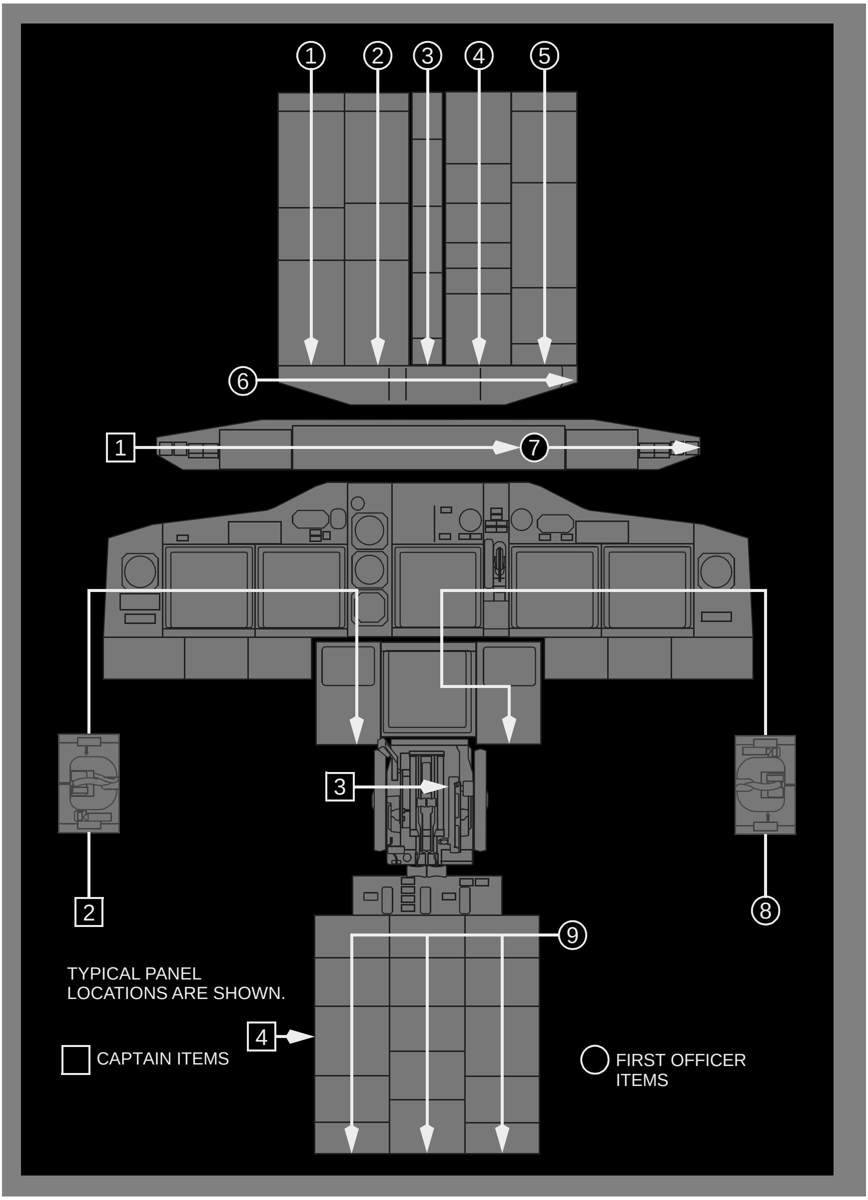
Announcing changes on the FMA and thrust mode display when they occur is a good CRM practice.

Scan Flow and Areas of Responsibility

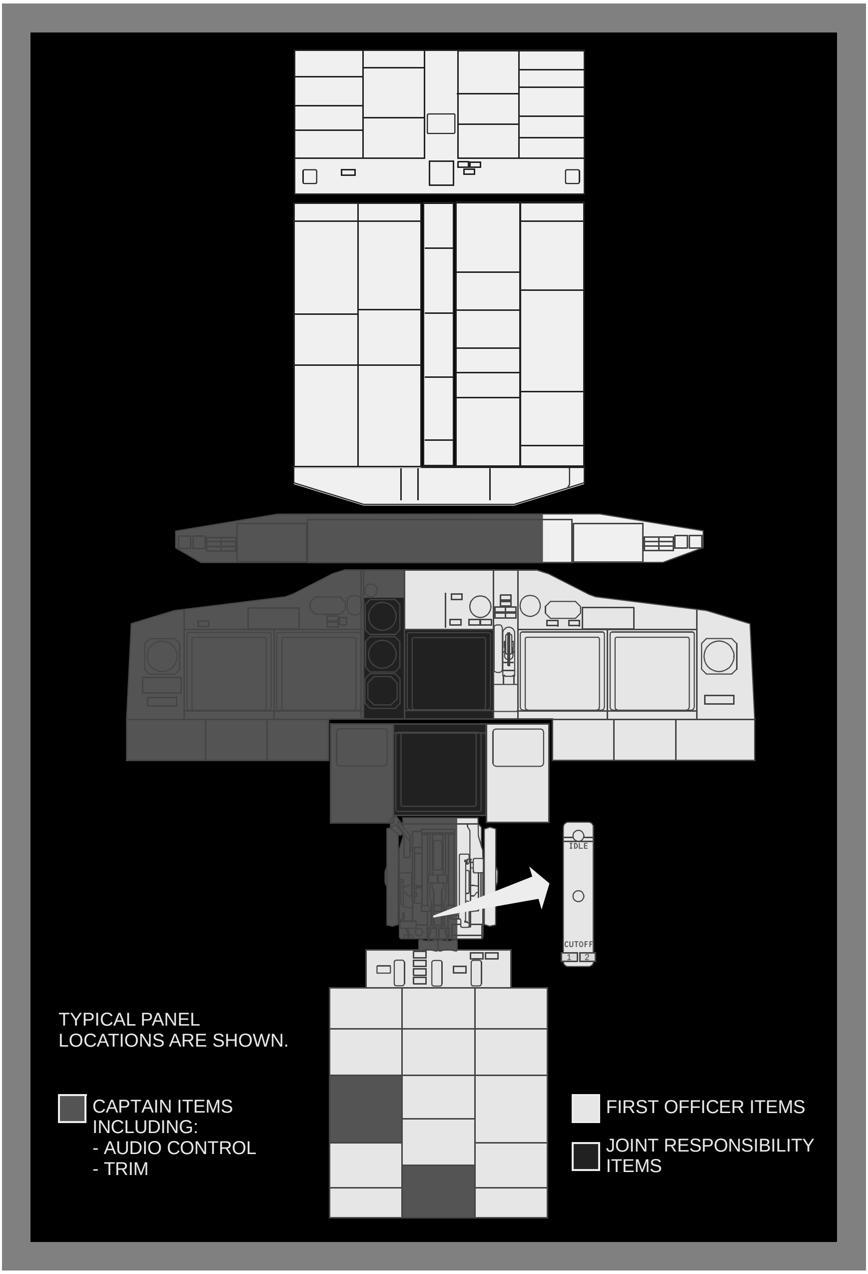
The scan flow and areas of responsibility diagrams shown below are representative and may not match the configuration(s) of your airplanes.

The scan flow diagram provides general guidance on the order each flight crew member should follow when doing the preflight and postflight procedures. Specific guidance on the items to be checked are detailed in the amplified Normal Procedures. For example, preflight procedure details are in the Preflight Procedure - Captain and Preflight Procedure - First Officer.

Preflight and Postflight Scan Flow



Areas of Responsibility - Captain as Pilot Flying or Taxiing



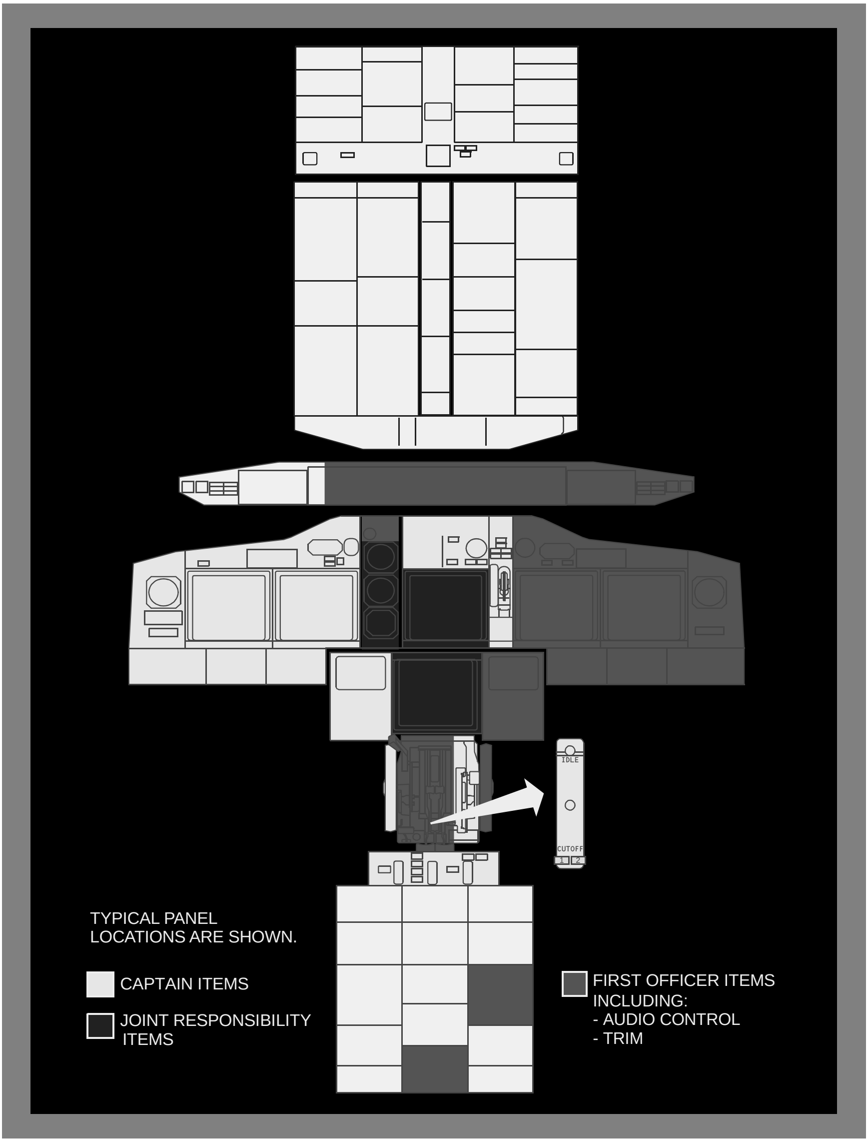
TYPICAL PANEL LOCATIONS ARE SHOWN.

▨ CAPTAIN ITEMS
INCLUDING:
- AUDIO CONTROL
- TRIM

☐ FIRST OFFICER ITEMS

■ JOINT RESPONSIBILITY ITEMS

Areas of Responsibility - First Officer as Pilot Flying or Taxiing



Intentionally
Blank

Preliminary Preflight Procedure – Captain or First Officer

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

A full IRS alignment is recommended before each flight. If time does not allow a full alignment, do the Fast Realignment supplementary procedure.

IRS mode selectors .... OFF, then NAV

Verify that the ON DC lights illuminate then extinguish.

Verify that the ALIGN lights are illuminated.

The UNABLE REQD NAV PERF-RNP message may show until IRS alignment is complete.

Verify that the following are sufficient for flight:

- oxygen pressure
- hydraulic quantity
- engine oil quantity

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

Maintenance documents .... Check

YA707 - YV754
FLIGHT DECK ACCESS SYSTEM switch .... Guard closed

Emergency equipment .... Check

Fire extinguisher – Checked and stowed

Crash axe – Stowed

Escape ropes – Stowed

Other needed equipment – Checked and stowed

PSEU light .... Verify extinguished

GPS light .... Verify extinguished

YV751 - YV754
ILS light .... Verify extinguished

YV751 - YV754
GLS light .... Verify extinguished

SERVICE INTERPHONE switch ....OFF

ENGINE panel ....Set

Verify that the REVERSER lights are extinguished.

Verify that the ENGINE CONTROL lights are extinguished.

EEC switches – ON

Oxygen panel ....Set

Note: PASSENGER OXYGEN switch activation causes deployment of the passenger oxygen masks.

PASSENGER OXYGEN switch - Guard closed

Verify that the PASS OXY ON light is extinguished.

Landing gear indicator lights ....Verify illuminated

YA707 - YV754

ELT switch ....Guard closed

Verify that the ELT light is extinguished.

Flight recorder switch ....Guard closed

MACH AIRSPEED WARNING
TEST switches ....Push, one at a time

Verify that the clacker sounds.

STALL WARNING TEST switches .Push and hold, one at a time

Verify that each control column vibrates when the respective switch is pushed.

Note: The stall warning test requires that AC transfer busses are powered for up to 4 minutes.

Note: With hydraulic power off, the leading edge flaps may droop enough to cause an asymmetry signal, resulting in a failure of the stall warning system test. Should this occur, obtain a clearance to pressurize the hydraulic system, place the “B” system electric pump ON and retract the flaps. When flaps are retracted repeat the test. At the completion of the test, turn the “B” system electric pump “OFF”.

Circuit breakers (P6 panel) ....Check

Manual gear extension access door ....Closed

Circuit breakers (control stand, P18 panel) .... Check

Parking brake .... As needed

Set the parking brake if brake wear indicators will be checked during the exterior inspection.

CDU Preflight Procedure - Captain and First Officer

Start the CDU Preflight Procedure anytime after the Preliminary Preflight Procedure. The Initial Data and Navigation Data entries must be complete before the flight instrument check during the Preflight Procedure. The Performance Data entries must be complete before the Before Start Checklist.

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

Enter data in all the boxed items on the following CDU pages.

Enter data in the dashed items or modify small font items that are listed in this procedure. Enter or modify other items at pilot's discretion.

Failure to enter enroute winds can result in flight plan time and fuel burn errors.

Initial Data .... Set

IDENT page:

Verify that the MODEL is correct.

Verify that the ENG RATING is correct.

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

POS INIT page:

Verify that the time is correct.

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

Navigation Data .... Set

ROUTE page:

Enter the ORIGIN.

Enter the route.

Enter the FLIGHT NUMBER.

Activate and execute the route.

DEPARTURES page:

Select the runway and departure routing.

Execute the runway and departure routing.

LEGS page:

Verify the correct RNP for the departure as needed.

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

Performance Data .... Set

PERF INIT page:

CAUTION: Do not enter the ZFW into the GW boxes. The FMC will calculate performance data with significant errors.

Enter the ZFW.

Verify that the FUEL on the CDU, the dispatch papers, and the fuel quantity indicators agree.

If refueling is not complete, enter the PLAN trip fuel as needed.

Verify that the fuel is sufficient for flight.

Verify that the gross weight and cruise CG (GW/CRZ CG) on the CDU and the dispatch papers agree.

Thrust mode display:

Verify that dashes are shown.

N1 LIMIT page:

Enter or verify OAT. Confirm the OAT value is correct and reasonable for the ambient conditions.

Select an assumed temperature, or a fixed derate takeoff, or both as needed.

Select a full or a derated climb thrust as needed.

TAKEOFF REF page:

Make data entries on page 2/2 before page 1/2.

Enter the CG.

Verify that a trim value is shown.

Select or enter the takeoff V speeds.

Verify or enter an acceleration height.

Verify or enter an engine out acceleration height.

Verify or enter a thrust reduction altitude.

Verify that the preflight is complete.

Exterior Inspection

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

Items at each location may be checked in any sequence.

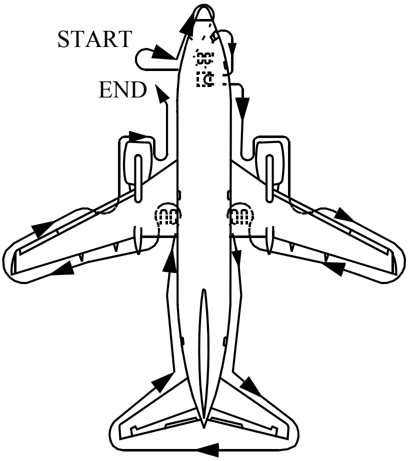
Use the detailed inspection route below to check that:

- the surfaces and structures are clear, not damaged, not missing parts and there are no fluid leaks*
- the tires are not too worn, not damaged, and there is no tread separation
- the gear struts are not fully compressed
- the engine inlets and tailpipes are clear, the access panels are secured, the fan cowls are latched, the exterior, including the bottom of the nacelles, is not damaged, and the reversers are stowed
- the doors and access panels that are not in use are latched
- the probes, vents, and static ports are clear and not damaged
- the skin area adjacent to the pitot probes and static ports is not wrinkled
- the antennas are not damaged
- the light lenses are clean and not damaged

For cold weather operations see the Supplementary Procedures.

Note: * Fluid leaks from the engine drains are allowed provided the leaks are less than a continuous stream. Refer to the Engine Start Procedure for additional guidance.

Inspection Route



Left Forward Fuselage

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

Doors and access panels (not in use) .... Latched

Nose

Radome .... Check

Conductor straps - Secure

Forward E and E door .... Secure

Nose Wheel Well

Tires and wheels .... Check

YA701 - YT508
Exterior light .... Check

Gear strut and doors .... Check

Nose wheel steering assembly .... Check

Nose gear steering lockout pin .... As needed

Gear pin .... As needed

Nose wheel spin brake (snubbers) .... In place

Right Forward Fuselage

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

Oxygen pressure relief green disc .... In place

Doors and access panels (not in use) .... Latched

Right Wing Root, Pack, and Lower Fuselage

Ram air deflector door .... Extended

Pack and pneumatic access doors .... Secure

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

Exterior lights .... Check

Leading edge flaps .... Check

Number 2 Engine

Exterior surfaces
(including the bottom of the nacelles) .... Check for damage

Access panels and fan cowl latches .... Latched

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

Fan blades, probes, and spinner .... Check

Thrust reverser .... Stowed

Exhaust area and tailcone .... Check

Right Wing and Leading Edge

Access panels .... Latched

Leading edge flaps and slats .... Check

Fuel measuring sticks .... Flush and secure

Wing Surfaces .... Check

Fuel tank vent .... Check

Right Wing Tip and Trailing Edge

Position and strobe lights .... Check

Static discharge wicks .... Check

Aileron and trailing edge flaps .... Check

Right Main Gear

Tires, brakes and wheels .... Check

Verify that the wheel chocks are in place as needed.

If the parking brake is set, the brake wear indicator pins must extend out of the guides.

Gear strut, actuators, and doors .... Check

Hydraulic lines .... Secure

Gear pin .... As needed

Right Main Wheel Well

APU FIRE CONTROL handle .... Up

YF048 - YF928, YK626 - YK630, *YK962, YK969*, *YK970*, YK973 - YK980, YL541 - YL551, YN531 - YV754
(SB Changes YA707, YA709, YA710, YK967)
NGS operability indicator light .... Check

Verify that the light is green.

Wheel well .... Check

Right Aft Fuselage

Doors and access panels (not in use) .... Latched

Negative pressure relief door .... Closed

Outflow valve .... Check

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

APU air inlet .... Open

Tail

Vertical stabilizer and rudder .... Check

Elevator feel probes .... Check

YF048 - YL551, YS151 - YV754

Tail skid .... Check

Verify that the tail skid is not damaged.

Horizontal stabilizer and elevator .... Check

Static discharge wicks .... Check

Strobe light .... Check

APU cooling air inlet and exhaust outlet .... Check

Left Aft Fuselage

Doors and access panels (not in use) .... Latched

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

Left Main Gear

Tires, brakes and wheels .... Check

Verify that the wheel chocks are in place as needed.

If the parking brake is set, the brake wear indicator pins must extend out of the guides.

Gear strut, actuators, and doors .... Check

Hydraulic lines .... Secure

Gear pin .... As needed

Left Main Wheel Well

Wheel well .... Check

Engine fire bottle pressure .... Check

Left Wing Tip and Trailing Edge

Aileron and trailing edge flaps .... Check

Static discharge wicks .... Check

Position and strobe lights .... Check

Left Wing and Leading Edge

Fuel tank vent .... Check

Wing Surfaces .... Check

Fuel measuring sticks .... Flush and secure

Leading edge flaps and slats .... Check

Access panels .... Latched

Number 1 Engine

Exhaust area and tailcone .... Check

Thrust reverser .... Stowed

Fan blades, probes, and spinner .... Check

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

Access panels and fan cowl latches .... Latched

Exterior surfaces
(including the bottom of the nacelles) .... Check for damage

Left Wing Root, Pack, and Lower Fuselage

Leading edge flaps .... Check

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

Exterior lights .... Check

Pack and pneumatic access doors .... Secure

Ram air deflector door .... Extended

Preflight Procedure – First Officer

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

Flight control panel .... Check

- FLIGHT CONTROL switches – Guards closed
  - Verify that the flight control LOW PRESSURE lights are illuminated.
- Flight SPOILER switches – Guards closed
- YAW DAMPER switch – ON
  - Verify that the YAW DAMPER light is extinguished.

Verify that the standby hydraulic LOW QUANTITY light is extinguished.

Verify that the standby hydraulic LOW PRESSURE light is extinguished.

Verify that the STBY RUD ON light is extinguished.

ALTERNATE FLAPS master switch – Guard closed

ALTERNATE FLAPS position switch – OFF

Verify that the FEEL DIFF PRESS light is extinguished.

Verify that the SPEED TRIM FAIL light is extinguished.

Verify that the MACH TRIM FAIL light is extinguished.

Verify that the AUTO SLAT FAIL light is extinguished.

NAVIGATION panel ....Set

VHF NAV transfer switch – NORMAL

IRS transfer switch – NORMAL

FMC source select switch – NORMAL

DISPLAYS panel ....Set

SOURCE selector – AUTO

CONTROL PANEL select switch – NORMAL

Fuel panel ....Set

Verify that the ENG VALVE CLOSED lights are illuminated dim.

Verify that the SPAR VALVE CLOSED lights are illuminated dim.

Verify that the FILTER BYPASS lights are extinguished.

CROSSFEED selector – Closed

Verify that the VALVE OPEN light is extinguished.

FUEL PUMP switches – OFF

Verify that the center tank fuel pump LOW PRESSURE lights are extinguished.

Verify that the main tank fuel pump LOW PRESSURE lights are illuminated.

Electrical panel ....Set

BATTERY switch – Guard closed

CAB/UTIL power switch – ON

IFE/PASS SEAT power switch – ON

STANDBY POWER switch – Guard closed

Verify that the STANDBY PWR OFF light is extinguished.

Verify that the BAT DISCHARGE light is extinguished.

Verify that the TR UNIT light is extinguished.

Verify that the ELEC light is extinguished.

Generator drive DISCONNECT switches – Guards closed

Verify that the DRIVE lights are illuminated.

BUS TRANSFER switch – Guard closed

Verify that the TRANSFER BUS OFF lights are extinguished.

Verify that the SOURCE OFF lights are extinguished.

Verify that the GEN OFF BUS lights are illuminated.

Overheat and fire protection panel ....Check

Do this check if the flight crew did not do the Electrical Power Up supplementary procedure. This check is needed once per flight day.

Verify that the engine No. 1, APU, and engine No. 2 fire switches are in.

Alert ground personnel before the following test is accomplished:

OVERHEAT DETECTOR switches – NORMAL

TEST switch – Hold to FAULT/INOP

Verify that the MASTER CAUTION lights are illuminated.

Verify that the OVHT/DET annunciator is illuminated.

Verify that the FAULT light is illuminated.

If the FAULT light fails to illuminate, the fault monitoring system is inoperative.

Verify that the APU DET INOP light is illuminated.

Do not run the APU if the APU DET INOP light does not illuminate.

Note: The fire warning light flashes and the horn sounds on the APU ground control panel when this test is done with the APU running. This can be mistaken by the ground crew as an APU fire.

TEST switch – Hold to OVHT/FIRE

Verify that the fire warning bell sounds.

Verify that the master FIRE WARN lights are illuminated.

Verify that the MASTER CAUTION lights are illuminated.

Verify that the OVHT/DET annunciator is illuminated.

Master FIRE WARN light – Push

Verify that the master FIRE WARN lights are extinguished.

Verify that the fire warning bell cancels.

Verify that the engine No. 1, APU and engine No. 2 fire switches stay illuminated.

YT512 - YV754
Verify that the engine No. 1 and engine No. 2 start lever lights stay illuminated.

Verify that the ENG 1 OVERHEAT and ENG 2 OVERHEAT lights stay illuminated.

Verify that the WHEEL WELL light stays illuminated.

EXTINGUISHER TEST switch – Check

TEST switch – Position to 1 and hold.

Verify that the three green extinguisher test lights are illuminated.

TEST switch – Release

Verify that the three green extinguisher test lights are extinguished.

Repeat for test position 2.

APU switch (as needed) ....START

Note: If extended APU operation is needed on the ground and the airplane busses are powered by AC electrical power, position an AC powered fuel pump ON. This will extend the service life of the APU fuel control unit.

Note: If fuel is loaded in the center tank, position the left center tank fuel pump switch ON to prevent a fuel imbalance before takeoff.

CAUTION: **Center tank fuel pump switches should be positioned ON only if the fuel quantity in the center tank exceeds 453 kgs.**

CAUTION: **Do not operate the center tank fuel pumps with the flight deck unattended.**

When the APU GEN OFF BUS light is illuminated:

APU GENERATOR bus switches – ON

Verify that the SOURCE OFF lights are extinguished.

Verify that the TRANSFER BUS OFF lights are extinguished.

Note: Run the APU for one full minute before using it as a bleed air source.

EQUIPMENT COOLING switches .... NORM

Verify that the OFF lights are extinguished.

EMERGENCY EXIT LIGHTS switch .... Guard closed

Verify that the NOT ARMED light is extinguished.

Passenger signs .... Set

YA701 - YA704

NO SMOKING switch – AUTO or ON

FASTEN BELTS switch – AUTO or ON

Windshield WIPER selectors .... PARK

Verify that the windshield wipers are stowed.

WINDOW HEAT switches .... ON

Position switches ON at least 10 minutes before takeoff.

Verify that the OVERHEAT lights are extinguished.

Verify that the ON lights are illuminated (except at high ambient temperatures.)

PROBE HEAT switches .... AUTO

Verify that all lights are illuminated.

WING ANTI–ICE switch .... OFF

Verify that the VALVE OPEN lights are extinguished.

ENGINE ANTI–ICE switches .... OFF

Verify that the COWL ANTI–ICE lights are extinguished.

Verify that the COWL VALVE OPEN lights are extinguished.

Hydraulic panel..Set

ENGINE HYDRAULIC PUMPS switches – ON

Verify that the LOW PRESSURE lights are illuminated.

ELECTRIC HYDRAULIC PUMPS switches – OFF

Verify that the OVERHEAT lights are extinguished.

Verify that the LOW PRESSURE lights are illuminated.

YN531 - YN534
High altitude landing switch ....As needed

Verify that the INOP light is extinguished

Air conditioning panel ....Set

AIR TEMPERATURE source selector – As needed

YF048 - YL551, YS151 - YV754
TRIM AIR switch – ON

YA701 - YA710, YM482 - YN534
Verify that the DUCT OVERHEAT lights are extinguished.

YF048 - YL551, YS151 - YV754
Verify that the ZONE TEMP lights are extinguished.

Temperature selectors – As needed

Verify that the RAM DOOR FULL OPEN lights are illuminated.

YA701 - YA710, YM482 - YN534
RECIRCULATION FAN switch – AUTO

YF048 - YL551, YS151 - YV754
RECIRCULATION FAN switches – AUTO

Air conditioning PACK switches – AUTO or HIGH

ISOLATION VALVE switch – OPEN

Engine BLEED air switches – ON

APU BLEED air switch – ON

Verify that the DUAL BLEED light is illuminated.

YA701 - YA710, YM482 - YN534
Verify that the PACK TRIP OFF lights are extinguished.

YF048 - YL551, YS151 - YV754
Verify that the PACK lights are extinguished.

Verify that the WING–BODY OVERHEAT lights are extinguished.

Verify that the BLEED TRIP OFF lights are extinguished.

Cabin pressurization panel .... Set

Verify that the AUTO FAIL light is extinguished.

Verify that the OFF SCHED DESCENT light is extinguished.

FLIGHT ALTITUDE indicator – Cruise altitude

LANDING ALTITUDE indicator – Destination field elevation

Pressurization mode selector – AUTO

Verify that the ALTN light is extinguished.

Verify that the MANUAL light is extinguished.

Lighting panel .... Set

YA701 - YT508

LANDING light switches – RETRACT and OFF

YT509 - YV754

LANDING light switches - OFF

RUNWAY TURNOFF light switches – OFF

TAXI light switch – OFF

Ignition select switch ....IGN L or R

Alternate the ignition select switch position on subsequent starts.

ENGINE START switches ....OFF

Lighting panel .... Set

LOGO light switch – As needed

POSITION light switch – As needed

ANTI–COLLISION light switch – OFF

WING illumination switch – As needed

WHEEL WELL light switch – As needed

Mode control panel .... Set

COURSE(S) – Set

FLIGHT DIRECTOR switch – ON

Move the switch for the pilot flying to ON first.

EFIS control panel .... Set

MINIMUMS reference selector – RADIO or BARO

MINIMUMS selector – Set decision height or altitude reference

FLIGHT PATH VECTOR switch – As needed

METERS switch – As needed

BAROMETRIC reference selector – IN or HPA

BAROMETRIC selector – Set local altimeter setting

VOR/ADF switches – As needed

Mode selector – MAP

CENTER switch – As needed

Range selector – As needed

TRAFFIC switch – As needed

WEATHER RADAR – Off

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

Map switches – As needed

Oxygen .... Test and set

YA701 - YM484, YS151 - YV754
Note the crew oxygen pressure.

YN531 - YN534
Note the crew/pass oxygen pressure.

Oxygen mask – Stowed and doors closed

TEST/RESET switch – Push and hold

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

EMERGENCY/Test selector – Push and hold

Continue to hold the TEST/RESET switch down and push the EMERGENCY/Test selector for 5 seconds. Verify that the yellow cross shows continuously in the flow indicator.

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

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

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

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

Normal/100% *switch* – 100%

YA701 - YM484, YS151 - YV754
Crew oxygen pressure - Check.

Verify that the pressure is sufficient for dispatch.

YN531 - YN534
Crew/pass oxygen pressure - Check.

Verify that the pressure is sufficient for dispatch.

Clock .... Set

Display select panel .... Set

MAIN PANEL DISPLAY UNITS selector – NORM

LOWER DISPLAY UNIT selector – NORM

TAKEOFF CONFIG light
(if installed and operative) .... Verify extinguished

CABIN ALTITUDE light
(if installed and operative) .... Verify extinguished

Disengage light TEST switch .... Hold to 1

Verify that the A/P light is illuminated steady amber.

Verify that the A/T light is illuminated steady amber.

Verify that the FMC light is illuminated steady amber.

Disengage light TEST switch .... Hold to 2

Verify that the A/P light is illuminated steady red.

Verify that the A/T light is illuminated steady red.

Verify that the FMC light is illuminated steady amber.

Do the Initial Data and Navigation Data steps from the CDU Preflight Procedure and verify that the IRS alignment is complete before checking the flight instruments.

Flight instruments .... Check

Verify that the flight instrument indications are correct.

Verify that only these flags are shown:

- TCAS OFF
- NO VSPD until V–speeds are selected
- expected RMI flags.

Verify that the flight mode annunciations are correct:

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

Select the map mode.

YN531 - YN534

BRAKE TEMP light .... Verify extinguished

GROUND PROXIMITY panel .... Check

FLAP INHIBIT switch – Guard closed

GEAR INHIBIT switch – Guard closed

TERRAIN INHIBIT switch – Guard closed

Verify that the GROUND PROXIMITY INOP light is extinguished.

Landing gear panel ....Set

LANDING GEAR lever – DN

Verify that the green landing gear indicator lights are illuminated.

Verify that the red landing gear indicator lights are extinguished.

AUTO BRAKE select switch ....RTO

Verify that the AUTO BRAKE DISARM light is extinguished

ANTISKID INOP light .... Verify extinguished

Engine display control panel ....Set

N1 SET selector – AUTO

SPEED REFERENCE selector – AUTO

FUEL FLOW switch – RATE

Move switch to RESET, then RATE.

Engine instruments .... Check

Verify that the primary and secondary engine indications show existing conditions.

Verify that no exceedance is shown.

Verify that the hydraulic quantity indications do not show RF.

CARGO FIRE panel .... Check

This check is needed once per flight day.

DETECTOR SELECT switches – NORM

TEST switch – Push

Verify that the fire warning bell sounds.

Verify that the master FIRE WARN lights are illuminated.

Master FIRE WARN light – Push

Verify that the master FIRE WARN lights are extinguished.

Verify that the fire warning bell cancels.

Verify that the green EXTINGUISHER test lights stay illuminated.

Verify that the FWD and AFT lights stay illuminated.

Verify that the DETECTOR FAULT light stays extinguished.

Verify that the DISCH light stays illuminated.

YK622 - YK625, YS179 - YS190
HUD system .... As needed

Radio tuning panel .... Set

WARNING: Do not key the HF radio while the airplane is being fueled. Injury to personnel or fire can occur.

Verify that the OFF light is extinguished.

VHF NAVIGATION radios .... Set for departure

Audio control panel .... Set

WEATHER RADAR control panel .... Set

Transponder panel .... Set

STABILIZER TRIM override switch .... Guard closed

WARNING: Do not put objects between the seat and the aisle stand. Injury can occur when the seat is adjusted.

Seat .... Adjust

Use the handhold above the forward window for assistance when pulling the seat forward. Do not use the glareshield as damage can occur.

Adjust the seat for optimum eye reference.

Whenever the seat is adjusted, verify a positive horizontal (fore and aft) seat lock by pushing against the seat.

Rudder pedals .... Adjust

Adjust the rudder pedals to allow full rudder pedal and brake pedal movement.

Seat belt and shoulder harness .... Adjust

Do the PREFLIGHT checklist on the captain's command.

Preflight Procedure – Captain

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

Lights .... Test

Master LIGHTS TEST and DIM switch – TEST

The fire warning lights are not checked during this test. Use individual test switches or push to test features to check lights which do not illuminate during the light test. Use scan flow to verify that all other lights are flashing or illuminated. Verify that all system annunciator panel lights are illuminated.

Master LIGHTS TEST and DIM switch – As needed

EFIS control panel .... Set

MINIMUMS reference selector – RADIO or BARO

MINIMUMS selector – Set decision height or altitude reference

FLIGHT PATH VECTOR switch – As needed

METERS switch – As needed

BAROMETRIC reference selector – IN or HPA

BAROMETRIC selector – Set local altimeter setting

VOR/ADF switches – As needed

Mode selector – MAP

CENTER switch – As needed

Range selector – As needed

TRAFFIC switch – As needed

WEATHER RADAR – Off

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

Map switches – As needed

Mode control panel .... Set

COURSE(S) – Set

FLIGHT DIRECTOR switch – ON

Move the switch for the pilot flying to ON first.

Bank angle selector – As needed

Autopilot DISENGAGE bar – UP

Oxygen .... Test and set

YA701 - YM484, YS151 - YV754
Note the crew oxygen pressure.

YN531 - YN534
Note the crew/pass oxygen pressure.

Oxygen mask – Stowed and doors closed

TEST/RESET switch – Push and hold

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

EMERGENCY/Test selector – Push and hold

Continue to hold the TEST/RESET switch down and push the EMERGENCY/Test selector for 5 seconds. Verify that the yellow cross shows continuously in the flow indicator.

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

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

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

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

Normal/100% *switch* – 100%

YA701 - YM484, YS151 - YV754
Crew oxygen pressure - Check.

Verify that the pressure is sufficient for dispatch.

YN531 - YN534
Crew/pass oxygen pressure - Check.

Verify that the pressure is sufficient for dispatch.

Clock .... Set

NOSE WHEEL STEERING switch .... Guard closed

Display select panel .... Set

MAIN PANEL DISPLAY UNITS selector – NORM

LOWER DISPLAY UNIT selector – NORM

TAKEOFF CONFIG light
(if installed and operative) .... Verify extinguished

CABIN ALTITUDE light
(if installed and operative) .... Verify extinguished

Disengage light TEST switch .... Hold to 1

Verify that the A/P light is illuminated steady amber.

Verify that the A/T light is illuminated steady amber.

Verify that the FMC light is illuminated steady amber.

Disengage light TEST switch .... Hold to 2

Verify that the A/P light is illuminated steady red.

Verify that the A/T light is illuminated steady red.

Verify that the FMC light is illuminated steady amber.

STAB OUT OF TRIM light .... Verify extinguished

Do the Initial Data and Navigation Data steps from the CDU Preflight Procedure and verify that the IRS alignment is complete before checking the flight instruments.

Flight instruments ....Check

Verify that the flight instrument indications are correct.

Verify that only these flags are shown:

- TCAS OFF
- NO VSPD until V–speeds are selected
- expected RMI flags

Verify that the flight mode annunciations are correct:

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

Select the map mode.

YA701 - YA706

Standby instruments ....Check

Standby horizon – Set

Gyro caging control – Pull, then release

Approach mode selector – As needed

Verify that the flight instrument indications are correct.

Verify that no flags are shown.

Standby altimeter – Set

Verify that the flight instrument indications are correct.

Verify that no flags are shown.

YA707 - YV754

Integrated standby flight display ....Set

Verify that the approach mode display is blank.

Set the altimeter.

Verify that the flight instrument indications are correct.

Verify that no flags or messages are shown.

Standby RMI ....Set

Select either VOR or ADF.

SPEED BRAKE lever ....DOWN detent

Verify that the SPEED BRAKE ARMED light is extinguished.

Verify that the SPEED BRAKE DO NOT ARM light is extinguished.

Verify that the SPEEDBRAKES EXTENDED light is extinguished.

Reverse thrust levers ....Down

Forward thrust levers ....Closed

FLAP lever...Set

Set the flap lever to agree with the flap position.

Parking brake ....Set

Verify that the parking brake warning light is illuminated

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

Engine start levers .... CUTOFF

STABILIZER TRIM cutout switches .... NORMAL

YK622 - YK625, YS179 - YS190
HUD system ....As needed

Radio tuning panel ....Set

WARNING: Do not key the HF radio while the airplane is being fueled. Injury to personnel or fire can occur.

Verify that the OFF light is extinguished.

VHF NAVIGATION radios ....Set for departure

Audio control panel ....Set

WARNING: Do not put objects between the seat and the aisle stand. Injury can occur when the seat is adjusted.

Seat ....Adjust

Use the handhold above the forward window for assistance when pulling the seat forward. Do not use the glareshield as damage can occur.

Adjust the seat for optimum eye reference.

Whenever the seat is adjusted, verify a positive horizontal (fore and aft) seat lock by pushing against the seat.

Rudder pedals .... Adjust

Adjust the rudder pedals to allow full rudder pedal and brake pedal movement.

Seat belt and shoulder harness .... Adjust

Call “PREFLIGHT CHECKLIST.”

Before Start Procedure

Start the Before Start Procedure after papers are on board.

Flight deck door ....Closed and locked F/O

YA701 - YA706
Verify that the CAB DOOR UNLOCKED light is extinguished.

YA707 - YV754
Verify that the LOCK FAIL light is extinguished.

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

CDU display .... Set C, F/O

Normally the PF selects the TAKEOFF REF page.

Normally the PM selects the LEGS page.

N1 bugs .... Check C, F/O

Verify that the N1 reference bugs are correct.

IAS bugs .... Set C, F/O

MCP .... Set C

AUTOTHROTTLE ARM switch – ARM

IAS/MACH selector – Set V2

Arm LNAV as needed

Arm VNAV

Initial heading – Set

Initial altitude – Set

Taxi and Takeoff briefings ....Complete C, F/O

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

As part of the takeoff briefing for the first flight of the day and following a change of either flight crew member, cabin altitude warning indications and memory item procedures must be briefed on airplanes in which the CABIN ALTITUDE and TAKEOFF CONFIG lights are not installed, or are installed but not activated. The briefing must contain the following information:

Whenever the intermittent warning horn sounds in flight at an airplane flight altitude above 10,000 feet MSL:

1. Immediately, don oxygen masks and set regulators to 100%.
2. Establish crew communications.
3. Do the CABIN ALTITUDE WARNING or Rapid Depressurization non-normal checklist.

Both pilots must verify on the overhead Cabin Altitude Panel that the cabin altitude is stabilized at or below 10,000 feet before removing oxygen masks.

Exterior doors ....Verify closed F/O

Flight deck windows ....Closed and locked C, F/O

Start clearance ....Obtain C, F/O

Obtain a clearance to pressurize the hydraulic systems.

Obtain a clearance to start the engines.

If pushback is needed:

Verify that the nose gear steering lockout pin is installed, or, if the nose gear steering lockout pin is not used, depressurize hydraulic system A during the hydraulic panel set step C, F/O

Fuel panel ....Set F/O

If the center tank fuel quantity exceeds 460 kilograms:

LEFT and RIGHT CENTER FUEL PUMPS switches – ON

Verify that the LOW PRESSURE lights illuminate momentarily and then extinguish.

If the LOW PRESSURE light stays illuminated turn off the CENTER FUEL PUMPS switch.

AFT and FORWARD FUEL PUMPS switches – ON

Verify that the LOW PRESSURE lights are extinguished.

Hydraulic panel .... Set F/O

If pushback is needed and the nose gear steering lockout pin is not installed:

WARNING: Do not pressurize hydraulic system A. Unwanted tow bar movement can occur.

System A HYDRAULIC PUMP switches – OFF

Verify that the system A pump LOW PRESSURE lights are illuminated.

System B electric HYDRAULIC PUMP switch – ON

Verify that the system B electric pump LOW PRESSURE light is extinguished.

Verify that the brake pressure is 2,800 psi minimum.

Verify that the system B pressure is 2,800 psi minimum.

If pushback is not needed, or if pushback is needed and the nose gear steering lockout pin is installed:

Electric HYDRAULIC PUMP switches – ON

Verify that the electric pump LOW PRESSURE lights are extinguished.

Verify that the brake pressure is 2,800 psi minimum.

Verify that the system A and B pressures are 2,800 psi minimum.

ANTI COLLISION light switch ....ON F/O

Trim .... Set C

Check each trim for freedom of movement.

Stabilizer trim – ___ UNITS

Set the trim for takeoff.

Verify that the trim is in the green band.

Aileron trim – 0 units

Rudder trim – 0 units

Call “BEFORE START CHECKLIST.” C

Do the BEFORE START checklist. F/O

Pushback or Towing Procedure

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

Establish communications with ground handling personnel. C

CAUTION: Do not hold or turn the nose wheel steering wheel during pushback or towing. This can damage the nose gear or the tow bar.

CAUTION: Do not use airplane brakes to stop the airplane during pushback or towing. This can damage the nose gear or the tow bar.

Transponder mode selector ....XPNDR F/O

Transponder reply selector ....AUTO F/O

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

When pushback or towing is complete:

Verify that the tow bar is disconnected C

Verify that the nose gear steering lockout pin is removed C

System A HYDRAULIC PUMPS switches – ON F/O

Verify that the system A pump LOW PRESSURE lights are extinguished

Verify that the system A pressure is 2800 psi minimum.

Engine Start Procedure

Normal starter duty cycle:

- Multiple consecutive start attempts are permitted. Each start attempt is limited to 2 minutes of starter usage.
- A minimum of 10 seconds is needed between start attempts.

Extended engine motorings:

- Starter usage is limited to 15 minutes for the first two extended engine motorings. A minimum of 2 minutes is needed between each attempt.
- For the third and subsequent extended engine motorings, starter usage is limited to 5 minutes. A minimum of 10 minutes is needed between each attempt.

Normal engine start considerations:

- do not move an engine start lever to IDLE detent early or a hot start can occur
- keep a hand on the engine start lever while monitoring RPM, EGT and fuel flow until stable
- if fuel is shutoff accidentally (by closing the engine start lever) do not reopen the engine start lever in an attempt to restart the engine
- failure of the ENGINE START switch to stay in GRD until the starter cutout RPM can cause a hot start. Do not re–engage the ENGINE START switch until engine RPM is below 20% N2.
- If a fluid leak (other than a continuous stream) from any of the engine drains is discovered during the Exterior Inspection, the engine can be started. If during engine start, the ground crew reports a fluid leak from an engine drain, the engine start may be continued. In either case, run the engine at idle thrust for up to 5 minutes. If the fluid leak stops during this time, no maintenance action is needed. If the fluid leak continues after 5 minutes, shut down the engine for maintenance action.
- For the first flight of the day, at airport elevations at or above 2,000 feet MSL, if the temperature is below 5°C/41°F, consider placing the Ignition select switch to BOTH before starting the engines. This may increase the likelihood of a successful engine start on the first attempt.

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

- the N1 or N2 does not increase or increases very slowly after the EGT increases
- there is no oil pressure indication by the time that the engine is stable at idle
- the EGT does not increase by *15* seconds after the engine start lever is moved to IDLE detent
- the EGT quickly nears or exceeds the start limit

Select the secondary engine indications. F/O

Air conditioning PACK switches .... OFF F/O

Start sequence.. Announce C

Call “START ___ ENGINE” C

ENGINE START switch .... GRD F/O

Verify that the N2 RPM increases. C, F/O

When N1 rotation is seen and N2 is at 25%, or (if 25% N2 is not possible), at maximum motoring and a minimum of 20% N2:

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

Caution: *Do not apply rotational force when moving the engine start lever.*

Engine start lever .... IDLE detent C

Verify SPAR VALVE CLOSED light transitions from dim, to bright and then extinguishes.

Monitor fuel flow and EGT indications. C, F/O

At 56% N2, verify that the ENGINE START switch moves to OFF. If not, move the ENGINE START switch to OFF. F/O

Verify that the START VALVE OPEN alert extinguishes when the ENGINE START switch moves to OFF. F/O

Call “STARTER CUTOUT.” F/O

Monitor N1, N2, EGT, fuel flow and oil pressure for normal indications while the engine accelerates to a stable idle. C, F/O

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

Before Taxi Procedure

GENERATOR 1 and 2 switches .... ON F/O

PROBE HEAT switches .... ON F/O

WING ANTI–ICE switch .... As needed F/O

ENGINE ANTI–ICE switches .... As needed F/O

PACK switches .... AUTO F/O

ISOLATION VALVE switch .... AUTO F/O

APU BLEED air switch .... OFF F/O

APU switch .... OFF F/O

ENGINE START switches .... CONT F/O

Engine start levers .... IDLE detent C

Verify that the ground equipment is clear. C, F/O

Call “FLAPS ___” as needed for takeoff. C

Flap lever .... Set takeoff flaps F/O

Verify that the LE FLAPS EXT green light is illuminated.

Flight controls	Check	C

Make slow and deliberate inputs, one direction at a time.

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

- freedom of movement
- that the controls return to center

Hold the nose wheel steering wheel during the rudder check to prevent nose wheel movement.

Move the rudder pedals to full travel in both directions and verify:

- freedom of movement
- that the rudder pedals return to center

Blank the lower display unit.		F/O
Transponder mode selector	XPNDR	F/O
Transponder reply selector	*AUTO*	*F/O*
Recall	Check	C, F/O

Verify that all system annunciator panel lights illuminate and then extinguish.

Update changes to the taxi briefing, as needed.	C or PF
Call “BEFORE TAXI CHECKLIST.”	C
Do the BEFORE TAXI checklist.	F/O

Before Takeoff Procedure

Engine warm up requirement:

- verify an increase in engine oil temperature before takeoff.

Engine warm up recommendations:

- run the engines for at least 2 minutes
- use a thrust setting normally used for taxi operations.

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

Takeoff Procedure *(not for QFE)*

Pilot Flying	Pilot Monitoring
Before entering the departure runway, verify that the runway and runway entry point are correct.	
	When entering the departure runway, set the STROBE light switch to ON. Use other lights as needed. Set the transponder mode selector to TA/RA.
Verify that the brakes are released. Align the airplane with the runway.	
Verify that the airplane heading agrees with the assigned runway heading.	
	When cleared for takeoff, set the FIXED LANDING light switches or LANDING light switches to ON.
Advance the thrust levers to approximately 40% N1. Allow the engines to stabilize.	
Push the TO/GA switch.	
Verify that the correct takeoff thrust is set.	

Pilot Flying	Pilot Monitoring
	Monitor the engine instruments during the takeoff. Call out any abnormal indications. Adjust takeoff thrust before 60 knots as needed. During strong headwinds, if the thrust levers do not advance to the planned takeoff thrust, manually advance the thrust levers before 60 knots. Call "THRUST SET".
After takeoff thrust is set, the captain’s hand must be on the thrust levers until V1.	
Monitor airspeed. Maintain light forward pressure on the control column.	Monitor airspeed and call out any abnormal indications.
Verify 80 knots and call “CHECK.”	Call “80 KNOTS.”
Verify V1 speed.	Verify the automatic V1 callout or call “V1.”
At VR, rotate toward 15° pitch attitude. After liftoff, follow F/D commands.	At VR, call “ROTATE.” Monitor airspeed and vertical speed.
Establish a positive rate of climb.	
	Verify a positive rate of climb on the altimeter and call “POSITIVE RATE.”
Verify a positive rate of climb on the altimeter and call “GEAR UP.”	
	Set the landing gear lever to UP.
Above 400 feet radio altitude, call for a roll mode as needed.	Select or verify the roll mode. Verify VNAV engaged.
At thrust reduction height, verify that climb thrust is set.	

Pilot Flying	Pilot Monitoring
Verify acceleration at the acceleration height. Call “FLAPS ___” according to the flap retraction schedule.	
	Set the FLAP lever as directed.
Engage the autopilot when above the minimum altitude for autopilot engagement.	
	After flap retraction is complete: • Set or verify engine bleeds and air conditioning packs are operating • Set the engine start switches as needed • Set the AUTO BRAKE select switch to OFF • Set the landing gear lever to OFF after landing gear retraction is complete.
Call “AFTER TAKEOFF CHECKLIST.”	
	Do the AFTER TAKEOFF checklist.

CAUTION: Do not allow the shoulder harness straps to retract quickly. Buckles can pull or damage circuit breakers.

Takeoff Flap Retraction Speed Schedule

Takeoff Flaps	At Speed (display)	Select Flaps
25	V2 + 15 “15” “5” “1”	15 5 1 UP
15 or 10	V2 + 15 “5” “1”	5 1 UP
5	V2 + 15 “1”	1 UP
1	“1”	UP
Limit bank angle to 15° until reaching V2 + 15		

Climb and Cruise Procedure

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

Pilot Flying	Pilot Monitoring
	During climb and cruise, verify the RNP as needed.
	At or above 10,000 feet MSL, set the LANDING light switches to OFF.
	Set the passenger signs as needed.
At transition altitude, set and crosscheck the altimeters to standard.	
	During climb, set the affected center tank fuel pump switch to OFF when a center tank fuel pump LOW PRESSURE light illuminates. Set both center tank fuel pump switches to OFF when a center tank fuel pump LOW PRESSURE light illuminates if the center tank is empty.
	When established in a level flight attitude, if the center tank contains usable fuel and a center tank fuel pump switch(es) is OFF, set the center tank fuel pump switch(es) to ON again. Set the affected center tank fuel pump switch to OFF when a center tank fuel pump LOW PRESSURE light illuminates. Set both center tank fuel pump switches to OFF when a center tank fuel pump LOW PRESSURE light illuminates if the center tank is empty.
	During an ETOPS flight, additional steps must be done. See the ETOPS supplementary procedure in SP.1.
	Before the top of descent, modify the active route as needed for the arrival and approach.

Descent Procedure

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

Complete the Descent Procedure by 10,000 feet MSL.

Pilot Flying	Pilot Monitoring
	During the descent, verify the RNP as needed.
	Set the affected center tank fuel pump switch to OFF when a center tank fuel pump LOW PRESSURE light illuminates. Set both center tank fuel pump switches to OFF when a center tank fuel pump LOW PRESSURE light illuminates if the center tank is empty.
	If established in a level flight attitude, for an extended period of time with usable fuel in the center tank and a center tank fuel pump switch(es) is OFF, set the center tank fuel pump switch(es) to ON again. Set the affected center tank fuel pump switch to OFF when a center tank fuel pump LOW PRESSURE light illuminates. Set both center tank fuel pump switches to OFF when a center tank fuel pump LOW PRESSURE light illuminates if the center tank is empty.
	Verify that pressurization is set to landing altitude.
Review the system annunciator lights.	Recall and review the system annunciator lights.
Verify VREF on the APPROACH REF page.	Enter VREF on the APPROACH REF page.
Set the RADIO/BARO minimums as needed for the approach.	

Pilot Flying	Pilot Monitoring
Set or verify the navigation radios and course for the approach.	
	Check landing performance.
	Set the AUTO BRAKE select switch to the needed brake setting.
Do the approach briefing.	
Call “DESCENT CHECKLIST.”	Do the DESCENT checklist.

Approach Procedure

The Approach Procedure is normally started at transition level.

Complete the Approach Procedure before:

- the initial approach fix, or
- the start of radar vectors to the final approach course, or
- the start of a visual approach

When using QFE, the use of LNAV/VNAV are not authorized.

YV751 - YV754
For a GLS approach, select the appropriate GLS channel.

For an ILS, LOC, BCRS, SDF or LDA approach, select the appropriate localizer frequency.

For a BCRS approach, enter the front course in the Mode Control Panel COURSE window. Do not select VOR/LOC.

If a flaps 15 landing is needed because of performance:

GROUND PROXIMITY flap inhibit switch .... FLAP INHIBIT F/O

Pilot Flying	Pilot Monitoring
	During arrival and approach, verify the RNP as needed.
	Set the passenger signs as needed.
	YA701 - YT508 At or above 10,000 feet MSL, set the FIXED LANDING light switches to ON. **YT509 - YV754** At or above 10,000 feet MSL, set the LANDING light switches to ON.
When descending below the transition level, set and crosscheck the altimeters.	
Update the arrival and approach, as needed.	
Update the approach briefing as needed.	
Call “APPROACH CHECKLIST.”	Do the APPROACH checklist.

Flap Extension Schedule

Current Flap Position	At Speedtape “Display”	Select Flaps	Command Speed for Selected Flaps
UP	“UP”	1	“1”
1	“1”	5	“5”
5	“5”	15	“15”
15	“15”	30 or 40	(VREF30 or VREF40) + wind additives

Landing Procedure - GLS

YV751 - YV754

<table>
<tr><th>Pilot Flying</th><th>Pilot Monitoring</th></tr>
<tr><td>Initially
• If on radar vectors
  • HDG SEL
  • Pitch mode (as needed)
• If enroute to a fix
  • LNAV or other roll mode
  • VNAV or other pitch mode</td><td></td></tr>
<tr><td></td><td>Notify the cabin crew to prepare for landing. Verify that the cabin is secure.</td></tr>
<tr><td>Call “FLAPS ___” according to the flap extension schedule.</td><td>Set the flap lever as directed. Monitor flaps and slats extension.</td></tr>
<tr><td colspan="2">When on localizer intercept heading:
• verify that the GLS is tuned and identified
• verify that the LOC and G/S pointers are shown.</td></tr>
<tr><td>Arm the APP mode.
If a dual channel approach is desired, engage the second autopilot.</td><td></td></tr>
<tr><td colspan="2">Note: When using LNAV to intercept the final approach course, LNAV might parallel the localizer without capturing it.</td></tr>
<tr><td>Use LNAV or HDG SEL to intercept the final approach course as needed.</td><td></td></tr>
<tr><td colspan="2">Verify that the localizer is captured.
Verify the final approach course heading.</td></tr>
<tr><td></td><td>Call “GLIDESLOPE ALIVE.”</td></tr>
<tr><td>At glideslope alive, call:
• “GEAR DOWN”
• “FLAPS 15”</td><td></td></tr>
</table>

Pilot Flying	Pilot Monitoring
	Set the landing gear lever to DN. Verify that the green landing gear indicator lights are illuminated. Set the flap lever to 15. Set the engine start switches to CONT.
Set the speed brake lever to ARM. Verify that the SPEED BRAKE ARMED light is illuminated.	
At glideslope capture, call “FLAPS ___” as needed for landing.	Set the flap lever as directed.
Set the missed approach altitude on the MCP.	
Call “LANDING CHECKLIST.”	Do the LANDING checklist.
At the final approach fix (LOM, MKR, DME), verify the crossing altitude.	
Monitor the approach. If an autoland is planned, verify the AFDS status at 500 feet AGL.	
For a single channel approach, disengage the autopilot and disconnect the autothrottle no later than the minimum use height for single autopilot operation. For a dual channel approach, disengage the autopilot after touchdown.	

Landing Procedure - ILS

<table>
<tr><th>Pilot Flying</th><th>Pilot Monitoring</th></tr>
<tr><td>Initially
• If on radar vectors
  • HDG SEL
  • Pitch mode (as needed)
• If enroute to a fix
  • LNAV or other roll mode
  • VNAV or other pitch mode</td><td></td></tr>
<tr><td></td><td>Notify the cabin crew to prepare for landing. Verify that the cabin is secure.</td></tr>
<tr><td>Call “FLAPS ___” according to the flap extension schedule.</td><td>Set the flap lever as directed. Monitor flaps and slats extension.</td></tr>
<tr><td colspan="2">When on localizer intercept heading:
• verify that the ILS is tuned and identified
• verify that the LOC and G/S pointers are shown.</td></tr>
<tr><td>Arm the APP mode.
If a dual channel approach is desired, engage the second autopilot.</td><td></td></tr>
<tr><td colspan="2">Note: When using LNAV to intercept the final approach course, LNAV might parallel the localizer without capturing it.</td></tr>
<tr><td>Use LNAV or HDG SEL to intercept the final approach course as needed.</td><td></td></tr>
<tr><td colspan="2">Verify that the localizer is captured.
Verify the final approach course heading.</td></tr>
<tr><td></td><td>Call “GLIDESLOPE ALIVE.”</td></tr>
<tr><td>At glideslope alive, call:
• “GEAR DOWN”
• “FLAPS 15”</td><td></td></tr>
<tr><td></td><td>Set the landing gear lever to DN.
Verify that the green landing gear indicator lights are illuminated.
Set the flap lever to 15.
Set the engine start switches to CONT.</td></tr>
</table>

Pilot Flying	Pilot Monitoring
Set the speed brake lever to ARM. Verify that the SPEED BRAKE ARMED light is illuminated.	
At glideslope capture, call “FLAPS ___” as needed for landing.	Set the flap lever as directed.
Set the missed approach altitude on the MCP.	
Call “LANDING CHECKLIST.”	Do the LANDING checklist.
At the final approach fix (LOM, MKR, DME), verify the crossing altitude.	
Monitor the approach. If an autoland is planned, verify the AFDS status at 500 feet AGL.	
For a single channel approach, disengage the autopilot and disconnect the autothrottle no later than the minimum use height for single autopilot operation. For a dual channel approach, disengage the autopilot after touchdown.	

Landing Procedure - Instrument Approach using VNAV

VNAV should be used only for approaches that have one of the following features:

- a published GP angle on the LEGS page for the final approach segment
- an RWxx waypoint at the approach end of the runway
- a missed approach waypoint before the approach end of the runway, (for example, MXxx).

Pilot Flying	*Pilot Monitoring*
The approach briefing should include speed and altitude restrictions.	*Enter the ISA deviation and QNH on the Descent Forecast page.*

This procedure is not authorized using QFE.

Pilot Flying	Pilot Monitoring

Initially
• If on radar vectors
  • HDG SEL
  • Pitch mode (as needed)
• If enroute to a fix
  • LNAV or other roll mode
  • VNAV or other pitch mode	

	Notify the cabin crew to prepare for landing. Verify that the cabin is secure.
Call “FLAPS ___” according to the flap extension schedule.	Set the flap lever as directed. Monitor flaps and slats extension.
The recommended roll modes for the final approach are: • for an RNAV or GPS approach use LNAV • for a LOC-BC, VOR or NDB approach use LNAV • for a LOC, SDF or LDA approach use LNAV or VOR/LOC.	

<table>
<tr><th>Pilot Flying</th><th>Pilot Monitoring</th></tr>
<tr><td colspan="2">When on the final approach course intercept heading for LOC, LOC-BC, SDF or LDA approaches:
• verify that the localizer is tuned and identified
YL545 - YL551, YN531 - YV750
• verify that the anticipation cue or LOC pointer is shown
YA701 - YL544, YM482 - YM484
• verify that the LOC pointer is shown.</td></tr>
<tr><td>Select LNAV or arm the VOR/LOC mode.</td><td></td></tr>
<tr><td colspan="2">WARNING: When using LNAV to intercept the localizer, LNAV might parallel the localizer without capturing it. The airplane can then descend on the VNAV path with the localizer not captured.</td></tr>
<tr><td>Use LNAV or HDG SEL to intercept the final approach course as needed.</td><td></td></tr>
<tr><td colspan="2">Verify that LNAV is engaged or that VOR/LOC is captured.</td></tr>
<tr><td>Approximately 2 NM before the final approach fix and after ALT HOLD or VNAV PTH or VNAV ALT is annunciated:
• <i>set DDA/DA</i> on the MCP
• select or verify VNAV
YF048 - YV754
• select or verify speed intervention, as needed.</td><td>Approximately 2 NM before the final approach fix, call “APPROACHING GLIDE PATH.”</td></tr>
<tr><td><i>Select VSD (as installed).</i></td><td></td></tr>
<tr><td>Call:
• “GEAR DOWN”
• “FLAPS 15.”</td><td></td></tr>
</table>

Pilot Flying	Pilot Monitoring
	Set the landing gear lever to DN. Verify that the green landing gear indicator lights are illuminated. Set the flap lever to 15. Set the engine start switches to CONT.
Set the speed brake lever to ARM. Verify that the SPEED BRAKE ARMED light is illuminated.	
Before the final approach fix (FAF), call "FLAPS ___" as needed for landing.	Set the flap lever as directed.
Call "LANDING CHECKLIST."	Do the LANDING checklist.
Before the final approach fix, verify the crossing altitude and crosscheck the altimeters ***(maximum 75 feet difference between primary altimeters).***	
When at least 300 feet below the missed approach altitude, set the missed approach altitude on the MCP.	
Monitor the approach.	
If suitable visual reference is established at *DDA/DA*, disengage the autopilot in accordance with regulatory requirements, and disengage the autothrottle at the same time. Maintain the glide path to landing.	

Go–Around and Missed Approach Procedure

Pilot Flying	Pilot Monitoring
At the same time: • push the TO/GA switch • call "FLAPS 15."	Position the FLAP lever to 15 and monitor flap retraction
Verify: • the rotation to go–around attitude • that the thrust increases.	
	Verify that the thrust is sufficient for the go-around or adjust as needed.
Verify a positive rate of climb on the altimeter and call "GEAR UP."	Verify a positive rate of climb on the altimeter and call "POSITIVE RATE." Set the landing gear lever to UP.
	Verify that the missed approach altitude is set.
If the airspeed is within the amber band, limit bank angle to 15°.	
YL545 - YL551, YN531 - YV754 Above 400 feet radio altitude, verify LNAV or select HDG SEL as appropriate. **YA701 - YL544, YM482 - YM484** Above 400 feet radio altitude, select appropriate roll mode and verify proper mode annunciation.	Observe mode annunciation.
Verify that the missed approach route is tracked.	
At acceleration height, call "FLAPS ___" according to the flap retraction schedule.	Set the FLAP lever as directed. Monitor flaps and slats retraction.
After flaps are set to the planned flap setting and at or above the flap maneuvering speed, select LVL CHG. VNAV may be selected if the flaps are up.	
Verify that climb thrust is set.	

Pilot Flying	Pilot Monitoring
Verify that the missed approach altitude is captured.	
	Set the landing gear lever to OFF after landing gear retraction is complete. Set the engine start switches as needed.
Call “AFTER TAKEOFF CHECKLIST.”	Do the AFTER TAKEOFF checklist.

Landing Roll Procedure

<table>
<tr><th>Pilot Flying</th><th>Pilot Monitoring</th></tr>
<tr><td>If an autoland was accomplished, disengage the autopilot. Control the airplane manually.</td><td></td></tr>
<tr><td>Verify that the thrust levers are closed.
Verify that the SPEED BRAKE lever is UP.
Without delay, fly the nose wheel smoothly onto the runway.</td><td>Verify that the SPEED BRAKE lever is UP.
Call “SPEED BRAKES UP.”
If the SPEED BRAKE lever is not UP, call “SPEED BRAKES NOT UP.”</td></tr>
<tr><td colspan="2">Monitor the rollout progress.</td></tr>
<tr><td colspan="2">Verify correct autobrake operation.</td></tr>
<tr><td colspan="2">WARNING: After the reverse thrust levers are moved, a full stop landing must be made. If an engine stays in reverse, safe flight is not possible.</td></tr>
<tr><td>Without delay, move the reverse thrust levers to the interlocks and hold light pressure until the interlocks release.
Apply reverse thrust as needed.</td><td>Verify that the forward thrust levers are closed.
When both REV indications are green, call "REVERSERS NORMAL".
If there is no REV indication(s) or the indication(s) stays amber, call "NO REVERSER ENGINE NUMBER 1", or "NO REVERSER ENGINE NUMBER 2", or "NO REVERSERS".</td></tr>
<tr><td>By 60 knots, start movement of the reverse thrust levers to be at the reverse idle detent before taxi speed.</td><td>Call “60 KNOTS.”</td></tr>
<tr><td>After the engines are at reverse idle, move the reverse thrust levers full down.</td><td></td></tr>
<tr><td>Before taxi speed, disarm the autobrake. Use manual braking as needed.</td><td></td></tr>
</table>

After Landing Procedure

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

Engine cooldown recommendations:

- run the engines for at least 3 minutes
- use a thrust setting normally used for taxi operations
- routine cooldown times less than 3 minutes are not recommended.

Pilot Flying	Pilot Monitoring
The captain moves or verifies that the SPEED BRAKE lever is DOWN.	
	Start the APU, as needed.
	Set the PROBE HEAT switches to AUTO.
	Set the exterior lights as needed.
	Set the ENGINE START switches to OFF.
Set the weather radar to OFF.	
	Set the AUTO BRAKE select switch to OFF.
	Set the flap lever to UP.
	Set the transponder mode selector to XPNDR.

Shutdown Procedure

Start the Shutdown Procedure after taxi is complete.

Parking brake .... Set   C or F/O

Verify that the parking brake warning light is illuminated.

Electrical power .... Set   F/O

If APU power is needed:

Verify that the APU GENERATOR OFF BUS light is illuminated.

APU GENERATOR bus switches – ON

Verify that the SOURCE OFF lights are extinguished.

If external power is needed:

Verify that the GRD POWER AVAILABLE light is illuminated.

GRD POWER switch – ON

Verify that the SOURCE OFF lights are extinguished.

Caution: *Do not apply rotational force when moving the engine start lever.*

Engine start levers .... CUTOFF C

Operate the engines at or near idle thrust for a minimum of three minutes before shutdown to thermally stabilize the engines and reduce undercowl soak-back temperatures. Taxi thrust can be considered idle thrust for this purpose.

If idle reverse thrust or no reverse thrust is used during the landing rollout, the three minute period can begin when thrust is reduced to idle for landing.

Routine cooldown times of less than three minutes before engine shutdown can cause engine degradation.

If towing is needed:

Establish communications with ground handling personnel C

WARNING: If the nose gear steering lockout pin is not installed and hydraulic system A is pressurized, any change to electrical or hydraulic power with the tow bar connected may cause unwanted tow bar movement.

Verify that the nose gear steering lockout pin is installed, or, if the nose gear steering lockout pin is not used C

System A HYDRAULIC PUMP switches – OFF

Verify that the system A pump LOW PRESSURE lights are illuminated.

CAUTION: Do not hold or turn the nose wheel steering wheel during pushback or towing. This can damage the nose gear or the tow bar.

CAUTION: Do not use airplane brakes to stop the airplane during pushback or towing. This can damage the nose gear or the tow bar.

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

FASTEN BELTS switch .... OFF F/O

ANTI COLLISION light switch .... OFF F/O

FUEL PUMP switches .... OFF F/O

CAB/UTIL power switch .... As needed F/O

IFE/PASS SEAT power switch .... As needed F/O

WING ANTI–ICE switch ....OFF F/O

ENGINE ANTI–ICE switches ....OFF F/O

Hydraulic panel ....Set F/O

ENGINE HYDRAULIC PUMPS switches - ON

ELECTRIC HYDRAULIC PUMPS switches - OFF

YA701 - YA710, YM482 - YN534

RECIRCULATION FAN switch .... As needed F/O

YF048 - YL551, YS151 - YV754

RECIRCULATION FAN switches .... As needed F/O

Air conditioning PACK switches.............................. AUTO F/O

ISOLATION VALVE switch .... OPEN F/O

Engine BLEED air switches .... ON F/O

APU BLEED air switch... ON F/O

Exterior lights switches .... As needed F/O

FLIGHT DIRECTOR switches ....OFF C, F/O

Transponder reply selector ....STBY F/O

After the wheel chocks are in place:

Parking brake – Release C or F/O

APU switch .... As needed F/O

Note: If extended APU operation is needed on the ground and the airplane busses are powered by AC electrical power, position an AC powered fuel pump ON. This will extend the service life of the APU fuel control unit.

Note: If fuel is loaded in the center tank, position the left center tank fuel pump switch ON to prevent a fuel imbalance before takeoff.

CAUTION: Center tank fuel pump switches should be positioned ON only if the fuel quantity in the center tank exceeds 453 kgs.

CAUTION: Do not operate the center tank fuel pumps with the flight deck unattended.

Call “SHUTDOWN CHECKLIST.” C

Do the SHUTDOWN checklist. F/O

Secure Procedure

IRS mode selectors .... OFF F/O

EMERGENCY EXIT LIGHTS switch .... OFF F/O

WINDOW HEAT switches .... OFF F/O

Air conditioning PACK switches .... OFF F/O

Call “SECURE CHECKLIST.” C

Do the SECURE checklist. F/O

Supplementary Procedures Chapter SP
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Supplementary Procedures Chapter SP

Introduction Section 05

General

This section contains procedures (adverse weather operation, engine crossbleed start, and so on) that are accomplished as required rather than routinely performed on each flight.

Supplementary procedures may be required because of adverse weather, unscheduled maintenance or as a result of a procedure referenced in a Non–Normal Checklist. Additionally, some may be performed if the flight crew must accomplish preflight actions normally performed by maintenance personnel.

At the discretion of the Captain, procedures may be performed by memory, by reviewing the procedure prior to accomplishment, or by reference to the procedure during its accomplishment.

Supplementary procedures are provided by section. Section titles correspond to the respective chapter title for the system being addressed except for the adverse weather section.

Intentionally
Blank

Interior Inspection

Emergency exit lights .... Check

Passenger signs .... Check

Service and entry doors .... Check

Escape slides .... Check pressure

Emergency exits .... Check

Wing upper surfaces .... Check

Lavatory fire extinguishers .... Check

Emergency equipment .... Check

Check availability and condition of emergency equipment, as required.

Flight Deck Door Access System Test

YA707 - YV754

Flight Deck Access System switch .... NORM

Flight deck door .... Open

Flight deck door lock selector .... AUTO

Emergency access code .... Enter

ENT key .... Push

Verify alert sounds.

Verify AUTO UNLK light illuminates.

Flight deck door lock selector .... DENY

Verify AUTO UNLK light extinguishes.

Flight deck door lock selector .... UNLKD

Flight deck access system switch .... OFF

Verify LOCK FAIL light illuminates.

Flight deck access system switch .... NORM

Guard - Down

Verify LOCK FAIL light extinguishes.

Water System Draining

Lavatory water supply selector valves .... SUPPLY/DRAIN

Galley water supply shutoff valves .... SUPPLY ON

The shutoff valve is found adjacent to each wet galley sink.

Drain line .... Connect to drain ports

- below the main passenger entry door
- aft of the water service panel

Water service panel .... Open

Tank drain valve handle .... OPEN

Drains potable water tank and water system aft of the wings.

Forward lavatory drain valve .... OPEN

Drain valve is found below the sink in the forward lavatory only.

Drain valves for coffee maker and
water boiler (if installed) .... OPEN

All galley and lavatory water faucets .... Open

Close faucets when water flow stops.

Accomplish the following items after verifying the potable water system is empty:

Drain valves for coffee maker and
water boiler (if installed) .... CLOSED

Forward lavatory drain valve .... CLOSED

Tank drain valve handle .... CLOSED

Water service panel .... Close

Drain line .... Disconnect from drain ports

If the potable water tank will not be refilled immediately after the system is emptied, open the following circuit breakers and attach DO–NOT–CLOSE tags:

P18–3 circuit breaker panel

- LAVATORY WATER HEATER A
- LAVATORY WATER HEATER D
- LAVATORY WATER HEATER E

Power distribution panel number 1

- POT WATER COMPRESSOR
- WATER QTY IND

Oxygen Mask Microphone Test

YA701 - YA710, YF921 - YM484, YS151 - YS178, YS191 - YS194

MASK/BOOM switch .... MASK

FLT INT switch .... Push

SPKR switch .... On

TEST/RESET switch .... Push and hold

EMERGENCY/Test selector .... Push and hold

Push-to-Talk switch .... INT

Simultaneously push the Push-to-Talk switch, the EMERGENCY/Test selector and the TEST/RESET switch.

Verify oxygen flow sound is heard through the flight deck speaker.

Push-to-Talk switch .... Release

EMERGENCY/Test selector .... Release

TEST/RESET switch .... Release

SPKR switch .... As needed

MASK/BOOM switch .... BOOM

Oxygen Mask Microphone Test

YF048, YF049, YN531 - YN534, YS179 - YS190, YT501 - YV754

FLT INT switch .... Push

SPKR switch .... On

TEST/RESET switch .... Push and hold

EMERGENCY/Test selector .... Push and hold

Push-to-Talk switch .... I/C

Simultaneously push the Push-to-Talk switch, the EMERGENCY/Test selector and the TEST/RESET switch.

Verify oxygen flow sound is heard through the flight deck speaker.

Push-to-Talk switch .... Release

EMERGENCY/Test selector .... Release

TEST/RESET switch .... Release

SPKR switch .... As needed

ETOPS

Operators conducting ETOPS are required to comply with appropriate regulations. An operator must have an ETOPS configured and approved airplane, and approved flight operations and maintenance programs in place to support ETOPS.

APU Operation

Unless otherwise authorized, start the APU before the ETOPS segment. The APU must be on for the entire ETOPS segment.

Fuel Crossfeed Valve Check

Unless accomplished by maintenance personnel prior to the ETOPS flight, do the following steps on the ground prior to engine start:

Crossfeed selector .... Open

Verify that the VALVE OPEN light illuminates bright, then dim.

Crossfeed selector .... Close

Verify that the VALVE OPEN light illuminates bright, then extinguishes.

During the last hour of cruise, do the following steps:

Crossfeed selector .... Open

Verify that the VALVE OPEN light illuminates bright, then dim.

Crossfeed selector .... Close

Verify that the VALVE OPEN light illuminates bright, then extinguishes.

Intentionally
Blank

Wing–Body Overheat Test

Wing–body OVHT TEST switch..Push

Hold for a minimum of 5 seconds.

Both WING–BODY OVERHEAT lights – illuminated

MASTER CAUTION – illuminated

AIR COND system annunciator – illuminated

Wing–body OVHT TEST switch...Release

Both WING–BODY OVERHEAT lights – extinguished

MASTER CAUTION lights – extinguished

AIR COND system annunciator – extinguished

External Air Cart Use

CAUTION: The BAT switch should always be on when using the airplane air conditioning system since the protective circuits are DC. This ensures protection in the event of loss of AC power.

Note: For engine start with a ground air source, see section SP.7.

APU BLEED air switch .... OFF

ISOLATION VALVE switch .... OPEN

YA701 - YA710, YM482 - YN534
RECIRC FAN switch...AUTO

YF048 - YL551, YS151 - YV754
RECIRC FAN switches ....AUTO

YF048 - YL551, YS151 - YV754
Trim Air Switch ....ON

PACK switches .... AUTO or HIGH

Cabin temperature selectors...AUTO

Set for desired temperature.

Duct pressure .... 20 psi minimum

If external air cannot hold 20 psi minimum and the APU is operating:

ISOLATION VALVE switch .... AUTO

APU BLEED air switch .... ON

APU supplies left pack and external air source supplies right pack.

Ground Conditioned Air Use

Before connecting ground conditioned air:

PACK switches ....OFF

Packs can be damaged if they are operated while ground conditioned air is connected.

After disconnecting ground conditioned air:

PACK switches .... As needed

Isolated Pack Operation during Engine Start

To improve cabin air quality between starting the first and second engine:

CAUTION: Moving engine BLEED air switches while a starter is engaged can damage the starter.

Engine No. 2 ....Start

After engine No. 2 stabilized:

ISOLATION VALVE switch .... CLOSE

Right PACK switch .... AUTO

Duct pressure .... Stabilized

Engine No. 1 ....Start

After engine No. 1 stabilized:

ISOLATION VALVE switch .... AUTO

Pressurization System Manual Mode Test

PACK switches ....OFF

Pressurization mode selector .... MAN

AUTO FAIL and ALTN lights – extinguished.

MANUAL light – illuminated.

Outflow valve switch .... CLOSE

Verify outflow valve position indicator moves toward CLOSE.

Outflow valve switch .... OPEN

Verify outflow valve position indicator moves toward OPEN.

Pressurization mode selector ....AUTO

Verify outflow valve position indicator moves toward OPEN.

MANUAL light – extinguished.

Manual Mode Operation

CAUTION: Switch actuation to the manual mode causes an immediate response by the outflow valve. Full range of motion of the outflow valve can take up to 20 seconds.

Pressurization mode selector .... MAN

MANUAL light – illuminated

CABIN/FLIGHT ALTITUDE placard... Check

Determine the desired cabin altitude.

If a higher cabin altitude is desired:

Outflow valve switch (momentarily) ....OPEN

Verify the outflow valve position indicator moves right, cabin altitude climbs at the desired rate, and differential pressure decreases. Repeat as necessary.

If a lower cabin altitude is desired:

Outflow valve switch (momentarily) ....CLOSE

Verify the outflow valve position indicator moves left, cabin altitude descends at the desired rate, and differential pressure increases. Repeat as necessary.

During Descent

Thrust lever changes should be made as slowly as possible to prevent excessive pressure bumps.

Outflow valve switch (momentarily) .... CLOSE

During descent, intermittently position the outflow valve switch toward CLOSE, observing cabin altitude decrease as the airplane descends.

Before entering the landing pattern, slowly position the outflow valve to full open to depressurize the airplane. Verify differential pressure is zero.

Pressurization Control Operation – Landing at Alternate Airport

At top of descent:

LAND ALT Indicator .... Reset

Reset to new destination field elevation.

Automatic Pressurization Control – Departure Airport Elevation Above 8400 Feet

YN531 - YN534

If departure airport elevation is above 10,000 feet:

Oxygen masks and regulators .... ON, Normal

Supplemental oxygen must be used from departure until the cabin altitude is below 10,000 feet.

After electrical power is applied to the airplane:

HIGH ALT LDG switch .... Off

Monitor CABIN ALT and CABIN rate of CLIMB indicators during climbout to ensure cabin altitude is descending below 8500 feet, at which time the cabin altitude warning system is reset to 10,000 feet.

Note: If departure airport elevation is above 9000 feet, the high altitude landing mode may be active and the warning system set at the High Altitude setpoint. If departure airport elevation is above 11,000 feet, the high altitude landing mode will be active and the warning system set at the High Altitude setpoint. When the cabin altitude descends below 8500 feet, the cabin altitude warning system is reset to 10,000 feet.

If landing altitude is at or below 6000 feet:

LAND ALT indicator ....Destination field elevation

If landing altitude is above 6000 feet:

Do the Automatic Pressurization Control - Landing Airport Elevation Above 6000 Feet supplementary procedure.

Automatic Pressurization Control – Landing Airport Elevation Above 6000 Feet

YA701 - YM484, YS151 - YV754

Do the normal Preflight Procedure - First Officer except as modified below.

Prior to takeoff:

LAND ALT indicator ....6000 feet

At initial descent or approximately 20 minutes prior to landing:

LAND ALT indicator .... Destination field elevation

Automatic Pressurization Control – Landing Airport Elevation Above 6000 Feet

YN531 - YN534

Do the normal Preflight Procedure - First Officer except as modified below.

Prior to takeoff:

LAND ALT indicator ....6000 feet

At initial descent or approximately 20 minutes prior to landing:

If landing elevation is above 8400 feet:

HIGH ALT LDG switch... ON

If landing elevation is above 10,000 feet:

Oxygen masks and regulators.....................ON, Normal

Supplemental oxygen must be used anytime the cabin altitude is above 10,000 feet.

LAND ALT indicator...................Destination field elevation

Unpressurized Takeoff and Landing

When making a no engine bleed takeoff or landing with the APU inoperative, or operative but not providing bleed air:

Takeoff

PACK switches...AUTO

ISOLATION VALVE switch...CLOSE

Engine BLEED air switches..OFF

APU BLEED air switch ....OFF

After Takeoff

Note: If engine failure occurs, do not position engine BLEED air switches ON until reaching 1500 feet or until obstacle clearance height has been attained.

At not less than 400 feet, and prior to 2000 feet above field elevation:

Engine No. 2 BLEED air switch ....ON

When CABIN rate of CLIMB indicator stabilizes:

Engine No. 1 BLEED air switch ....ON

ISOLATION VALVE switch..AUTO

Landing

When below 10,000 feet and starting the turn to final approach:

Engine BLEED air switches ....OFF

Avoid high rates of descent for passenger comfort.

No Engine Bleed Takeoff and Landing

YA701 - YM484, YS151 - YV754

When making a no engine bleed takeoff or landing with the APU operating.

Takeoff

Note: If anti–ice is required for taxi, configure for a “No Engine Bleed Takeoff” just prior to takeoff.

Note: If anti–ice is not required for taxi, configure for a “No Engine Bleed Takeoff” just after engine start.

Right PACK switch..AUTO

ISOLATION VALVE switch ....CLOSE

Left PACK switch...AUTO

Engine No. 1 BLEED air switch ....OFF

APU BLEED air switch..ON

Engine No. 2 BLEED air switch ....OFF

YF048 - YL551, YS151 - YV754
Trim Air Switch ....ON

WING ANTI-ICE switch ....OFF

The WING ANTI-ICE switch must remain OFF until the engine BLEED air switches are repositioned to ON and the ISOLATION VALVE switch is repositioned to AUTO.

After Takeoff

Note: If engine failure occurs, do not position engine BLEED air switches ON until reaching 1500 feet or until obstacle clearance height has been attained.

Engine No. 2 BLEED air switch ....ON

APU BLEED air switch.......................................OFF

When CABIN rate of CLIMB indicator stabilizes:

Engine No. 1 BLEED air switch ....ON

ISOLATION VALVE switch ....AUTO

Landing

If additional go–around thrust is desired, configure for a "No Engine Bleed Landing."

When below 10,000 feet:

WING ANTI-ICE switch ....OFF

Right PACK switch ....AUTO

ISOLATION VALVE switch .... CLOSE

Left PACK switch ....AUTO

Engine No. 1 BLEED air switch ....OFF

APU BLEED air switch .... ON

Engine No. 2 BLEED air switch ....OFF

No Engine Bleed Takeoff and Landing

YN531 - YN534

When making a no engine bleed takeoff or landing with the APU operating.

Takeoff

Note: If anti–ice is required for taxi, configure for a "No Engine Bleed Takeoff" just prior to takeoff.

Note: If anti–ice is not required for taxi, configure for a "No Engine Bleed Takeoff" just after engine start.

Right PACK switch .... AUTO

ISOLATION VALVE switch .... CLOSE

Left PACK switch .... AUTO

Engine No. 1 BLEED air switch ....OFF

APU BLEED air switch .... ON

Engine No. 2 BLEED air switch ....OFF

WING ANTI-ICE switch .... OFF

The WING ANTI-ICE switch must remain OFF until the engine BLEED air switches are repositioned to ON and the ISOLATION VALVE switch is repositioned to AUTO.

After Takeoff

Note: If engine failure occurs, do not position engine BLEED air switches ON until reaching 1500 feet or until obstacle clearance height has been attained.

Engine No. 2 BLEED air switch ....ON

APU BLEED air switch.. OFF

When CABIN rate of CLIMB indicator stabilizes:

Engine No. 1 BLEED air switch ....ON

ISOLATION VALVE switch .... AUTO

Landing

If additional go–around thrust is desired, configure for a “No Engine Bleed Landing.”

When below 17,000 feet:

WING ANTI-ICE switch .... OFF

Right PACK switch .... AUTO

ISOLATION VALVE switch ....CLOSE

Left PACK switch... AUTO

Engine No. 1 BLEED air switch .... OFF

APU BLEED air switch ....ON

Engine No. 2 BLEED air switch .... OFF

Intentionally
Blank

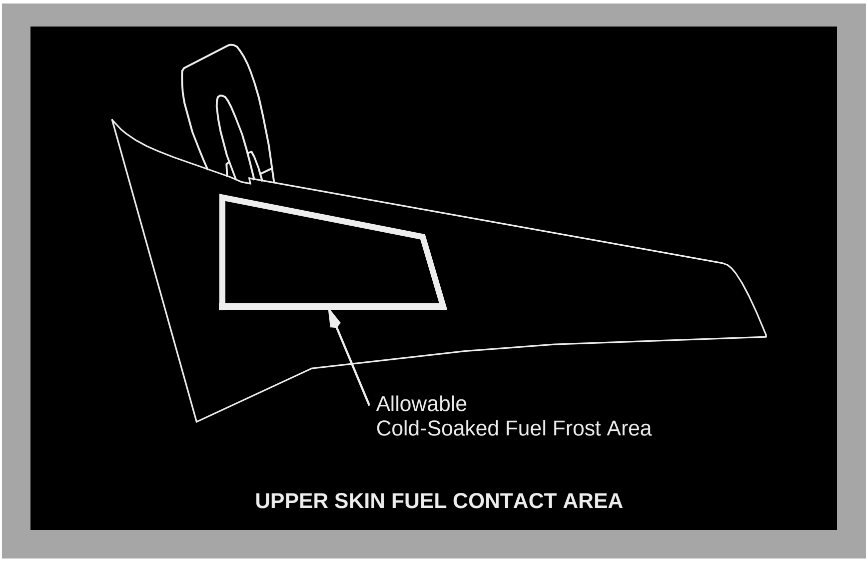
Anti–Ice Operation

Requirements for use of anti–ice and operational procedures for engine and wing anti–ice are contained in Supplementary Procedures, Adverse Weather Section SP.16.

Cold-Soaked Fuel Frost (CSFF)

Frost may form on the lower and upper wing surfaces due to cold-soaked fuel touching the wing surface after long flights with large fuel loads.

Exterior Safety Inspection - Airplanes with Defined Cold-Soaked Fuel Frost Area



Note: The presence of the painted cold soaked fuel frost area on the upper wing and the inclusion of these procedures in the FCOM do not constitute operational approval. Operators may be allowed to use these procedures by referring to the appropriate regulatory authority for approval or exemption, as required, to implement the procedure.

Surfaces.. Check

Visually inspect the lower and upper wing surfaces.

If there is frost or ice on the lower surface outboard of measuring stick 4, there may also be frost or ice on the upper surface. The distance that the frost extends outboard of measuring stick 4 can be used as an indication of the extent of the frost on the upper surface.

Takeoff with CSFF on lower wing surfaces is allowable provided all of the following condition are met::

- Ambient air temperature is at or above +4°C, +39°F
- There is no precipitation or visible moisture (rain, snow, drizzle, or fog with less than 1 mile visibility)
- Tank fuel temperature is at or above -16°C, or +3°F

YF048 - YV754

- All leading edge devices, all control surfaces, tab surfaces, winglet surfaces, and control surface balance panel cavities must be free of snow, ice and frost.

YA701 - YA710

- All leading edge devices, all control surfaces, tab surfaces, and control surface balance panel cavities must be free of snow, ice and frost.

YF048 - YV754

If all of the above conditions are not met, takeoff with light coatings of frost, up to 1/8 inch (3 mm) in thickness, on lower wing surfaces due to cold fuel is allowable; however, all leading edge devices, all control surfaces, tab surfaces, winglet surfaces and control surface balance panel cavities must be free of snow, ice and frost. If the frost on the lower surface is greater than 1/8 inch (3 mm) in thickness, all snow, ice and frost on the wings must be removed using appropriate deicing/anti-icing procedures.

YA701 - YA710

If all of the above conditions are not met, takeoff with light coatings of frost, up to 1/8 inch (3 mm) in thickness, on lower wing surfaces due to cold fuel is allowable; however, all leading edge devices, all control surfaces, tab surfaces and control surface balance panel cavities must be free of snow, ice and frost. If the frost on the lower surface is greater than 1/8 inch (3 mm) in thickness, all snow, ice and frost on the wings must be removed using appropriate deicing/anti-icing procedures.

Takeoff with CSFF on upper wing surfaces is allowed provided all of the following conditions are met:

- The CSFF on the wing tank upper surfaces is only within the lines defining the permissible CSFF area with no ice or frost on the leading edges or control surfaces
- Ambient air temperature is at or above +4°C, +39°F
- There is no precipitation or visible moisture (rain, snow, drizzle, or fog with less than 1 mile visibility)
- Tank fuel temperature is at or above -16°C, +3°F.

If all of the above conditions are not met, all snow, ice and frost on the wings must be removed using appropriate deicing/anti-icing procedures.

Exterior Safety Inspection - Airplanes without Defined Cold-Soaked Fuel Frost Area

Surfaces .... Check

Visually inspect the lower and upper wing surfaces.

If there is frost or ice on the lower surface outboard of measuring stick 4, there may also be frost or ice on the upper surface. The distance that the frost extends outboard of measuring stick 4 can be used as an indication of the extent of the frost on the upper surface.

Takeoff with CSFF on lower wing surfaces is allowable provided all the following condition are met::

- Ambient air temperature is at or above +4°C, +39°F
- There is no precipitation or visible moisture (rain, snow, drizzle, or fog with less than 1 mile visibility)
- Tank fuel temperature is at or above -16°C, or +3°F

YF048 - YV754

- All leading edge devices, all control surfaces, tab surfaces, winglet surfaces, and control surface balance panel cavities must be free of snow, ice and frost.

YA701 - YA710

- All leading edge devices, all control surfaces, tab surfaces, and control surface balance panel cavities must be free of snow, ice and frost.

YF048 - YV754

If all of the above conditions are not met, takeoff with light coatings of frost, up to 1/8 inch (3 mm) in thickness, on lower wing surfaces due to cold fuel is allowable; however, all leading edge devices, all control surfaces, tab surfaces, winglet surfaces and control surface balance panel cavities must be free of snow, ice and frost. If the frost on the lower surface is greater than 1/8 inch (3 mm) in thickness, all snow, ice and frost on the wings must be removed using appropriate deicing/anti-icing procedures.

YA701 - YA710

If all of the above conditions are not met, takeoff with light coatings of frost, up to 1/8 inch (3 mm) in thickness, on lower wing surfaces due to cold fuel is allowable; however, all leading edge devices, all control surfaces, tab surfaces and control surface balance panel cavities must be free of snow, ice and frost. If the frost on the lower surface is greater than 1/8 inch (3 mm) in thickness, all snow, ice and frost on the wings must be removed using appropriate deicing/anti-icing procedures.

Takeoff with frost on upper wing surfaces due to cold fuel (CSFF) is not allowable. If any frost is present on the upper wing surface, all snow, ice and frost on the wings must be removed using appropriate deicing/anti-icing procedures.

Window Heat System Tests

Overheat Test

The overheat test simulates an overheat condition to check the overheat warning function of the window heat system.

WINDOW HEAT switches .... ON

WINDOW HEAT TEST switch .... OVHT

OVERHEAT lights – On

ON lights – Extinguish

Lights extinguish after approximately 1 minute.

MASTER CAUTION – On

ANTI–ICE system annunciator – On

WINDOW HEAT switches .... Reset

Position the WINDOW HEAT switches OFF, then ON.

Power Test

The power test verifies operation of the window heat system. The test may be accomplished when any of the window heat ON lights are extinguished and the associated WINDOW HEAT switch is ON.

WINDOW HEAT switches .... ON

Note: Do not perform the power test when all ON lights are illuminated

WINDOW HEAT TEST switch .... PWR

The controller is forced to full power, bypassing normal temperature control. Overheat protection is still available.

WINDOW HEAT ON lights .... Illuminated

If any ON light remains extinguished, the window heat system is inoperative. Observe the maximum airspeed limit of 250 kts below 10,000 feet.

Intentionally
Blank

Level Change Climb/Descent

ALTITUDE selector ....Set desired altitude

Note: If a new MCP altitude is selected while in ALT ACQ, the AFDS engages in V/S and the existing vertical speed is maintained.

LVL CHG switch ....Push

Verify FMA display:

Thrust mode (climb) – N1

Thrust mode (descent) – RETARD then ARM

Pitch mode – MCP SPD

IAS/MACH Selector..Set desired speed

Vertical Speed (V/S) Climb/Descent

ALTITUDE selector ....Set desired altitude

Note: If a new MCP altitude is selected while in ALT ACQ, the AFDS engages in V/S and the existing vertical speed is maintained.

V/S thumbwheel ....Set desired vertical speed

Verify FMA display:

Thrust mode (climb or descent) – MCP SPD

Pitch mode – V/S

IAS/MACH Selector..Set desired speed

To transition to the vertical speed mode from another engaged climb or descent mode:

V/S mode switch ....Push

V/S climb mode engages at existing V/S.

V/S thumbwheel ....Set desired vertical speed

Verify FMA display:

Thrust mode (climb or descent) – MCP SPD

Pitch mode – V/S

IAS/MACH Selector .... Set desired speed

Intervention of FMC Altitude Constraints during VNAV Climb

YF048 - YV754

MCP altitude selector .... Set new altitude

New altitude must be higher than the FMC altitude constraint(s) to be deleted.

ALT INTV switch .... Push

Each push of the ALT INTV switch will delete an FMC altitude constraint.

Intervention of FMC Cruise Altitude during VNAV Cruise

YF048 - YT513, YV604, YV605

MCP altitude selector .... Set

ALT INTV switch .... Push

If a higher altitude is selected, a CRZ climb will be started.

If a lower altitude is selected, an early descent will be started.

Intervention of FMC Cruise Altitude during VNAV Cruise

YT514 - YT521, YV741 - YV754

MCP altitude selector .... Set

ALT INTV switch .... Push

If a higher altitude is selected, a CRZ climb will be started.

If the airplane is more than 50 nm from T/D, if a lower altitude is selected, a CRZ descent will be started if the selected altitude is above any FMC altitude constraint.

If the airplane is more than 50 nm from T/D, if a lower altitude is selected, an early descent will be started if the selected altitude is below any FMC altitude constraint.

If the airplane is 50 nm or less from T/D, if a lower altitude is selected, an early descent will be started.

Intervention of FMC Altitude Constraints during VNAV Descent

YF048 - YV754

MCP altitude selector .... Set new altitude

New altitude must be lower than the FMC altitude constraint (s) to be deleted.

ALT INTV switch .... Push

Each push of the ALT INTV switch will delete an FMC altitude constraint.

If all FMC altitude constraints are deleted, the descent mode will revert to a VNAV speed descent.

Intervention of FMC Airspeed Constraints during VNAV

YF048 - YV754

SPD INTV switch .... Push

MCP IAS/MACH display shows current FMC target speed.

IAS/MACH Selector .... Set desired speed

VNAV remains engaged.

To resume former FMC speed:

SPD INTV switch .... Push

MCP IAS/MACH display blanks and FMC commanded VNAV speed is active.

Altitude Hold

Altitude HOLD switch .... Push

Verify FMA display:

Pitch mode – ALT HOLD

Heading Select

Heading selector .... Set desired heading

Heading select switch .... Push

Verify FMA display:

Roll mode – HDG SEL

VOR Navigation

VHF NAV radio(s) .... Tune and Identify

COURSE selector .... Set desired course

When on an intercept heading to the VOR course:

VOR LOC mode switch .... Push

Verify VOR LOC armed mode annunciates.

A/P automatically captures the VOR course.

Verify VOR LOC engaged mode annunciates upon course capture.

Note: If change to a localizer frequency is desired when captured in the VOR mode, disengage VOR LOC mode prior to selection of the localizer. VOR LOC mode can then be reengaged.

Instrument Approach using Vertical Speed (V/S)

Pilot Flying	Pilot Monitoring
Initially • If on radar vectors • HDG SEL • Pitch mode (as needed) • If enroute to a fix • LNAV or other roll mode • VNAV or other pitch mode	
Call "FLAPS ___" according to the flap extension schedule.	Set the flap lever as directed. Monitor flaps and slats extension.

Note: *Use the published MDA(H)+50ft as the minimums. It is required to remain above MDA(H) for the published procedures during the missed approach.This does not apply to circling approach.*

Note: *When executing a missed approach prior to the MAP and not cleared by an air traffic control (ATC) climb-out instruction, the published missed approach procedure should be flown, and no turn should be initiated before reaching the missed approach point.*

Recommended roll modes:

- *NDB approach: LNAV or HDG SEL.*
- VOR, LOC, SDF or LDA approach: VOR/LOC or LNAV.

Note: When using LNAV to intercept a localizer, LNAV might parallel the localizer without capturing it. Use HDG SEL to intercept the final approach course, if needed.

Note: *When using LNAV to track the final path, ensure that the navigation accuracy meets the requirements.*

Ensure appropriate navaids (VOR, LOC or NDB) are tuned and identified before commencing the approach.

Pilot Flying	Pilot Monitoring
Use LNAV or other roll mode to intercept the final approach course as needed.	
Approximately 2 NM before the final approach fix, set the first intermediate altitude constraint or *the minimums*. If the constraint or *the minimums* does not end in zero zero (00), for example, 1820, set the MCP ALTITUDE window to the closet 100 foot increment above the constraint or *the minimums*. When the current constraint is assured, set the next constraint before ALT HOLD is engaged to achieve a continuous descent path.	Approximately 2 NM before the final approach fix, call “APPROACHING GLIDE PATH.”
Select VSD (as installed).	

Pilot Flying	Pilot Monitoring
Call: • “GEAR DOWN” • “FLAPS 15.”	Set the landing gear lever to DN. Verify that the green landing gear indicator lights are illuminated. Set the flap lever to 15. Set the engine start switches to CONT.
Set the speed brake lever to ARM. Verify that the SPEED BRAKE ARMED light is illuminated.	
Before the final approach fix, call "FLAPS ___" as needed for landing.	Set the flap lever as directed.
Call "LANDING CHECKLIST."	Do the LANDING checklist.
At the final approach fix, crosscheck the altimeters. Verify they agree within 100 feet.	

At descent point:

Desired V/S ....Set

Set desired V/S to descend to *the minimums*. Use a V/S that results in no level flight segment at *the minimums*.

Verify V/S mode annunciates.

Approximately 300 feet above *the minimums*:

MCP altitude ....Set missed approach altitude

At *the minimums*/missed approach point:

If suitable visual reference is not established, execute missed approach.

After suitable visual reference is established:

A/P disengage switch ....Push

Disengage the autopilot in accordance with regulatory requirements.

A/T disengage switch ....Push

Disengage the autothrottle when disengaging the autopilot.

Step Descent Approach using Vertical Speed (V/S)

Note: This traditional method only applies to the approaches which cannot be flown using CDFA technique. (The weather minimum is the published RVR/VIS+400M.)

Pilot Flying	Pilot Monitoring

Initially
• If on radar vectors
  • HDG SEL
  • Pitch mode (as needed)
• If enroute to a fix
  • LNAV or other roll mode
  • VNAV or other pitch mode	

Call “FLAPS ___” according to the flap extension schedule.	Set the flap lever as directed. Monitor flaps and slats extension.

Note: Autopilot is used until suitable visual reference is established on final approach.

Note: Use the published MDA (H) as the minimums. It is required to remain above MDA(H) for the published procedures during the missed approach. This does not apply to circling approach.

Note: When executing a missed approach prior to the MAP and not cleared by an air traffic control (ATC) climb-out instruction, the published missed approach procedure should be flown, and no turn should be initiated before reaching the missed approach point.

Recommended roll modes:

- NDB approach: HDG SEL or LNAV
- VOR/LOC, SDF or LDA approach: VOR/LOC or LNAV

> **Note:** When using LNAV to intercept a localizer, LNAV might parallel the localizer without capturing it. Use HDG SEL to intercept the final approach course, if needed.
>
> **Note:** When using LNAV to track the final path, ensure that the navigation accuracy meets the requirements.

Ensure appropriate navaids (VOR,LOC or NDB) are tuned and identified before commencing the approach.

Pilot Flying	Pilot Monitoring
Use LNAV or other roll mode to intercept the final approach course as needed.	
Approximately 2 NM before the final approach fix, (or for the procedure without a published FAF, before establishing the final approach path), set the first intermediate altitude constraint or the minimums. If the constraint or the minimums does not end in zero zero (00), for example,1820, set the MCP ALTITUDE window to the closet 100 foot increment above the constraint or the minimums. When the current constraint is assured, set the next constraint before ALT HOLD is engaged to achieve a continuous descent path.	Approximately 2 NM before the final approach fix (approaching final approach path), call "APPROACHINGGLIDE PATH."
Select VSD (as installed).	
Call: • "GEAR DOWN" • "FLAPS 15."	Set the landing gear lever to DN. Verify that the green landing gear indicator lights are illuminated. Set the flap lever to 15. Set the engine start switches to CONT.
Set the speed brake lever to ARM. Verify that the SPEED BRAKE ARMED light is illuminated.	
Before approaching FAF (final approach path), call "FLAPS ___" as needed for landing.	Set the flap lever as directed.
Call "LANDING CHECKLIST."	Do the LANDING checklist.
At the final approach fix (final approach path), crosscheck the altimeters (verify maximum 100 feet difference between primary altimeters).	

At descent point:

V/S 1000ft/min

Set V/S to descend to MDA(H).

Verify V/S mode annunciates.

When FMA indicates ALT HOLD, set missed approach altitude.

MCP altitude ....Set missed approach altitude

Before the MAP, suitable visual reference must be established, and the stable approach criteria must be maintained.

(Stable approach requirements: With the 3° glide path as the reference, the crew must establish suitable visual reference before the point at a distance from the runway threshold corresponding to MDA(H). For example: MDH900 feet corresponds to a distance of 3nm from the runway, so the suitable visual reference must be established before 3nm from the runway. If the distance from runway threshold is not assured, the crew can use VASI or PAPI to determine if the airplane is on the glide path. In cold weather, cold temperature altitude corrections are required to determine the corresponding geometric position.)

A/P disengage switch .... push

Disengage the autopilot in accordance with regulatory requirements.

A/T disengage switch .... push

Disengage the autothrottle when disengaging the autopilot.

Establish and maintain suitable glide path until landing.

If suitable reference is not established at the missed approach point or the stable approach requirements can not be satisfied before the missed approach point:

execute missed approach.

Circling Approach

If a missed approach is needed at any time while circling, make an initial climbing turn toward the landing runway and intercept the missed approach course.

Configuration at MDA(H):

- Gear down
- Flaps 15
- Speedbrake armed

MCP altitude selector .... Set

If the MDA(H) does not end in zero zero, for example, 1820, set MCP ALTITUDE window to the closest 100 foot increment above the MDA(H).

Accomplish an instrument approach, establish suitable visual reference and level off at MCP altitude.

Verify ALT HLD or VNAV ALT mode annunciates.

ALT HLD mode .... Verify/select

Verify ALT HLD mode annunciates.

MCP altitude selector .... Set missed approach altitude

HDG SEL switch .... Push

Verify HDG SEL mode annunciates.

Before starting the turn to base:

- Landing flaps (if not previously selected)
- Do the LANDING checklist.

Intercepting the landing profile:

Autopilot disengage switch .... Push

Autothrottle disengage switch .... Push

Instrument Approach - RNP APCH

This procedure is not authorized using QFE.

The RNP APCH Instrument Approach Procedure below supplements Normal Descent and Approach Procedures and replaces the complete Landing Procedure. Additional information is given in case of a go-around.

Pre-approach Requirements

Airplane equipment required to begin the approach:

- EGPWS
- 2 FMCs, CDUs*
- 2 GPS Receivers
- Current Navigation Database
- 2 Radio Altimeters
- 2 ADIRUs, IRSs in NAV mode*
- 2 PFD/2 ND displays*
- 1 A/P and 1 F/D capable of LNAV and VNAV* (If LNAV minimums (MDA+50) is used, the VNAV is not required)

Note: Go-around/missed approach is required if the UNABLE REQ’D NAV PERF-RNP, FMC DISAGREE, or VERIFY POSITION alert is displayed unless suitable visual reference is established and maintained.

Note: Single failure of (*) items should cause the crew to consider a go-around/missed approach if that is the safest course of action.

Do the following prior to beginning the approach:

- verify that the UNABLE REQD NAV PERF-RNP alert is not displayed
- review RNP availability predictions
- verify that the approach RNP is equal to or greater than 0.3
- set current local altimeter. If remote altimeter settings are used, only execute DDA which applies to LNAV approach minimums (MDA+50)
- verify that wind is within limits published for the approach (if applicable)
- verify that the reported airport temperature is within published limits for the approach; if the reported airport temperature is over the limitation, Baro-VNAV is prohibited, and only execute DDA which applies to LNAV approach minimums(MDA+50)

Descent Procedure

Pilot Flying	Pilot Monitoring
The approach briefing shall include speed and altitude restrictions, missed approach, engine failure, and unable RNP procedures.	Select VOR UPDATE - OFF on the NAV OPTIONS page; Inhibit other navaids as needed per NOTAM; Enter the ISA deviation and QNH on the Descent Forecast page.

Approach Procedure

Complete the Approach Procedure before the initial approach fix, or the start of radar vectors to the final approach course. When it is necessary to temporarily change the procedure from other approach to RNP APCH, the crew shall verify the following items and accomplish the supplementary briefing as needed before the approach:

- The autopilot is engaged.
- Both flight directors are used.
- DDA/DA is set.
- Transfer and verify Waypoint, Speed / Altitude Constraints for the FMC approach procedure; the glide path angle on the final approach segment. VOR UPDATE -OFF
- RNP is equal to that published on the approach chart, and ANP is lower than RNP.
- Verify or enter ISA Deviation and QNH (DEV/QNH) on the DES FORECASTS page.
- LNAV is engaged or armed (when proceeding a direct–to or leg intercept to the final approach course)
- The UNABLE REQD NAV PERF-RNP alert is not displayed
- ND- map mode.

Note: DDA applies to LNAV approach minimums, and is the published MDA+50 feet.

Note: When receiving radar vectors from ATC, intercept course modifications may be used to join the LNAV path at any point on the initial, intermediate or missed approach segments.

Note: Direct To modifications are not permitted when:

- The fix is the beginning of an RF leg.
- The fix is the Final Approach Fix (FAF) for the procedure.

Note: During RNP operations containing RF leg, the published maximum air speed limit shall not be exceeded.

Landing Procedure

Pilot Flying	Pilot Monitoring
Select TERR on map. Select CDU: LEGS page.	Select TERR or WX radar on map.
Use LNAV and VNAV or other pitch mode for initial descent. Verify/engage VNAV at FAF on final approach (only for Baro-VNAV).	
Call “FLAPS_______” according to the flap extension schedule or approach speed constraint.	Set the flap lever as directed. Monitor flaps and slats extension.
Approximately 2 NM before the FAF and after ALT HOLD or VNAV PTH or VNAV ALT (as installed) is annunciated: • set DDA/DA on the MCP • select or verify VNAV (only for Baro-VNAV) • select or verify VNAV or V/S (for only LNAV approach)	Approximately 2NM before the final approach fix, call “APPROACHING GLIDE PATH.”
Maximum Lateral Deviation (XTK ERROR): NPS amber indication (as installed) or 1 x RNP Maximum Vertical Deviation - FAF to DA (only for Baro-VNAV): +100 feet/-50 feet Monitor NPS (as installed) or RNP progress pages. Select VSD (as installed).	
Approaching glide path, call: • “GEAR DOWN” • “FLAPS15”	Set the landing gear lever to DN. Verify that the green landing gear indicator lights are illuminated. Set the flap lever to 15. Set the engine start switches to CONT.
Set the speed brake lever to ARM. Verify that the SPEED BRAKE ARMED light is illuminated.	
Before the final approach fix (FAF), call “FLAPS____” as needed for landing.	Set the flap lever as directed.

Pilot Flying	Pilot Monitoring
Call “LANDING CHECKLIST.”	Do the LANDING checklist.
Before the final approach fix, verify the crossing altitude and crosscheck the altimeters (maximum 75 feet difference between primary altimeters). If V/S is used, adjust V/S as needed.	
On VNAV, when at least 300 feet below the missed approach altitude, set the missed approach altitude on the MCP. On V/S, when at 300 feet above the DDA, set the missed approach altitude on the MCP.	
Monitor the approach.	
If suitable visual reference is established at DDA/DA, disengage the A/P in accordance with regulatory requirements and disconnect A/T. Maintain the glide path to landing.	
Note: If a go-around is needed, fly the published missed approach procedure.	

Instrument Approach - RNP APCH (Using VNAV)

Instrument Approach - RNP APCH (Using V/S)

Instrument Approach - RNAV (RNP) AR

Note: Operators need approval to conduct RNAV (RNP) AR Instrument Approaches.

Note: This procedure is not authorized using QFE.

The RNAV (RNP) AR Instrument Approach Procedure below supplements Normal Cruise, Descent and Approach Procedures and replaces the complete Landing Procedure.

YA701 - YL544, YM482 - YM484
Additional information is given in case of a go-around.

Pre-approach Requirements

Airplane equipment required to begin the approach:

- EGPWS
- 2 FMCs, CDUs *
- 2 GPS Receivers
- Current Navigation Database
- 2 Radio Altimeters
- 2 ADIRUs, IRSs in NAV mode *
- 2 EFIS/MAP or PFD/ND displays (as installed) *
- 1 A/P and 2 F/Ds capable of LNAV and VNAV * (for RNP 0.15 or greater)
- 2 A/P and 2 F/Ds capable of LNAV and VNAV * (for RNP less than 0.15)

Note: Go-around/missed approach is required if the UNABLE REQD NAV PERF-RNP, FMC DISAGREE, or VERIFY POSITION alert is displayed unless suitable visual reference is established and maintained.

Note: Single failure of (*) items should cause the crew to consider a go-around/missed approach if that is the safest course of action.

Do the following before beginning the approach

- verify that the UNABLE REQD NAV PERF-RNP alert is not displayed
- review RNP availability predictions
- verify that the approach RNP is equal to or greater than:

  YL545 - YL551, YN531 - YV750
  - 0.10 (A/P or F/D)

YA701 - YL544, YM482 - YM484

- 0.11 (A/P)

YA701 - YL544, YM482 - YM484

- 0.15 (F/D)

- set current local altimeter (remote altimeter settings not allowed)
- verify that wind is within limits published for the approach (if applicable)
- verify that the reported airport temperature is within published limits for the approach
- review the maximum IAS for each segment of the approach as determined by aircraft category and applicable regulatory airspeed requirements.

Cruise Procedure

Pilot Flying	Pilot Monitoring
	When selecting the approach from the navigation database verify FMC LEGS page matches the charted approach. If the IAF has an “at or above” altitude restriction, it may be changed to an “at” altitude restriction using the same altitude. Speed modifications are allowed as long as the maximum published speed is not exceeded. No other lateral or vertical modifications after the IAF may be made.

Descent Procedure

Pilot Flying	Pilot Monitoring
In the approach briefing include speed and altitude restrictions, missed approach, engine failure, and unable RNP procedures.	Select VOR UPDATE - OFF on the NAV OPTIONS page. Inhibit other navaids as needed per NOTAM.

Approach Procedure

Complete the Approach Procedure before the initial approach fix, or the start of radar vectors to the final approach course.

Note: When receiving radar vectors from ATC, intercept course modifications may be used to join the LNAV path at any point on the initial, intermediate or missed approach segments.

Note: Direct To modifications are not permitted when:

- The fix is the beginning of an RF leg
- The fix is the Final Approach Fix (FAF) for the procedure.

Pilot Flying	Pilot Monitoring
	On the RNP PROGRESS Page set or verify RNP for the approach.

YL545 - YL551, YN531 - YV750

Note: For airplanes with NPS, the flight crew may enter 125 feet for vertical RNP. While there are no vertical RNP values published on the approach chart, the use of 125 feet will cause the NPS amber deviation exceedance alert to occur at 75 feet or slightly less deviation, since vertical ANP will be at least 50 feet at all times.

Landing Procedure

YL545 - YL551, YN531 - YV750

Pilot Flying	Pilot Monitoring

Initially
• If on radar vectors
  • HDG SEL
  • Pitch mode (as needed)
• If enroute to a fix
  • Verify LNAV
  • VNAV or other pitch mode	

	Notify the cabin crew to prepare for landing. Verify that the cabin is secure.
Select TERR on map. Select CDU: LEGS page.	Select TERR or WX radar on map.
Use LNAV and VNAV or other pitch mode for initial descent. VNAV is required FAF inbound. Some approach procedures may require use of VNAV from the IAF onward. On intercept heading, select or verify LNAV.	
Before established on the final approach course, call “FLAPS ___” according to the flap extension schedule or approach speed constraint.	Set the flap lever as directed. Monitor flaps and slats extension.

Pilot Flying	Pilot Monitoring
Approximately 2 NM before the FAF and after ALT HOLD or VNAV PTH or VNAV ALT (as installed) is annunciated: • set DA(H) on the MCP • select or verify VNAV • select or verify speed intervention (as installed)	
Maximum Lateral Deviation (XTK ERROR): NPS amber indication or 1 x RNP Maximum Vertical Deviation - FAF to DA: 75 feet Monitor NPS	
Approaching glide path, call: • “GEAR DOWN” • “FLAPS 15”	Set the landing gear lever to DN. Verify that the green landing gear indicator lights are illuminated. Set the flap lever to 15. Set the engine start switches to CONT.
Set the speed brake lever to ARM. Verify that the SPEED BRAKE ARMED light is illuminated.	
Beginning the final approach descent, call “FLAPS ___” as needed for landing.	Set the flap lever as directed.
Call “LANDING CHECKLIST.”	Do the LANDING checklist.
When at least 300 feet below the missed approach altitude, set the missed approach altitude on the MCP.	
After the initial approach fix (IAF) and before the final approach fix(FAF), verify the crossing altitude and crosscheck the altimeters (maximum *75* feet difference between primary altimeters).	
Monitor the approach.	
If suitable visual reference is established at DA(H), disengage the autopilot in accordance with regulatory requirements, and disengage the autothrottle at the same time. Maintain the glide path to landing.	

Landing Procedure

YA701 - YL544, YM482 - YM484

Pilot Flying	Pilot Monitoring

Initially
• If on radar vectors
  • HDG SEL
  • Pitch mode (as needed)
• If enroute to a fix
  • Verify LNAV
  • VNAV or other pitch mode	

	Notify the cabin crew to prepare for landing. Verify that the cabin is secure.
Select TERR on map. Select CDU: LEGS page.	Select TERR or WX radar on map. Select CDU: RNP PROGRESS page.
One pilot must have the map display in 10 NM range or less to monitor path tracking during the final approach segment.	
Use LNAV and VNAV or other pitch mode for initial descent. VNAV is required FAF inbound. Some approach procedures may require use of VNAV from the IAF onward. On intercept heading, select or verify LNAV.	
Before established on the final approach course, call “FLAPS ___” according to the flap extension schedule or approach speed constraint.	Set the flap lever as directed. Monitor flaps and slats extension.
Approximately 2 NM before the FAF and after ALT HOLD or VNAV PTH or VNAV ALT (as installed) is annunciated: • set DA(H) on the MCP • select or verify VNAV • select or verify speed intervention (as installed)	
Maximum Lateral Deviation (XTK ERROR): 1 x RNP Maximum Vertical Deviation - FAF to DA: 75 feet Monitor RNP PROGRESS page	

<table>
<tr><th>Pilot Flying</th><th>Pilot Monitoring</th></tr>
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• “FLAPS 15”</td><td>Set the landing gear lever to DN.
Verify that the green landing gear indicator lights are illuminated.
Set the flap lever to 15.
Set the engine start switches to CONT.</td></tr>
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Verify that the SPEED BRAKE ARMED light is illuminated.</td><td></td></tr>
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<tr><td>Call “LANDING CHECKLIST.”</td><td>Do the LANDING checklist.</td></tr>
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Maintain the glide path to landing.</td><td></td></tr>
</table>

Note: If a go-around/missed approach is needed, track the required course manually using the trend vector and map until LNAV is re-engaged.

Low Visibility Operations (LVO)

LVO Requirements

- Definition
  - LVO includes Low Visibility Takeoff (LVTO), CAT II and CAT III operations.
  - LVTO is the takeoff with RVR below 400m.
  - CAT II operation is the approach and landing with DH between 60m (200 feet) and 30m (100 feet), and RVR no less than 300m.
- The flight crew could implement CAT II operations in dispatched (released) airports only under the following conditions: aircraft, crew qualification and airport condition meet the requirements of CAT II operations; CAT II operation qualification should be noted on the Dispatch Release List and Flight Assignment.
- Autoland should be used during CAT II operations (except for training).
- LVO is not allowed on contaminated runways.
- LVO wind speed limits:

	Headwind	**Crosswind**	**Tailwind**
Meteorological wind limit	KTS	KTS	KTS
	25	15	10

Low Visibility Ground Operation and Departure

- The following should be added to the Takeoff Briefing during LVO:
  - Airport runway lights and markings of LVO
  - Airport's LVO procedures, especially low visibility taxi route, stop line lights, ILS signal sensitive area, waiting point/area specific program, "H/S" and other specific requirements
  - Takeoff weather standards and confirmation of departure alternate airports.
- During LVO, only the specified taxi route is allowed. The flight crew should be aware of operations of other aircrafts. If the taxiing instruction is not fully understood, further explanation from ATC is needed; and should not begin taxiing without further instruction.
- The LVO taxiing speed should be less than 10KTS. Stop taxiing if the obstacle distance is less than 10m and there is no ground guidance.
- During LVO taxiing, when procedures other than taxiing need to be conducted or checklists need to be accomplished, stop taxiing.
- Strictly follow the regulations of the ILS signal reserve area and wait.

- Tune the departing runway ILS frequency before entering the runway.
- If rejected takeoff occurs, the PM should inform the ATC in time based on the relative position of the lights and runway/ intersection.

Low Visibility Operation Arrival

- Acquire weather information
  - The destination has RVR reports of the touchdown zone and the middle point of the runway. And the weather condition is no worse than the highest requirements of the minimums published by Xiamen Airlines, flight crew and the airport. The alternate destination shold not also be a CAT II operation airport.
- Accomplish descending preparations according to the Low Visibility Operation Reveiw Card before descending.
- The fellowing equipments must be operative:
  - 2 autopilots;
  - 2 flight directors;
  - 1 GPWS;
  - 2 radio altimeters and indications;
  - 2 DA indications;
  - 2 air data computer systems;
  - 2 windshield wipers (during precipitation);
  - 2 ILS receivers and display annunciation;
  - 2 FMAs
  - 2 ADIRUs in NAV mode;
  - 2 hydraulic systems;
  - 2 independent power (APU can be one independent power);
  - 2 engines operative;
  - autothrottle.
- Pilot seats and lights adjustment
  - The flight crew should adjust the seats and flight deck lights for optimum visual reference before CAT II ILS approach.
- Accomplish supplementary approach briefing for CAT II operations
  - Terminal weather information and applicable standards;
  - Airport and landing runway for CAT II operations, field conditions;
  - The equipments of the aircraft meet the requirements of CAT II equipment list;
  - Flight crew duties: The PF is responsible for making landing and go-around decisions; the PM is responsible for monitoring airplane status, looking for visual reference and making standard callouts.
  - Review the decisions for airplane faults and deviations.

Approach and Landing Procedure-ILS-CAT II

PF	PM
	Notify the cabin crew to prepare for landing. Verify that the cabin is secure.
Call "FLAPS___" according to the flap extension schedule.	Set the flap lever as directed. Monitor flaps and slats extension.
When on localizer intercept heading: • Verify that ILS is tuned and identified • Verify that the LOC and G/S pointers are shown	
Arm the APP mode. Engages the second A/P. **Note:** Two navaids should be tuned to current ILS frequency before APP mode is armed.	
Note: When using LNAV to intercept the final approach course, LNAV might parallel the localizer without capturing it.	
Use LNAV or HDG SEL to intercept the final approach course, as needed.	
Verify that the localizer is captured.	
	Call "GLIDESLOPE ALIVE."
At glideslope alive, call: • "GEAR DOWN" • "FLAPS 15"	
	Set the landing gear lever to DN. Verify that the green landing gear indicator lights are illuminated. Set the flap lever to 15. Set the engine start switches to CONT.
Set the speedbrake lever to ARMED. Verify that the SPEED BRAKE ARMED light is illuminated.	
At glideslope capture, call "FLAPS___" as needed for landing.	Set the flap lever as directed.
Set the missed approach altitude on the MCP.	

PF	PM
Call “LANDING CHECKLIST.”	Do the LANDING checklist.
At the final approach fix or LOM, verify the crossing altitude.	
Below 1500 feet AGL	
	Call“CMD, FLARE ARM”
Verify CMD active and FLARE armed	
At 1,000 feet AGL	
	Call“1,000 feet”.
At 500 feet AGL	
	Call“500 feet”.
Monitor the airplane status.	FO begins to look for outside visual reference.
At 400 feet AGL	
	Call "STABILIZER TRIM"
Verify stabilizer is automatically trimmed.	
Note: If "FLARE" is not armed above approximately 350 AGL, A/P will be disconnected.	
Note: When the visibility is low, turning on the external lights tends to form light screen and effect the establishment of effective visual reference.	
Above RH(DH/DA)100 feet	
“Continue approach”	Call "approaching DA".
Monitor the airplane status.	Continue looking for visual reference.
RH（DH/DA）	
The captain should make decisions according to outside visual reference: 1.Missed approach 2.Autoland 3.Manual landing	
Note: PM should report the acquired visual reference in time above RH(DH/DA), PF must perform missed approach at RH(DH/DA) if visual reference report is not acquired above RH(DH/DA).	
1.If outside visual reference is not acquired at DH, execute missed approach.	

PF	PM
• Call “Missed approach” Push TO/GA switch Monitor A/P missed approach and complete the missed approach procedure.	Complete the relative missed approach procedure.
2..If outside visual reference is acquired at RH(DH/DA) and the captain decides to use autoland	
• Call“Landing” Monitor the airplane autoland.	Monitor the airplane status and remind deviations.
When "FLARE" is active at 50 feet (RA)	
Monitor the airplane status.	Call "FLARE ACTIVE". Monitor the automatic callout report.
When "RETARD" is active at 27 feet (RA)	
Monitor the airplane status.	Call "RETARD"
After touchdown	
Disconnect autopilot and manually operate the airplane.	
Verify that the thrust levers are closed.	
Verify that the SPEED BRAKE lever is UP.	Verify that the SPEEDBRAKE lever is UP.
Without delay, fly the nose wheel smoothly onto the runway.	Call "SPEEDBRAKES UP". If the SPEEDBRAKE lever is not UP, call "SPEEDBRAKES NOT UP". Call "REVERSER normal".
Control the rollout direction and pull up the reverser manually.	Monitor and call the operation situation of the autobrake. Remind the tendency of the airplane’s deviation from the runway centerline.
When the airplane decelerates to 60KTS	
Begin to retract the reverser.	Call "60 KNOTS"
After turning off the runway	
Complete the after landing procedure	
3.If outside visual reference is acquired at RH(DH/DA) and the captain decides a manual landing	

PF	PM
• Call "Landing" Continue monitoring autopilot	Monitor the airplane status and remind deviations.
When the captain makes sure that the visual reference is completely established and has enough confidence to operate the airplane to land, disconnect A/P and A/T, and manually operate the airplane to land.	
	Call "AUTOPILOT, AUTOTHROTTLE DISENGAGE"
After touchdown	
Control the rollout direction and pull up the reverser.	Call "SPEEDBRAKES UP", "REVERSER normal". Monitor and call the operation situation of the autobrake.
During the rollout	
Control and correct the rollout direction in time.	Monitor and remind the tendency of the airplane's deviation from the runway centerline.
When the airplane decelerates to 60KTS	
Begin to retract the reverser.	Call "60 KNOTS"
After turning off the runway	
Complete the after landing procedure.	

Note: visual reference:

Unless visual reference, including the approach lights, touchdown lights, centerline lights and edge lights or at least 3 consecutive lights of the combination of these lights, is acquired and maintained, pilots should not continue to approach below the RH (DH/DA). Visual reference must include the lateral elements of the ground configuration, such as the approach crossbar light, threshold lights and touchdown zone lights, except using approved HUD to touchdown.

Go-around/Missed Approach

Besides the conditions for go-around in CAT I operation, a go-around /missed approach must also be conducted if any of the following occurs:

- Before FAF, if a fault occurs, an evaluation should be made in accordance with “Handling procedures under non-normal conditions” and then decision should be made to continue the approach or execute a go-around;
- After FAF but before establishing visual reference, if a fault occurs, go-around should be conducted immediately. Subsequent evaluation should be made in accordance with “Handling procedures under non-normal conditions”;
- Below 1000 feet AGL, the expanded localizer scale deviation is more than 2/3 dot, or the glideslope deviation is more than 1 dot;
- Below DH, the visual reference is deteriorating or lost;
- Any other situation where the PIC considers it is necessary to conduct go-around.

Handling Procedures Under Non-normal Conditions

In CAT II approach, the flight crew shall first follow the non-normal procedures regulated by Airplane Flight Manual, and then make evaluation of the non-normal situations in accordance with “Requirements on airborne equipment in low visibility operations”in Operations Manual (MF/0410-25), and respond as follows:

- When the flight crew confirm that the situations will **NOT** affect CAT II operations, the flight crew shall continue to approach as planned;
- When the flight crew confirm that the situations will affect CAT II operations, the flight crew shall use a higher minimum standard to conduct approach operations, if the weather conditions permit;
- If the flight crew are unable to confirm the aircraft’s capability of CAT II approach, the flight crew shall stop approach, and conduct go-around. The flight crew shall then make evaluation of the situations and decide whether to conduct approach once again or to make diversion;
- If the flight crew have established visual reference when the abnormal conditions occur, the flight crew shall continue to land as long as the flight crew are able to control the aircraft status and maintain the aircraft within the allowable envelope.

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Aircraft Communication Addressing and Reporting System (ACARS)

The following procedures are applicable to the noted ACARS functions from the company pages.

Pre-Departure Clearance

The flight crew shall manually verify (compare) the filed flight plan versus the digital pre-departure clearance and shall initiate voice contact with Air Traffic Control if any question/confusion exists between the filed flight plan and the digital pre-departure clearance.

Digital-Automatic Information Service

The flight crew shall verify that the D-ATIS altimeter setting numeric value and alpha value are identical. If the D-ATIS altimeter setting numeric value and alpha values are different, the flight crew must not accept the D-ATIS altimeter setting.

Oceanic Clearances

The flight crew shall manually verify (compare) the filed flight plan versus the digital oceanic clearance and initiate voice contact with Air Traffic Control if any questions/confusion exists between the filed flight plan and the digital oceanic clearance.

Weight and Balance

The flight crew shall verify the Weight and Balance numeric and alphabetical values are identical. If the Weight and Balance numeric and alphabetical values are different, the flight crew must not accept the Weight and Balance data.

Takeoff Data

The flight crew shall verify the Takeoff Data numeric and alphabetic values are identical. If the Takeoff Data numeric and alphabetic values are different, the flight crew must not accept the Takeoff Data message.

Cockpit Voice Recorder Test

Test switch .... Push

Hold switch for 5 seconds. Observe that the STATUS light flashes once. A tone may be heard through a headset plugged into the headset jack.

Electrical Power Up

The following procedure is accomplished to permit safe application of electrical power.

BATTERY switch .... Guard closed

YA707 - YV754

Note: Do not move the airplane until Integrated Standby Flight Display (ISFD) alignment is complete.

STANDBY POWER switch .... Guard closed

ALTERNATE FLAPS master switch .... Guard closed

Windshield WIPER selector(s) .... PARK

ELECTRIC HYDRAULIC PUMPS switches .... OFF

LANDING GEAR lever ....DN

Verify that the green landing gear indicator lights are illuminated.

Verify that the red landing gear indicator lights are extinguished.

If external power is needed:

Verify that the GRD POWER AVAILABLE light is illuminated.

GRD POWER switch – ON

Verify that the SOURCE OFF lights are extinguished.

Verify that the TRANSFER BUS OFF lights are extinguished.

Verify that the STANDBY PWR OFF light is extinguished.

If APU power is needed:

Verify that the engine No. 1, APU and the engine No. 2 fire switches are in.

Alert ground personnel before the following test is accomplished.

OVERHEAT DETECTOR switches – NORMAL

TEST switch – Hold to FAULT/INOP

Verify that the MASTER CAUTION lights are illuminated.

Verify that the OVHT/DET annunciator is illuminated.

Verify that the FAULT light is illuminated.

If the FAULT light fails to illuminate, the fault monitoring system is inoperative.

Verify that the APU DET INOP light is illuminated.

Do not operate the APU if the APU DET INOP light fails to illuminate.

TEST switch – Hold to OVHT/FIRE

Verify that the fire warning bell sounds.

Verify that the master FIRE WARN lights are illuminated.

Verify that the MASTER CAUTION lights are illuminated.

Verify that the OVHT/DET annunciator is illuminated.

Master FIRE WARN light – Push

Verify that the master FIRE WARN lights are extinguished.

Verify that the fire warning bell cancels.

Verify that the engine No. 1, APU and the engine No. 2 fire switches stay illuminated.

YT512 - YV754

Verify that the engine No. 1 and engine No. 2 start lever lights stay illuminated.

Verify that the ENG 1 OVERHEAT and ENG 2 OVERHEAT lights stay illuminated.

EXTINGUISHER TEST switch – Check

TEST Switch - Position to 1 and hold

Verify that the three green extinguisher test lights are illuminated.

TEST Switch - Release

Verify that the three green extinguisher test lights are extinguished.

Repeat for test position 2.

APU - Start

Note: If extended APU operation is needed on the ground and the airplane busses are powered by AC electrical power, position an AC powered fuel pump ON. This will extend the service life of the APU fuel control unit.

Note: If fuel is loaded in the center tank, position the left center tank fuel pump switch ON to prevent a fuel imbalance before takeoff.

CAUTION: Center tank fuel pump switches should be positioned ON only if the fuel quantity in the center tank exceeds 453 kgs.

CAUTION: Do not operate the center tank fuel pumps with the flight deck unattended.

When the APU GEN OFF BUS light is illuminated:

APU GENERATOR bus switches - ON

Verify that the SOURCE OFF lights are extinguished.

Verify that the TRANSFER BUS OFF lights are extinguished.

Verify that the STANDBY PWR OFF light is extinguished.

Verify that the APU MAINT light is extinguished.

Verify that the APU LOW OIL PRESSURE light is extinguished.

Verify that the APU FAULT light is extinguished.

Verify that the APU OVERSPEED light is extinguished.

Wheel well fire warning system ....Test

Test switch – Hold to OVHT/FIRE

Verify fire warning bell sounds, master FIRE WARN lights, MASTER CAUTION lights and OVHT/DET annunciator illuminate.

Fire warning BELL CUTOUT switch – Push

Verify that the master FIRE WARN lights extinguish.

Verify that the fire warning bell cancels.

Verify that the WHEEL WELL fire warning light is illuminated.

Electrical Power Down

This procedure assumes the Secure procedure is complete.

APU switch and/or GRD POWER switch .... OFF

If APU was operating:

Delay approximately 2 minutes after the APU GEN OFF BUS light extinguishes before placing the BATTERY switch OFF.

BATTERY switch .... OFF

Standby Power Test

YA701 - YF049, YM482 - YM484

Battery switch .... ON

AC and DC meter selectors .... STBY PWR

If APU generator is on–line:

BUS TRANSFER switch .... OFF

APU GEN No. 2 switch or GRD PWR switch .... OFF

Turn OFF appropriate switch depending on power source in use. Removes power from TR 3.

STANDBY POWER switch .... OFF

Check STANDBY PWR OFF light illuminated.

AC–DC voltmeters .... Zero

STANDBY POWER switch .... BAT

Check STANDBY PWR OFF Light extinguished

AC–DC voltmeters .... Check

AC voltmeter 115 +/-5 volts

DC voltmeter 24 +/-2 volts

Frequency meter .... Check

Check frequency meter for normal indication: 400 +/- 10 CPS.

STANDBY POWER switch .... AUTO

BUS TRANS switch .... AUTO

APU GEN No. 2 switch or GRD PWR switch .... ON

Note: It may take up to 3 minutes for CDS displays to recover when power is interrupted for more than 2 seconds on the ground.

Standby Power Test

YF921 - YL551, YN531 - YV754

Battery switch .... ON

AC and DC meter selectors ....STBY PWR

If APU generator is on–line:

APU GEN No. 1 switch .... OFF

APU GEN No. 2 switch .... OFF

If ground power is on–line:

GRD PWR switch .... OFF

STANDBY POWER switch .... OFF

Check STANDBY PWR OFF light illuminated.

AC–DC voltmeters .... Zero

STANDBY POWER switch .... BAT

Check STANDBY PWR OFF Light extinguished.

AC–DC voltmeters .... Check

AC voltmeter 115 +/-5 volts

DC voltmeter 24 +/-2 volts

Frequency meter .... Check

Check frequency meter for normal indication: 400 +/- 10 CPS.

DC meter selector .... BAT

Check DC voltmeter for normal indication: 24 +/- 2 volts.

Check DC ammeter for discharge indication: a negative value.

DC meter selector .... AUX BAT

Check DC voltmeter for normal indication: 24 +/- 2 volts.

Check DC ammeter for discharge indication: a negative value.

STANDBY POWER switch ....AUTO

GRD PWR switch or APU GEN No. 1 and No. 2 switches ....ON

Note: It may take up to 3 minutes for CDS displays to recover when power is interrupted for more than 2 seconds on the ground.

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Battery Start

(With APU bleed or ground air available)

Maintenance documents .... Check

YA707 - YV754
FLIGHT DECK ACCESS SYSTEM
switch .... Guard closed

BATTERY switch .... Guard closed

ELECTRIC HYDRAULIC PUMPS
switches .... OFF

LANDING GEAR lever ....DN

Verify that the green landing gear indicator lights are illuminated.

Verify that the red landing gear indicator lights are extinguished.

Emergency equipment .... Check

Fire extinguisher - Checked and stowed

Crash axe - Stowed

Escape ropes - Stowed

Other needed equipment - Checked and stowed.

Flight recorder switch .... Guard closed

Circuit breakers (P6 panel) .... Check

Circuit breakers (control stand, P18 panel) .... Check

Accomplish the Interior and Exterior Inspection if required, except for items requiring electrical or hydraulic power.

Verify that the oxygen pressure is sufficient for flight.

Accomplish the following Preflight Procedure - First Officer items:

Overheat and fire protection panel .... Check

OVERHEAT DETECTOR switches - NORMAL

TEST switch - Hold to FAULT/INOP

TEST switch - Hold to OVHT/FIRE

EXTINGUISHER TEST switch - Check

APU switch
(bleed air source, if available) .... START

On the captain's command, the first officer reads and the captain does the following items:

Oxygen .... Test and set

CAB/UTIL power switch .... ON

IFE/PASS seat power switch .... ON

EMERGENCY EXIT LIGHTS switch .... Guard closed

Passenger signs .... Set

HYDRAULIC PUMP switches .... ON

Air conditioning panel .... Set

PACK switches - AUTO or HIGH

Engine BLEED air switches - ON

APU BLEED air switch - ON

SPEED BRAKE lever .... DOWN detent

Reverse thrust levers .... Down

Forward thrust levers .... Closed

Parking brake .... Set

Note: The wheels should be chocked in case the brake pressure has bled down.

Engine start levers .... CUTOFF

Papers .... Aboard

When cleared for Engine Start, do the following:

Air conditioning PACK switches .... OFF

ANTICOLLISION light switch .... ON

Ignition select switch .... IGN-R

Engine Start

Engine No. 1 start .... Accomplish

Only N1, N2, and oil quantity are displayed until the EECs are powered.

Generator 1 switch .... ON

IRS mode selectors .... OFF, then NAV

Verify that the ON DC lights illuminate, then extinguish

Verify that the ALIGN lights are illuminated.

FMC/CDU .... Set IRS position

Verify that the following are sufficient for flight:

- hydraulic quantity
- engine oil quantity

WARNING: If engine No. 1 was started using a ground air source, to minimize the hazard to ground personnel, the external air should be disconnected and engine No. 2 started using the Engine Crossbleed Start procedure.

Engine No. 2 start .... Accomplish

Generator 2 switch .... ON

Cabin pressurization panel .... Set

FLIGHT ALTITUDE indicator - Cruise altitude

LANDING ALTITUDE indicator - Destination field elevation

Pressurization mode selector - AUTO

Verify that the ALTN light is extinguished.

Verify that the MANUAL light is extinguished.

Complete the Preliminary Preflight Procedure - Captain or First Officer by doing the following items:

PSEU light .... Verify extinguished

GPS light .... Verify extinguished

YV751 - YV754
ILS light .... Verify extinguished

YV751 - YV754

GLS light .... Verify extinguished

SERVICE INTERPHONE switch ....OFF

ENGINE panel ....Set

Verify that the REVERSER lights are extinguished

Verify that the ENGINE CONTROL lights are extinguished

EEC switches - ALTN then ON

Oxygen panel ....Set

CREW OXYGEN pressure indicator - Check

Verify that the pressure meets dispatch requirements.

Note: PASSENGER OXYGEN switch activation causes deployment of the passenger oxygen masks.

PASSENGER OXYGEN switch - Guard closed

Verify that the PASS OXY ON light is extinguished.

Landing gear indicator lights ....Verify illuminated

Manual gear extension access door ....Closed

Accomplish the normal CDU Preflight Procedure - Captain and First Officer, Preflight Procedure - First Officer, Preflight Procedure - Captain, Before Start Procedure and Before Taxi Procedure to ensure that the flight deck preparation is complete.

BEFORE TAXI checklist ....Accomplish

IRS alignment .... Complete

The airplane is ready for taxi. Refer to the normal checklists for subsequent checks.

Starting with Ground Air Source (AC electrical power available)

Engine No. 1 must be started first.

When cleared to start:

APU BLEED air switch ....OFF

Engine No. 1 start ....Accomplish

Use normal start procedures.

WARNING: To minimize the hazard to ground personnel, the external air should be disconnected, and engine No. 2 started using the Engine Crossbleed Start procedure.

Engine Crossbleed Start

Do not accomplish a crossbleed start during pushback.

Before using this procedure, ensure that the area to the rear is clear.

Engine BLEED air switches ....ON

APU BLEED air switch ....OFF

PACK switches ....OFF

ISOLATION VALVE switch ....AUTO

Ensures bleed air supply for engine start.

Engine thrust lever
(operating engine) .... Advance thrust lever

Advance thrust lever until bleed duct pressure indicates 30 PSI.

Non–operating engine .... Start

Use normal start procedures with crossbleed air.

After starter cutout, adjust thrust on both engines, as required.

Setting N1 Bugs with No Operative FMC (Manual N1 Bug Setting)

Reference the Performance – Inflight section to determine N1 setting for desired phase of flight.

N1 SET outer knob ....BOTH

The last FMC computed value is displayed by reference N1 bugs and readouts. If the FMC has not calculated an input since power up, a default value of 104% is displayed.

N1 SET inner knob ....Set N1

Note: If the N1 SET outer knob is returned to the AUTO position, the bugs and readouts will revert to the last FMC computed value or 104% if the FMC has not calculated an input since power up.

High Altitude Airport Engine Start (Above 8400 Feet)

YN531 - YN534

Engine start .... Accomplish

An indication of N1 rotation plus maximum motoring and a minimum of 20% N2 are required prior to introducing fuel to the engine.

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

Fire and Overheat System Test with an Inoperative Loop

YA701 - YT511

To determine the specific inoperative loop:

OVHT DET switches .... A

Test switch .... OVHT/FIRE

If the FAULT light stays extinguished and both ENG OVERHEAT lights and engine fire switches illuminate, loop A is good.

If the FAULT light illuminates and the ENG OVERHEAT light and engine fire switch for an engine stay extinguished, there is a fault in loop A of the detection system for that engine.

OVHT DET switches ....B

Test switch .... OVHT/FIRE

If the FAULT light stays extinguished and both ENG OVERHEAT lights and engine fire switches illuminate, loop B is good.

If the FAULT light illuminates and the ENG OVERHEAT light and engine fire switch for an engine extinguished, there is a fault in loop B of the detection system for that engine.

OVHT DET switches ....As required

Select the good loop for each engine (NORMAL if both loops tested good).

Test switch .... OVHT/FIRE

If the test is successful leave the fire panel in this configuration for flight.

Fire and Overheat System Test with an Inoperative Loop

YT512 - YV754

To determine the specific inoperative loop:

OVHT DET switches .... A

Test switch .... OVHT/FIRE

If the FAULT light stays extinguished and both ENG OVERHEAT lights, engine start lever lights, and engine fire switches illuminate, loop A is good.

If the FAULT light illuminates and the ENG OVERHEAT light, engine start lever light, and engine fire switch for an engine stay extinguished, there is a fault in loop A of the detection system for that engine.

OVHT DET switches .... B

Test switch .... OVHT/FIRE

If the FAULT light stays extinguished and both ENG OVERHEAT lights, engine start lever lights, and engine fire switches illuminate, loop B is good.

If the FAULT light illuminates and the ENG OVERHEAT light, engine start lever light, and engine fire switch for an engine stay extinguished, there is a fault in loop B of the detection system for that engine.

OVHT DET switches .... As required

Select the good loop for each engine (NORMAL if both loops tested good).

Test switch .... OVHT/FIRE

If the test is successful leave the fire panel in this configuration for flight.

Altimeter Difference

Note: If flight in RVSM airspace is planned use the RVSM table in the limitations section.

This procedure is accomplished when there is a noticeable difference between the altimeters. Accomplish this procedure in stabilized level flight or on the ground.

Altimeter barometric settings .... Check

Check all altimeters set to proper barometric setting for phase of flight.

Standby altimeter baro set control ....Rotate and reset

Rotate to a different setting, then reset proper barometric setting.

Altimeters .... Crosscheck

Maximum differences between the altimeter readings:

Altitude	CDS/CDS	CDS/Standby
Sea Level	50 feet	60 feet
5,000 feet	50 feet	80 feet
10,000 feet	60 feet	120 feet
15,000 feet	70 feet	(see note)
20,000 feet	80 feet	(see note)
25,000 feet	100 feet	(see note)
30,000 feet	120 feet	(see note)
35,000 feet	140 feet	(see note)
40,000 feet	160 feet	(see note)
41,000 feet	170 feet	(see note)

Note: Above 10,000 feet and 0.4 Mach, position error causes the tolerance to diverge rapidly and direct crosscheck becomes inconclusive. Between 10,000 feet and 29,000 feet, differences greater than 400 feet should be suspect and verified by ground maintenance checks. Between 29,000 feet and the maximum operating altitude, differences greater than 500 feet should be suspect and verified by ground maintenance checks.

If it is not possible to identify which altimeter is indicating the correct altitude:

ATC .... Notify

QFE Operation

Use this procedure when ATC altitude assignments are referenced to QFE altimeter settings.

Note: Do not use LNAV or VNAV.

YF048 - YF928, YK624 - YK630, YK966 - YL551, YN531 - YV754
Note: Do not use the vertical situation display.

FMC/CDU APPROACH REFERENCE page
or TAKEOFF REFERENCE page 2/2 .... Select

LANDING REF line select key .... Push

Verify QFE selected.

[This sets the landing altitude to zero.]

Altimeters .... Set

Set altimeters to QFE when below transition altitude/level.

Note: If the QFE altimeter setting is beyond the range of the altimeters, QNH procedures must be used with QNH set in the altimeters.

LAND ALT indicator .... Set at zero

YA704 - YV754
Terrain inhibit switch .... TERRAIN INHIBIT

Setting Airspeed Bugs with No Operative FMC (Manual Airspeed Bug Setting)

To set reference airspeed bugs for takeoff:

Speed reference selector (outer) V1

Default speed of 80 knots is displayed.

Speed reference selector (inner) .... Set V1 speed

V1 bug is displayed when a speed greater than 80 knots is set. The NO VSPD flag is displayed until both V1 and VR are set.

Speed reference selector (outer) ....VR

Default speed of 80 knots is displayed.

Speed reference selector (inner) ....Set VR speed

VR bug is displayed when a speed greater than 80 knots is set. The NO VSPD flag is removed after both V1 and VR are set.

MCP speed selector ....Set V2

Airspeed cursor and V2+15 bug move to the correct speeds.

Speed reference selector (outer) .... WT

Default weight of 32,000 kgs is displayed.

Speed reference selector (inner) ....Set takeoff gross weight

Flaps up maneuver speed bug is displayed.

Note: If VREF is selected on the ground, INVALID ENTRY is displayed.

To set the spare bug, if desired:

Speed Reference selector (outer) ....Spare bug

Default speed of 60 knots is displayed.

Speed reference selector (inner).......................................Set

Set speed as desired.

Speed reference selector (outer) .... SET

Digital readout is removed.

Note: When the flap lever is set to any takeoff flap setting above flaps 1, a bug comes into view for the next smaller flap maneuvering speed, between takeoff flaps and flaps up. For example, if the flap lever is set to 15 for takeoff, a bug for flaps 5 maneuvering speed will appear. For a flaps 1 takeoff, the flaps 1 maneuvering speed will be displayed.

To set reference airspeed bugs for approach:

Speed reference selector (outer) ....WT

Default weight of 32,000 kgs is displayed.

Speed reference selector (inner) .... Set current gross weight

Flaps up maneuver speed bug is displayed.

Speed reference selector (outer) ....VREF

Default speed of 80 knots is displayed.

Speed reference selector (inner) ....Set VREF speed

YA701 - YA710, YM482 - YN534

The green VREF bug and white VREF +15 bug are shown when a speed greater than 80 knots is set.

YF048 - YL551, YS151 - YV754

The green VREF bug and white VREF +20 bug are shown when a speed greater than 80 knots is set.

Note: If V1 or VR is selected in flight, INVALID ENTRY is displayed.

To set the spare bug, if desired:

Speed reference selector (outer) .... Spare bug

Default speed of 60 knots is displayed.

Speed reference selector (inner) .... Set

Set speed as desired.

Speed reference selector (outer) ....SET

Digital readout is removed.

HUD Supplemental Procedures

HUD procedures provided in this section are in addition to normal procedures. Accomplish the procedures as applicable.

In all cases, it is assumed that the left seat pilot (Captain) is the pilot flying (PF) and the right seat pilot (First Officer) is the pilot monitoring (PM).

Preflight

HUD .... On

Lower the Combiner to its operating position and allow the HUD to warm-up for 2 - 5 minutes (generally, once an image is displayed on the Combiner the system is capable of normal operation).

HUD COMBINER .... Set

Verify symbology is displayed on the Combiner (may consist of little more than the Aircraft Reference Symbol and flags if IRS #1 is not aligned). If no symbology is visible, verify that the HCP FAULT and/or dot annunciator on the CLR (clear) key are not on.

Set the Combiner HUD BRT control, in either the Auto or Manual mode, and adjust to the desired intensity.

Select the IMC or VMC mode and verify the absence of the “ALIGN HUD” message. If necessary, reposition the Combiner to eliminate.

Following the Combiner check, Combiner may be stowed or symbology cleared (by selecting CLR on HCP) if not desired during any remaining preflight or taxi out.

HUD CONTROL PANEL .... Set/Check

Verification of the proper operation of all HCP displays can be accomplished by performing an HCP Display Test.

Runway Length and Elevation .... Set

Enter the published runway length in feet or meters for the departing runway (between 7,500 and 13,500 feet or 2,287 and 4,114 meters). Enter the TDZE for possible return for landing (for the expected runway).

Glideslope Angle .... Set

Enter the glideslope angle for possible return for landing for the anticipated runway. (The glideslope angle must be set between -2.51 and -3.00 degrees for an AIII approach.)

Mode .... Set

Select or verify the Primary mode on the HCP.

HUD ANNUNCIATOR PANEL .... Check

Verification of the HUD Annunciator Panel (Six Panel or HAP) is accomplished with the master lamp test. To initiate a master lamp test, set the Master BRT/DIM/TEST switch to the TEST position. All the messages on the Annunciator Panel should come on.

The Annunciator Panel can also be tested using the test function of the HUD. To initiate an Annunciator Panel test, push and release the TEST key on the HCP. All the messages on the Annunciator Panel should come on for 2-5 seconds. Push TEST again to return the HUD to normal operation.

Note: For low visibility takeoff, set both VHF to takeoff runway ILS frequency and MCP course to takeoff runway heading.

Takeoff

To maintain proficiency, it is recommended that HUD low visibility takeoff procedures be used for takeoffs where conditions allow. Generally, anytime the departing runway has a localizer available and system/time constraints allow for the proper execution of the procedure. This table identifies the supplemental procedures for an HUD low visibility takeoff.

Pilot Flying	Pilot Monitoring
Before taking runway: • Set both VHF receivers to the ILS frequency. • Set Selected Course to the runway heading. • Verify “ILS1” (is indicated) as the Nav Source for the HUD display. • Position Combiner and confirm proper HUD operation and Primary mode.	• Standard procedures.
Cleared for Takeoff: • Taxi aircraft and align on runway centerline with the Aircraft Reference symbol positioned overlaying the runway centerline at the furthest distance that can be observed. A rolling takeoff is not recommended.	• Standard procedures.

Pilot Flying	Pilot Monitoring
• Readjust Selected Course to align the Selected Course Mark and Ground Localizer Deviation symbols with the runway centerline. • Verify display of Ground Roll Guidance Cue. • Adjust symbology intensity to allow runway markings and symbology to both be viewed clearly. • Call out “HUD SET”	• Verify localizer deviation display is centered.
• Initiate takeoff using standard procedures. • Use standard call outs.	• Use standard call outs. • Standard procedures
• Track runway centerline with HUD Guidance while visually augmenting with runway markings and lights	• Monitor head-down instruments. • Monitor localizer deviation. • Call out “CENTERLINE STEER LEFT/RIGHT” as necessary.
• At VR, rotate at the recommended rotation rate using the Aircraft Reference symbol and TO/GA Pitch Target Line and transition to Flight Path and the Flight Director Guidance Cue when it’s displayed.	• Monitor head-down instruments. • Standard procedures. • Use standard call outs.

Climb/Cruise

Monitor and/or manually control the aircraft utilizing the HUD display. Use standard operating procedures.

Note: A particular advantage during operations near other aircraft, is that the pilot is able to monitor flight information on the HUD while looking out for traffic.

Note: The pilot should utilize the display of TCAS Resolution Advisory information when presented on the Combiner.

Descent

HUD .... Set & X-Checked

HUD approach and landing parameters shall be entered (PM) and verified (PF).

The proper operating configuration shall be established by the Captain (C).

HUD COMBINER .... Set

If the Combiner has been stowed, position the Combiner in the operating position.

Verify normal operation of the HUD display. Check for the absense of the "ALIGN HUD" message in the IMC or VMC mode and reposition Combiner as necessary. Adjust the intensity of the display symbology with the HUD BRT Control as desired, considering the current and expected ambient and runway lighting conditions.

RUNWAY ELEVATION .... Enter/Verify

On the HCP, enter the Touch Down Zone Elevation of the landing runway. If the TDZE is not available, use the closest airport elevation given.

RUNWAY LENGTH .... Enter/Verify

On the HCP, enter the Runway Useable Length Beyond Threshold, in feet or meters.

HCP GLIDESLOPE .... Enter/Verify

On the HCP, enter the glideslope angle of the approach.

HUD MODE .... Set

On the HCP, select the desired mode. It is anticipated that the Primary mode will continue to be utilized for the approach intercept.

Prior to an HUD AIII approachΔ, the approach briefing should include a review of the approach procedures, and a reminder that the Captain will be Head-Up throughout the approach. The First Officer is to remain headdown to monitor all phases of the approach and landing. The AIII approach briefing should include a verbal review of all call outs, particularly with respect to approach minimums, in addition to other standard approach briefing items.

Approach and Landing

The HUD may be utilized during all approach and landing operations. Profiles, configurations, and speeds remain the same as for a similar headdown approach. Normally, all maneuvering prior to the final approach will be flown in the Primary mode. Flight Director guidance is displayed in either the Primary or IMC mode through standard MCP settings.

On ILS approaches, it is recommended that whenever possible, the HUD AIII mode$^{\Delta}$ and procedures be used to maintain proficiency, and to reinforce crew coordination and system confidence.

The following table identifies the supplemental procedures for an HUD AIII approach and landing:

Note: AIII Approach Limitations:

Headwind	25 knots
Tailwind	10 knots
Crosswind	15 knots
Field Elevation	5,500 feet

Pilot Flying	Pilot Monitoring
• Verify that all system configuration requirements for an AIII approach are met. This is evident by the “AIII” displayed on the HCP prior to AOC. Establish a stable landing configuration as early as possible on final approach.	
• Observe “AIII ARM” on Combiner. • Call out “AIII ARM” when displayed.	• Select/Verify AIII ARM mode. Call out “AIII ARM” (on HUD Annunciator Panel) when displayed.
At ILS (LOC & G/S) Intercept: • Observe “AIII” on Combiner. Call out “AIII”. • Track ILS with HUD guidance. • Establish target airspeed prior to 500 feet. • Monitor for “NO AIII” annunciation and flags.	• Observe for “AIII” on annunciator panel. Call out “AIII”. • Monitor ILS tracking on head-down displays. • Monitor for loss of “AIII” annunciation and flags. Call out “NO AIII” when appropriate.
At 500 feet above TDZE: • Check altitude. • Track ILS and airspeed aggressively. • Monitor for “NO AIII” and/or “APCH WARN” annunciations and flags.	• Check altitude. Call out “500 FEET”. • Monitor for loss of “AIII” and “APCH WARN” annunciations.

Pilot Flying	Pilot Monitoring
Below 500 feet: • Track ILS and airspeed aggressively. • Monitor for “NO AIII”, “RO CTN” and/or “APCH WARN” annunciations and flags. • Perform go-around if “APCH WARN” is displayed or when “RO CTN” is displayed and landing is predicated on RO guidance. Call out “GO-AROUND”.	• Monitor approach parameters relative to approach tolerances. Call out any deficiencies as indicated. • Monitor for loss of “AIII”, “RO CTN” and “APCH WARN” annunciations. Call out “APCH WARN” or “RO CTN” when annunciated.
When landing cues become available: • Verify runway visual cues • Call out visual cue (i.e., “APPROACH LIGHTS” or “CUES”).	• Remain head-down on instruments. • Monitor for DH and approach performance.
At or before DH: • Determine that adequate landing cues are available to assure a normal landing. If so, call out “LANDING”. • If not, call out “GO-AROUND" and execute normal go-around.	• Remain head-down on instruments. • Continue to monitor approach performance.

Pilot Flying	Pilot Monitoring
DH to touchdown: • Follow guidance cue and perform flare and landing using HUD guidance while assimilating proper airplane positioning on runway by visual cues. Monitor "RO" annunciation and transition to rollout guidance. • Position throttles to idle on "IDLE" command.	• Remain head-down on instruments. • If "LANDING" call out not heard by 20 feet below DH, call out "GO-AROUND, MAX POWER" and assume control of aircraft and execute a normal go-around, otherwise; • Monitor flare maneuver following flare illumination on Annunciator Panel with particular attention to Radio Altitude and sink rate. • If any conditions arise that the First Officer considers hazardous, call out "GO-AROUND" and if necessary, take control of the aircraft.
Touchdown and rollout: • Perform normal touchdown and nose rotation, establish aircraft touchdown prior to 2500 feet (viewed from pilot position) to satisfy approach monitor. • Rollout using "RO" guidance and the Ground Roll Reference symbol. • Monitor for excessive deviation, ">" or "<", from localizer guidance and correct back to runway centerline. • Monitor runway remaining from the Runway Remaining readout and aircraft deceleration from the Ground Deceleration Scale presented along the acceleration cue symbology. • Use normal procedures to decelerate to taxi speed.	• Monitor localizer deviation (headdown) throughout rollout and call out "STEER RIGHT" or "STEER LEFT" if captain is not correcting to runway centerline and/or assume Head-Up posture after touchdown as directed or desired.

From 500 feet above the TDZE to touchdown, the F/O will monitor the following parameters in addition to other standard procedures. In the event any of the following limits are exceeded, the F/O will make the corresponding call out to the Captain.

Approach Parameters and Tolerances

PARAMETER	LIMIT	CALL OUT
AIRSPEED	"Bug" speed ±5 knots (down to flare initiation)	"AIRSPEED"
LOCALIZER	±1/2 full scale on ADI expanded display	"LOCALIZER"
GLIDESLOPE	±1 dot (down to 100 feet)	"GLIDESLOPE"
SINK RATE	>1000 fpm (down to 50 feet)	"SINK RATE"
No flare, over flare, no throttle retard, long landing, excessive bank angle, or other hazard after flare initiation.		"GO-AROUND" Perform go-around as required.

Non-Normal Procedures

HUD non-normal procedures provided in this section are primarily related to an HUD degraded display or degraded capabilities.

Use of the HUD during non-normal operations related to other systems (e.g., engine failure) is recommended to the extent that information is available for display. Generally, during any non-normal operation where information continues to be displayed, then the source of that information is valid and the continued use of the information for flight operations is appropriate using normal crosscheck procedures. The unique properties associated with the integrated display of attitude, airspeed, altitude, flight path, energy status and environmental conditions, greatly enhances the pilot's awareness of flight conditions. This combination also enhances the pilot's ability to make critical, time-sensitive decisions.

Degraded Display

A degraded display exists any time one or more symbols is not displayed as a result of a fault condition. A fault condition can be due to a sensor failure, sensor data miscompare, or an HUD failure. Continued use of the display is dependent on the value of the remaining symbology.

Sensor Failure

The failure of an HUD display sensor will result in the removal of all display information dependent on that sensor. In some cases, the display source is based on the position of the FMC, IRS, or NAV transfer switches in the cockpit. In these cases, selection of the alternate source will restore the display. For example, when the IRS transfer switch is positioned in the "NORMAL" or "BOTH ON L" position, then the HUD receives and displays information relative to IRS #1 (left side source). If ADIRU #1 fails, by selecting "BOTH ON R", the HUD will display information from ADIRU #2, as this is now the left side source of information. In all cases, the HUD displays from the same source as is selected for the Captain's head-down displays.

In many cases, the loss of a sensor or even a single input parameter will result in the loss of multiple symbols. For example, the loss of Vertical Speed from the IRS will result in the removal of the digital Vertical Speed data and Flight Path and all its related symbols. A "VS" flag is displayed in this case.

Sensor Miscompare

The HUD monitors sensor parameters for validation based on a comparison with the offside sensor. For normal display purposes, IRS pitch and roll parameters are monitored along with airspeed and altitude. Any miscompare between ADIRU-IRs #1 and 2 of greater than 5° causes the appropriate miscompare message, "PITCH" or "ROLL", to be displayed on the Combiner. Any miscompare between ADIRU #1 and #2 airspeed of greater than 5 knots causes the "IAS DISAGREE" miscompare message to be displayed on the Combiner. Any miscompare between ADIRU #1 and #2 altitude of greater than 200 feet causes the "ALT DISAGREE" miscompare message to be displayed on the Combiner. If one of these messages is displayed, the appropriate data should be crosschecked with other cockpit displays to determine which source is correct.

HUD Failure

The HUD has extensive self-monitoring capability. If a fault is detected, that affects its ability to accurately display symbology, the entire display is turned off, and the HCP FAULT annunciator is illuminated. BITE detected failures will only be indicated as long as the fault is detected. Consequently, it is possible to observe a momentary interruption or fault indication followed by normal operation. In the event that a prolonged fault occurs, use of the HUD should be discontinued and the Combiner stowed.

Degraded Capabilities

A degraded capability exists any time a condition occurs which prevents the use of the HUD for a specific purpose (e.g., a low visibility takeoff/rollout, AIII approach, or a VMC (or IMC) visual approach). This degraded display condition can be the result of other sensor faults or miscompares, or as a result of an improperly configured aircraft. In any case, use of the display is dependent on the value of the remaining symbology or its remaining display capability and must be assessed by the pilot.

Low Visibility Takeoff

Low visibility takeoff capability may be lost due to the aircraft being improperly configured, the failure of a required sensor input, or failure of the HUD.

A low visibility takeoff configuration requires that all of the following conditions be satisfied:

- Aircraft is on the ground
- HUD Primary mode is selected
- Both NAV receivers are tuned to the departing runway ILS frequency
- Combiner is not stowed.

This configuration enables the display of the Ground Roll Reference symbol and identifies to the HUD that a low visibility takeoff is to be performed. This configuration also causes the HUD Computer to command the forward localizer antennas to be selected.

Additional requirements need to be met to allow the display of the Ground Roll Guidance Cue for takeoff. The additional aircraft configuration requirements include:

- IRS and NAV transfer switches are in the “NORMAL”.
- ADIRU #1 is in the NAV mode.
- The difference between the Captain’s Selected Course and the aircraft’s Magnetic Heading is less than 10° (provides a gross check of the Selected Course input for the takeoff).
- The runway length entered on the HCP is set for the departing runway and is from 7,500 feet to 13,500 feet (2286 to 4115 meters).

These configuration requirements and the validity of all required sensor and HUD inputs will result in the display of the low visibility takeoff symbology. The display of the Guidance Cue is also dependent on a localizer deviation comparison tolerance and the aircraft being within 4/5 of a dot of localizer deviation. (This is generally not until taxiing near or onto the runway.) If any of these conditions cannot be met prior to or while positioning on the runway, then the HUD low visibility takeoff cannot be performed.

AIII Approach∆

The AIII capability$^{\Delta}$ is unique in that at any given time the HUD monitors system inputs to determine AIII capability. AIII status is indicated based on the assessment of specific requirements. The loss of the AIII status is indicated as follows:

- Loss of the AIII capability prior to Approach On Course (AOC) will cause the removal of the “AIII” status displayed on the right half of the HCP STBY display line. This however does not indicate that the AIII capability will not be available again prior to, or once, AOC is achieved.
- Loss of the AIII capability following AOC, and prior to the selection of the AIII mode, will cause the removal of the “AIII” status displayed on the left half of the HCP STBY display line or removal of the AIII Arm displayed on the HCP STBY line and the Combiner. The AIII (with AOC) criteria must be reacquired prior to 500 feet above the TDZE for the AIII mode to be available.

- Loss of the AIII capability following AIII mode selection is indicated by a “NO AIII” displayed on the Combiner and on the HCP MODE display line. If this occurs below 500 feet (above the TDZE), it results in the “APCH WARN” annunciations on the Combiner and HUD Annunciator Panel. The AIII capability will again be indicated if the capability is reacquired (independent of AOC or altitude).
- “RO” rollout guidance$^{\Delta}$ is provided after an AIII approach and status of “RO” capability is available below 500 feet AGL. “RO ARM” is displayed on the Combiner and the First Officer’s Annunciator Panel when rollout guidance is available. Should “RO” not be available the “RO ARM” will be removed from the Combiner and First Officer’s Annunciator Panel, and if the aircraft is below 500 feet AGL, a “RO CTN” (Rollout Caution) will be displayed. The pilot must determine whether to continue the approach or go-around dependent on whether landing minimums requires the use of rollout guidance.

AIII approach capability may also be lost due to the aircraft being improperly configured, the failure of required sensor inputs (including additional sensor comparison tolerances), or failure of the HUD. Generally, no action is required if the AIII capability is lost prior to AOC. During the approach preparation, the pilots should ensure that all AIII aircraft configuration requirements are met or will be met, prior to or at AOC. Due to the less stringent AIII requirements prior to AOC, it is acceptable to proceed to and initiate the approach, establishing AOC before making a determination as to the availability of AIII. In any case, it is at the discretion of the Captain to determine (above 500 feet) if the approach should be discontinued or whether another approach method is used (if current conditions allow).

Any time the AIII capability is lost below 500 feet, or any time the “APCH WARN” is indicated, and the aircraft is currently in instrument conditions, then the approach shall be terminated and a go-around performed. A decision for another attempt at the approach, another approach method, or a diversion must be based on the available information and circumstances.

Visual Approach - VMC or IMC

If an “ALIGN HUD” message occurs, apply slight pressure, either fore or aft, on the Combiner glass until the “ALIGN HUD” message is removed. If the message cannot be removed with the glass in the operating detents, the HUD is not presenting conformal data, and must not be used for a visual approach.

Use of the HUD for other flight operations (e.g., Flight Director approaches using the Primary or IMC mode) depends on the data presented on the Combiner.

Intentionally
Blank

Tests

Transponder Test

Transponder reply selector ....ON or AUTO

Transponder mode selector .... TEST

Check FAIL light illuminates.

Check all code segments illuminate. Verify no error codes exist.

Verify aural indicates TCAS system test passed.

Note: TCAS TEST is displayed on the navigation display during the test followed by TCAS TEST PASSED or TCAS TEST FAILED. This test remains in view for 8 seconds then blanks. An aural annunciation sounds at the completion of the test.

YA701 - YA706, YN531 - YV754

AURAL ALERTS	DEFINITION
“TCAS TEST” “TCAS TEST FAIL”	Test failed. Maintenance required.
“TCAS TEST” “TCAS TEST OK”	Test complete. System operable.

YA707 - YM484

AURAL ALERTS	DEFINITION
“TCAS SYSTEM TEST FAIL”	Test failed. Maintenance required.
“TCAS SYSTEM TEST OK”	Test complete. System operable.

Weather Radar Test

EFIS mode selector .... MAP, MAP CTR, VOR, or APP

Weather Radar Mode .... TEST

YA701 - YA710, YM482 - YM484
STAB .... ON

WXR (EFIS control panel) .... ON

Verify test pattern consisting of the following colors appears:

- Green
- Yellow
- Red
- Magenta.

If testing of the PWS system is desired:

Weather Radar Mode .... Deselect TEST

WXR (EFIS control panel) .... ON

Weather Radar Mode .... TEST

Verify the amber WINDSHEAR caution, red WINDSHEAR warning and PWS FAIL annunciations display momentarily and then extinguish.

Note: In the short time the weather radar is on and not in the TEST position, it will radiate.

IRS

Align Light(s) Flashing

Do not move IRS Mode selector to OFF except where called for in procedure.

POS INIT page .... Select

Set IRS position .... Enter present position

Enter present position using the most accurate latitude and longitude available. If the present position is being entered via the CDU and a position is already displayed on the SET IRS POS line, enter new position over displayed position.

If ALIGN light continues to flash:

Set IRS position .... Enter present position

Re-enter same present position.

If ALIGN light continues to flash after re-entry:

IRS .... OFF

Rotate IRS Mode Selector to OFF and verify ALIGN light extinguished.

Note: Light must be extinguished before continuing with procedure (approximately 30 seconds.)

IRS .... NAV

Rotate IRS Mode Selector to NAV and verify ALIGN light illuminated.

Set IRS position .... Enter present position

Enter present position. If ALIGN light flashes, re-enter same present position over displayed position.

Note: Approximately five to seventeen minutes are required for alignment.

If ALIGN light continues to flash, maintenance action is required.

Fast Realignment

Prior to commencing procedure the airplane must be parked and not moved until procedure is complete and ALIGN lights extinguish.

IRS mode selectors .... ALIGN

Observe ALIGN lights illuminate steadily.

CDU ....Set

Enter present position on SET IRS POS line of the POS INIT page.

IRS mode selector...NAV

Observe ALIGN light extinguished within 30 seconds.

Note: If time permits it is preferable to perform a full alignment of the IRS. A more precise alignment will result.

Note: If the mode selector is accidentally switched to OFF or ATT, position mode selector to OFF, wait for ALIGN light(s) to extinguish, then perform full alignment procedure.

Inadvertent Selection of Attitude Mode (while on the ground)

Inadvertent selection of the attitude mode may be due to physically overpowering the switch during turn–on or may be the result of a faulty switch which prevents the flight crew from accurately determining which mode is selected.

If ATT position is selected inadvertently when switching to NAV

IRS mode selectors ....OFF

Observe ALIGN lights extinguish.

After ALIGN lights extinguish, initiate a full alignment.

IRS Entries

Present Position Entry

IRS mode selector ....NAV

ALIGN lights must be illuminated (steady or flashing).

IRS display selector ....PPOS

Latitude ....Enter

Key–in latitude in the data display, beginning with N or S, then press the ENT Key (the Cue Lights extinguish).

Longitude ....Enter

Key–in longitude in the data display, beginning with E or W, then press the ENT key (the cue lights extinguish). Observe that proper latitude and longitude are displayed and that the ALIGN light is not flashing.

Heading – Enter through CDU

FMC/CDU POS INIT page .... Select

Enter the correct heading into the CDU scratch pad then press line select key 5R. Verify entered heading appears on line 5R. Select HDG on the IRS display selector and verify that the entered heading is displayed on the navigation displays.

Heading – Enter through ISDU

IRS display selector .... HDG

Press the H key to initiate a heading entry.

Key–in present magnetic heading. Press the ENT key (the cue lights extinguish). Observe proper heading displayed on the navigation displays.

Lateral Navigation (LNAV)

Proceeding Direct to a Waypoint (overwrite)

RTE LEGS page .... Select

On page 1/XX, line 1L, enter desired waypoint over the presently active waypoint.

Correct any ROUTE DISCONTINUITY if entered waypoint was not in original flight plan.

Intercepting a Leg (Course) to a Waypoint

RTE LEGS page .... Select

On page 1/XX, line 1L, enter desired waypoint over presently active waypoint.

Observe INTC CRS prompt displayed in line 6R.

Enter the desired intercept course in the INTC CRS line. Observe the desired course is displayed on line 6R. The displayed course on line 1L may vary by several degrees due to magnetic variation.

Correct any ROUTE DISCONTINUITY if the entered waypoint was not in original flight plan.

EXEC key .... Push

Observe MOD RTE LEGS page changes to ACT.

LNAV may disengage after execution of an intercept leg to a waypoint. If LNAV disengages, turn to a heading to satisfy LNAV capture criteria, as described in Chapter 11, and then engage LNAV.

Route Modification

YA701 - YT513, YV604, YV605

RTE LEGS or RTE page .... Select

Line select existing waypoints in the desired sequence.

Key–in any new waypoints in the scratch pad and line select into the flight plan. Correct any ROUTE DISCONTINUITY.

EXEC key .... Push

Observe MOD RTE or MOD RTE LEGS page changes to ACT.

Active Route Modification

YT514 - YT521, YV741 - YV754

ACT RTE x LEGS or ACT RTE x page .... Select

Line select existing waypoints in the desired sequence.

Key–in any new waypoints in the scratch pad and line select into the flight plan. Correct any ROUTE DISCONTINUITY.

EXEC key .... Push

Observe MOD RTE x LEGS or MOD RTE x page changes to ACT.

Inactive Route Modification

YT514 - YT521, YV741 - YV754

RTE x LEGS or RTE x page .... Select

Line select existing waypoints in the desired sequence.

Key–in any new waypoints in the scratch pad and line select into the flight plan. Correct any ROUTE DISCONTINUITY.

Note: The flight number should not be changed in the inactive route as it will change the flight number in the active route.

Route Copy

YT514 - YT521, YV741 - YV754

ACT RTE x LEGS or ACT RTE x page .... Select

RTE COPY line select key .... Push

Inactive Route Activation

YT514 - YT521, YV741 - YV754

RTE x LEGS or RTE x page .... Select

ACTIVATE line select key .... Push

Correct any ROUTE DISCONTINUITY.

EXEC key .... Push

Route Removal

RTE page .... Select

ORIGIN .... Enter

If EXEC key illuminates

EXEC key .... Push

Linking a Route Discontinuity

Correct the ROUTE DISCONTINUITY by entering or deleting waypoints in a sequence that provides a continuous flight–plan path.

EXEC key .... Push

Observe MOD RTE or MOD RTE LEGS page changes to ACT.

Determining ETA and Distance to Cross Radial (Bearing) or Distance from a Fix

FIX INFO page .... Select

Enter the identifier of the reference waypoint (normally an off–route waypoint) onto the FIX line. Enter the desired radial or distance from the FIX on a RAD/DIS line, or line select the ABM prompt if the desired radial from the FIX is perpendicular to the present route/course.

Time and distance to go .... Check

Check ETA and DTG, as desired.

Note: If ETA and DTG are not displayed, the fix radial and/or distance do not intersect the route.

Changing Destination

RTE page .... Select

Enter the new destination over the original DEST. Enter desired routing to the new destination using the RTE, RTE LEGS, and ARRIVALS pages, as appropriate. Correct any ROUTE DISCONTINUITY.

EXEC key .... Push

Observe the MOD RTE or MOD RTE LEGS page changes to ACT.

Note: If destination is changed during climb, performance predictions may be blanked if the new flight plan is incompatible with the entered cruise altitude. Correct by entering a lower CRZ ALT on the CLB page.

Entering Holding Fix Into Route

HOLD key .... Push

(If RTE HOLD page is displayed, observe NEXT HOLD prompt. Line select 6L until (RTE LEGS) HOLD AT page is displayed.)

Observe HOLD AT box prompts and PPOS prompt (if in flight) are displayed. Enter the holding fix in line 6L, or line select PPOS.

If the holding fix is a waypoint in the active route, or PPOS was selected, observe MOD RTE HOLD page displayed. If the holding fix is a waypoint not in the active route, observe message HOLD AT XXXXX displayed in the scratch pad. Enter the holding fix into the route by line selecting in the desired waypoint sequence. Observe the MOD RTE HOLD page displayed. If displayed holding details are incorrect or inadequate, enter correct information on appropriate line(s).

EXEC key .... Push

Observe MOD RTE HOLD page changes to RTE HOLD (ACT RTE HOLD if holding at PPOS).

Exiting Holding Pattern

HOLD key .... Push

Observe EXIT HOLD prompt displayed.

EXIT HOLD line select key .... Push

Observe EXIT HOLD prompt changes to EXIT ARMED.

EXEC key .... Push

Observe EXIT ARMED is highlighted in reverse video and LNAV flight returns to the holding fix and resumes the active route.

Note: The holding pattern may be exited by performing a DIRECT TO modification if desired. In this case, the flight path may not return to the holding fix before proceeding to the selected waypoint.

Note: A late sequencing of the hold exit waypoint may occur if multiple route modifications are performed just prior to exiting the hold. LNAV guidance may be temporarily interrupted while sequencing the hold exit waypoint.

Along Track Displacement

RTE LEGS page ....Select

Line select the reference waypoint to the scratch pad. Add a "/" and the + or – distance desired. (EX: SEA/15 for a point 15 miles downtrack from SEA)

Line select the reference waypoint. (The FMC will automatically position the created waypoint to appropriate position.)

EXEC key ....Push

Observe the MOD RTE LEGS page change to ACT.

Entering Created Waypoints on the Route or Route Legs Pages

Note: Created waypoints are stored in the temporary navigation data base for one flight only.

RTE or RTE LEGS page ....Select

Using any of the following methods, key into the scratch pad the parameters which define the new created waypoint (place identifiers must already be stored in one of the FMC data bases):

- Place bearing/distance (for example, SEA250/40);
- Place bearing/place bearing (for example, SEA180/ELN270);
- Along–track displacement (for example, SEA/-10);
- Latitude and longitude (for example, N4731.8W12218.3).

Enter into the route by line selecting to the appropriate waypoint sequence.

Repeat the above steps to define additional created waypoints as desired. Correct any ROUTE DISCONTINUITY.

EXEC key ....Push

Observe the MOD RTE or MOD RTE LEGS page changes to ACT (for an inactive route, activate and execute on the RTE or RTE LEGS page).

Entering Created Waypoints on the Nav Data Pages

Note: Created waypoints entered on the SUPP NAV DATA pages (permitted on the ground only) are stored in the supplemental navigation data base for an indefinite time period; those entered on REF NAV DATA pages are stored in the temporary navigation data base for one flight only.

INIT/REF key .... Push

Observe INDEX prompt displayed.

INIT/REF INDEX page .... Select

Observe the NAV DATA prompt displayed. To access the SUPP NAV DATA page, enter SUPP into the scratch pad.

NAV DATA page .... Select

(If the SUPP NAV DATA page is selected, observe the EFF FRM date line displayed. If an effective date had not been previously entered, box prompts are displayed. The effective date must be entered before proceeding. If required, enter the current or appropriate date on EFF FRM line and execute.)

Data ....Enter

Enter a crew-assigned identifier on either the WPT IDENT, NAVAID IDENT, or AIRPORT IDENT line, as appropriate. Use the navaid category only for stations with DME.

For a WPT IDENT entry, define the waypoint with entries for either latitude and longitude, or with entries for REF IDENT and RADIAL/DIST (REF IDENT identifier must already be stored in one of the FMC data bases).

For a NAVAID IDENT or AIRPORT IDENT entry, enter appropriate data.

EXEC key illuminates when data has been entered into all box prompts.

EXEC key .... Push

Repeat above steps to define additional created waypoints as desired. To enter a new identifier in the same category, simply overwrite the previous identifier.

Note: To enter a created waypoint into the flight plan, key the identifier into the scratch pad and follow the route modification procedure.

Deleting Created Waypoints on the Nav Data Pages

INIT/REF key .... Push

Observe the INDEX prompt displayed.

INIT/REF INDEX page .... Select

Observe the NAV DATA prompt displayed. To access the SUPP NAV DATA page, key SUPP into the scratch pad.

NAV DATA page .... Select

Enter the identifier on either the WPT IDENT, NAVAID IDENT, or AIRPORT IDENT line, as appropriate.

Data .... Delete

Push the DEL key and then line select the identifier. Observe the EXEC key illuminates.

EXEC key .... Push

Data previously entered is deleted. Observe NAV DATA page displayed with prompts.

Entering a Crossing Radial (Bearing) or Distance from a Fix as a Route Waypoint

FIX INFO page .... Select

Enter identifier of the reference waypoint (normally an off–route waypoint) onto the FIX line. Enter the desired radial or distance from the FIX on a RAD/DIS line, or line select the ABM prompt if the desired radial or distance from the FIX is perpendicular to the present route/course.

Line select the desired intersection (lines 2L–5L) into the scratch pad and observe the new created waypoint displayed as FIX/Radial/Distance.

RTE LEGS page .... Select

Line select the new created waypoint, displayed in the scratch pad, to the desired waypoint sequence.

Repeat the above steps to define additional created waypoints as desired. Correct any ROUTE DISCONTINUITY.

EXEC key .... Push

Observe the MOD RTE LEGS page changes to ACT.

Note: These created waypoints are stored in the temporary navigation data base for one flight only.

Entering a Lateral Offset

RTE page .... Select

Observe the OFFSET prompt displayed.

LATERAL OFFSET page .... Select

Observe dash prompts for OFFSET DIST.

OFFSET DIST .... Enter

Enter desired offset distance using format Lxx or Rxx for left or right offset up to 99 nm. Observe dash prompts for START WAYPOINT and END WAYPOINT.

START/END WAYPOINT .... Enter

If no start/end waypoint is entered, offset will begin/end at first/last valid offset leg.

Change SID or Runway

This entire procedure must be accomplished when a SID is used and the runway or SID is changed. This will prevent the possibility of incorrect routing or inadequate obstacle clearance.

DEPARTURES page .... Select

RUNWAY .... Reselect

SID .... Reselect

TRANSITION (if required) .... Reselect

RTE LEGS page .... Select

WAYPOINT SEQUENCE and ALTITUDES .... Check

Modify as necessary to agree with clearance.

EXEC key .... Push

Change STAR, PROF DES, or APP

The associated airport must be entered as route origin or destination.

ARRIVAL page .... Select

STAR or PROFILE DESCENT (if required) .... Select

TRANSITION (if required) .... Select

APPROACH .... Select

APPROACH TRANSITION (if required) .... Select

RTE LEGS page .... Select

WAYPOINT SEQUENCE .... CHECK

Modify as necessary to agree with clearance.

EXEC key ....Push

Delete Procedure Turn

DEP/ARR page .... Select

Approach .... Select

Reselecting same approach or selecting a new approach will remove procedure turn and select a straight in approach on the LEGS page.

EXEC key ....Push

or

RTE LEGS page ....Select

Select last waypoint of procedure turn to scratchpad and overwrite PROC TURN line. Check waypoint sequencing to comply with clearance.

EXEC key ....Push

Other Operations

FMC Navigation Check

YT514 - YT521, YV741 - YV754

If the VERIFY POSITION message, UNABLE REQD NAV PERF – RNP message, IRS-L DRIFT, IRS-R DRIFT or both GPS-L INVALID and GPS-R INVALID messages are shown in the scratch pad, or course deviation is suspected, do the following as necessary to ensure navigation accuracy:

YA701 - YT513, YV604, YV605

If the VERIFY POSITION message, UNABLE REQD NAV PERF – RNP message, or both GPS-L INVALID and GPS-R INVALID messages are shown in the scratch pad, or course deviation is suspected, do the following as necessary to ensure navigation accuracy:

Actual position .... Determine and compare with FMC position

Determine actual airplane position using raw data from VHF navigation or ADF radios.

If radio navaids are unavailable:

FMC position .... Compare with the IRS position

Use the POS SHIFT page of the FMC CDU. If the two IRS positions are in agreement and the FMC position is significantly different, the FMC position is probably unreliable. The POS SHIFT page may be used to shift FMC position to one of the IRS positions. This is accomplished by line selecting the IRS or radio position and then pressing the EXEC Key.

Actual position .... Confirm with ATC radar or visual reference points.

Navigate using most accurate information available (continue to monitor FMC position using VOR/ADF raw data displays on non–flying pilot's navigation display).

CAUTION: Navigating in LNAV mode with an unreliable FMC position may result in significant navigation errors.

Navigate by conventional VOR/ADF procedures, radar vectors from ATC, dead reckoning from last known position, and/or use of visual references.

Inhibiting VOR/DME Use for Position Updating

Note: This procedure inhibits the use of VOR/DME information for FMC position updating. Use DEL key to remove a VOR/DME from inhibit status.

PROG page .... Select

Observe NAV STATUS prompt displayed.

NAV STATUS page .... Select

NAV OPTIONS page ....Select (NEXT/PREV page)

Observe dash prompts for VOR/DME INHIBIT. Enter desired VOR/DME identifier (a previous entry may be overwritten but will no longer be inhibited).

Inhibiting GPS Updating

Note: For terminal operations, if the airspace, FMC database and charts are not referenced to the WGS-84 datum, inhibit GPS updates unless other appropriate procedures are used.

PROG page ....Select

Observe NAV STATUS prompt displayed.

NAV STATUS page ....Select

NAV OPTIONS page ....Select (NEXT/PREV page)

GPS UPDATE .... OFF

Vertical Navigation (VNAV)

Temporary Level Off during Climb or Descent (Not at FMC Cruise Altitude)

MCP altitude selector ....Set desired altitude

Verify VNAV ALT is annunciated on the flight mode annunciator when leveling at the selected MCP altitude.

MCP N1 light extinguishes if leveling from a climb.

N1 limit changes to CRZ if leveling from a climb.

To continue climb or descent:

MCP altitude selector ....Set desired altitude

ALT INTV switch ....Push

Climb or descent is initiated. Mode annunciations appear as initial climb or descent.

Intervention of FMC Altitude Constraints during VNAV Climb

YF048 - YV754

MCP altitude selector .... Set new altitude

New altitude must be higher than the FMC altitude constraint(s) to be deleted.

ALT INTV switch .... Push

Each push of the ALT INTV switch will delete an FMC altitude constraint.

Intervention of FMC Cruise Altitude during VNAV Cruise

YF048 - YT513, YV604, YV605

MCP altitude selector .... Set

ALT INTV switch .... Push

If a higher altitude is selected, a CRZ climb will be started.

If a lower altitude is selected, an early descent will be started.

Intervention of FMC Cruise Altitude during VNAV Cruise

YT514 - YT521, YV741 - YV754

MCP altitude selector .... Set

ALT INTV switch .... Push

If a higher altitude is selected, a CRZ climb will be started.

If the airplane is more than 50 nm from T/D, if a lower altitude is selected, a CRZ descent will be started if the selected altitude is above any FMC altitude constraint.

If the airplane is more than 50 nm from T/D, if a lower altitude is selected, an early descent will be started if the selected altitude is below any FMC altitude constraint.

If the airplane is 50 nm or less from T/D, if a lower altitude is selected, an early descent will be started.

Intervention of FMC Altitude Constraints during VNAV Descent

YF048 - YV754

MCP altitude selector .... Set new altitude

New altitude must be lower than the FMC altitude constant (s) to be deleted.

ALT INTV switch .... Push

Each push of the ALT INTV switch will delete an FMC altitude constraint.

If all FMC altitude constraints are deleted, the descent mode will revert to a VNAV speed descent.

Intervention of FMC Airspeed Constraints during VNAV

YF048 - YV754

SPD INTV switch .... Push

MCP IAS/MACH display shows current FMC target speed.

MCP speed selector .... Set desired speed

VNAV remains engaged.

To resume former FMC speed:

SPD INTV switch .... Push

MCP IAS/MACH display blanks and FMC commanded VNAV speed is active.

Entering Waypoint Speed and Altitude Restriction (On Climb or Descent Legs Only)

RTE LEGS page .... Select

Key–in desired speed and altitude, or speed only (followed by /), or altitude only, into scratch pad.

An altitude followed by A or B signifies a requirement to be “at or above” or “at or below” that altitude at the waypoint (for example, key–in 220A or 240B).

Line select to desired waypoint line.

EXEC key .... Push

Observe MOD RTE LEGS page changes to ACT.

Note: This changes any prior speed and altitude restriction at this waypoint.

Deleting Waypoint Speed and Altitude Restriction

RTE LEGS page .... Select

Push DEL key to enter DELETE in scratch pad. Line select to appropriate waypoint line.

EXEC key .... Push

Observe MOD RTE LEGS page changes to ACT and restriction is deleted and replaced with an FMC predicted value (small size characters).

Changing Speed and/or Altitude Restriction during Climb or Descent

CLB/DES page .... Select

Push DEL key to enter DELETE in the scratch pad, or key–in the desired speed and altitude in the scratch pad. Line select to the SPD REST line.

EXEC key .... Push

Observe the MOD CLB or the MOD DES page changes to ACT and the restriction is changed or deleted.

Changing Climb/Cruise/Descent Speed Schedule

CLB/CRZ/DES page .... Select

Select the prompt for the desired climb/cruise/descent schedule, or key–in the desired speed in the scratch pad and line select to the TGT SPD line.

EXEC key .... Push

Observe the MOD CLB, MOD CRZ, or MOD DES page changes to ACT and new speed schedule is specified.

Early Descent

MCP altitude selector .... Set

Set next level–off altitude.

DES page .... Select

Line select DES NOW prompt.

EXEC key .... Push

Observe MOD DES page changes to ACT. Observe descent is initiated (if VNAV engaged).

Note: For a PATH DES, this will result in a 1000 FPM rate of descent until the planned path is intercepted. For a SPD DES, this will result in an idle thrust normal rate of descent.

Step Climb or Descent from Cruise

MCP altitude selector .... Set

Set new level–off altitude.

FLT ALT indicator .... Set

Set new level–off altitude.

CRZ page .... Select

Enter new altitude on the CRZ ALT line. The display changes to MOD CRZ CLB or MOD CRZ DES.

If the desired climb/descent speed is different from the displayed cruise speed, manually enter the desired TGT SPD, or use access prompts to select desired CLB/DES page.

EXEC key .... Push

Observe the MOD CRZ CLB/MOD CRZ DES page (or other selected MOD CLB/MOD DES page) changes to ACT. Observe climb/descent is initiated at the TGT SPD (if VNAV engaged).

Performance and Progress Functions

Determining ETA and Fuel Remaining for New Destination

RTE page .... Select

Enter the new destination over the original DEST. Enter correct routing to the new destination using RTE, RTE LEGS, and ARRIVALS pages, as appropriate. Correct any ROUTE DISCONTINUITY.

PROGRESS page .... Select

Observe new destination with a MOD title. Check ETA and FUEL remaining.

RTE page .... Select

EXEC or ERASE the new destination/routing, as desired. Observe MOD RTE page changes to ACT.

Estimated Wind Entries for Cruise Waypoints

RTE LEGS page .... Select

Observe the DATA prompt displayed.

RTE DATA page .... Select

Enter the estimated true wind direction/speed on the appropriate line(s).

Step Climb Evaluation

CRZ page .... Select

Enter the desired step climb altitude on the STEP line. If known, enter the estimated average true wind direction/speed for the desired step climb altitude on the ACTUAL WIND line.

Step climb savings .... Determine

Observe the fuel SAVINGS/PENALTY and FUEL AT ______ (destination) lines to determine if a higher cruise altitude is advantageous.

If step climb fuel savings are significant, use the appropriate climb procedure to initiate climb to the higher altitude when NOW is displayed on STEP POINT line.

Note: Step climb evaluations do not consider buffet margin limits. If the altitude entered for the step climb evaluation is higher than the maximum altitude for flight with an adequate buffet margin, the message “MAX ALT FLXXX” will be displayed in the scratch pad. Ensure the new cruise altitude entered for the climb is at or below the MAX ALT displayed in the message in order to maintain a safe buffet margin.

Entering Descent Forecasts

DES page .... Select

Observe FORECAST prompt displayed.

DES FORECASTS page .... Select

Verify the TRANS LVL and revise if required. Enter average ISA DEV forecast for descent and destination QNH. Enter forecast descent WINDs (for up to three different altitudes).

EXEC key .... Push

Observe MOD DES FORECASTS page changes to ACT.

Engine Out

Engine out climb and cruise pages provide advisory information for engine out operation. Refer to section 11.41 and 11.42 for a complete description of ENG OUT CLB and ENG OUT CRZ pages.

Required Time of Arrival (RTA)

Note: An active FMC flight plan complete with all performance data must exist before the required time of arrival (RTA) mode can be used.

Entering an RTA Waypoint and Time

RTA PROGRESS page .... Select

On PROGRESS page 2, line 1L, enter the flight plan waypoint where required time of arrival is applicable. Observe the MOD RTA PROGRESS page displayed with the computed ETA, for the entered waypoint, displayed in line 1R.

RTA .... Enter

Enter required time of arrival into line 1R. Time should be entered in hours, minutes, and seconds (Examples: 174530, 1745, 1745.5). Observe MOD RTA PROGRESS page displayed with pertinent data for complying with entered RTA. Observe EXEC key illuminated.

EXEC key .... Push

Observe ACT RTA PROGRESS page displayed.

Entering Speed Restrictions for RTA Navigation

PERF LIMITS page .... Select

Enter minimum or maximum speed restriction for RTA navigation in lines 2, 3, or 4 depending on phase of flight. Observe RTA parameters change to reflect new limits (RTA PROGRESS page) and EXEC key illuminated.

EXEC key .... Push

Observe MOD PERF LIMITS page change to ACT PERF LIMITS page.

Note: Entered restrictions on line 2, 3, and 4 also restrict other navigation modes such as ECON.

Entering New Time Error Tolerances for RTA Navigation

PERF LIMITS page .... Select

Enter desired time error tolerance (5 to 30 seconds) for the RTA waypoint on line 1L (Example: 25). Observe MOD PERF LIMITS page displayed and EXEC key illuminated.

EXEC key .... Push

Observe ACT PERF LIMITS page displayed.

Additional CDU Functions

Navigation Display Plan Mode (Center Step Operation)

EFIS Control Panel Mode Selector ....PLAN

RTE LEGS page .... Select

EFIS Control Panel Range Selector .... As required

MAP CTR STEP key .... Push

Each push moves the CTR label to the next geographically fixed waypoint in the route. Selecting PREV PAGE or NEXT PAGE moves the CTR label to the first geographically fixed waypoint on the new page.

EFIS Control Panel Mode Selector .... As required

Enter Position Shift on Runway

TAKEOFF REF page .... Select

RWY REMAIN distance ....Enter

Enter runway remaining distance. When TO/GA is pushed, FMC will update to the runway remaining distance.

If position shift must be removed

RTE page .... Select

RWY .... Enter

Reenter runway on RTE page. Check and reenter other performance data as required.

Spar Fuel Shutoff Valve Operational Check

YA701 - YS187, YS191 - YS194

Note: Regulatory approval for use of the following flight crew procedure(s) is required.

Note: The check is considered failed for any of the following procedures if the SPAR VALVE CLOSED light (located on the fuel control panel) fails to illuminate bright during the check.

Unless accomplished by maintenance personnel, do the following spar fuel shutoff valve checks once per flight day:

Spar Fuel Shutoff Valve Operational Check During Engine Start

Engine start lever (first engine) .... IDLE

Verify SPAR VALVE CLOSED light transitions from dim, to bright and then extinguishes.

Engine start lever (second engine)... IDLE

Verify SPAR VALVE CLOSED light transitions from dim, to bright and then extinguishes.

Fuel Balancing

If an engine fuel leak is suspected:

Accomplish the Fuel Leak Engine checklist.

If the fuel IMBAL alert shows:

Accomplish the IMBAL checklist.

Maintain main tank No. 1 and No. 2 fuel balance within limitations.

Note: Fuel pump pressure should be supplied to the engines at all times. At high altitude, without fuel pump pressure, thrust deterioration or engine flameout may occur.

If the center tank contains fuel:

Center tank fuel pump switches ....OFF

[Fuel CONFIG indication may be displayed with fuel in the center tank.]

Crossfeed selector .... Open

Fuel pump switches (low tank) ....OFF

When quantities are balanced:

Fuel pump switches (main tank).......................................ON

Center tank fuel pump switches..ON

Crossfeed selector .... Close

If the center tank contains no fuel:

Crossfeed selector .... Open

Fuel pump switches (low tank) ....OFF

When quantities are balanced:

Fuel pump switches ....ON

Crossfeed selector .... Close

Refueling

Fuel Load Distribution

Main tanks No. 1 and No. 2 should normally be serviced equally until full. Additional fuel is loaded into the center tank until the desired fuel load is reached.

Note: Main tanks No. 1 and No. 2 must be scheduled to be full if the center tank contains more than 453 kgs of fuel. With less than 453 kgs of center tank fuel, partial main tank fuel may be loaded provided the effects of balance have been considered.

Fuel Pressure

Apply from a truck or fuel pit. A nozzle pressure of 50 psi provides approximately 1136 liters per minute.

Normal Refueling

YK622 - YK630, YL541 - YL551
When a full fuel load is required, the fuel shutoff system closes the fueling valves automatically when the tanks are full. When a partial fuel load is required, the fuel shutoff system closes the fueling valves automatically when the quantity preselected on the fuel quantity selector (located on the test gauges and fueling panel) is reached.

YA701 - YF928, YK961 - YL077, YM482 - YV754
When a full fuel load is required, the fuel shutoff system closes the fueling valves automatically when the tanks are full. When a partial fuel load is required, the fuel quantity indicators are monitored and the fueling valves are closed by manually positioning the fueling valve switches to CLOSED when the desired fuel quantity is aboard the airplane.

Refueling with Battery Only

When the APU is inoperative and external power is not available, refueling can be accomplished as follows:

Battery switch .... ON

Note: The refueling system will operate normally. Operation is limited only by battery life.

Refueling with No AC or DC Power Source Available

When it becomes necessary to refuel with the APU inoperative, the aircraft battery depleted, and no external power source available, refueling can still be accomplished:

Fueling hose nozzle ....Attached to the refueling receptacle

Fueling valves .... Open for the tanks to be refueled

Note: Main tanks No. 1 and No. 2, and the center tank refueling valves each have a red override button that must be pressed and held while fuel is being pumped into the tank. Releasing the override button allows the spring in the valve to close the valve.

Caution must be observed not to overfill a tank, since there is no automatic fuel shutoff during manual operation. When the desired amount of fuel has been pumped into the tanks, the refueling valves for the respective tanks can be released.

Ground Transfer of Fuel

Fuel can be transferred from one tank to another tank using the fuel pumps, fueling valve, defueling valve, and crossfeed valve. AC power must be available.

Note: Before transferring fuel, ensure that the associated FUEL PUMP LOW PRESSURE lights are operating.

CAUTION: Transferring fuel with passengers onboard is prohibited, unless the fuel quantity in the tank from which fuel is being taken is maintained at or above 2000 pounds/900 kilograms.

To transfer fuel from the main tanks to the center tank:

Main tank fuel pump switches .... ON

Crossfeed selector .... Open

Manual defueling valve .... Open

Center tank fueling valve switch .... OPEN

Fuel transfer .... Monitor

The center tank fuel quantity indicator shows an increase in fuel. The main tank indicators show a decrease in fuel.

When a FUEL PUMP LOW PRESSURE light illuminates, turn OFF the associated fuel pump.

When the required amount of fuel has been transferred:

Center tank fueling valve switch ....CLOSED

Manual defueling valve ....Close

Crossfeed selector ....Close

Main tank fuel pump switches .... OFF

Main Tanks ....Refill

Refueling panel and defuel panel access doors ....Close

Fuel Crossfeed Valve Check

Crossfeed selector .... Open

Verify crossfeed VALVE OPEN light illuminates bright and then dim.

Crossfeed selector ....Close

Verify crossfeed VALVE OPEN light illuminates bright and then extinguishes.

Intentionally
Blank

Supplementary Procedures Chapter SP

Warning Systems Section 15

Ground Proximity Warning System (GPWS) Test

Verify IRS alignment is complete.

Verify that the guards are closed for all GROUND PROXIMITY INHIBIT switches.

Ground proximity SYS TEST switch .... Push momentarily

Verify the following:

- BELOW G/S and GPWS INOP lights illuminate
- TERR FAIL and TERR TEST show on navigation displays
- PULL UP and WINDSHEAR alerts illuminate
- “GLIDESLOPE”, “PULL UP” and “WINDSHEAR” aurals sound
- terrain display test pattern shows on navigation displays
- “CAUTION TERRAIN” aural sounds and TERRAIN caution message shows on navigation displays.

Note: If the test switch is held until the aurals begin, additional GPWS aural warnings are tested.

Intentionally
Blank

Supplementary Procedures Chapter SP

Adverse Weather Section 16

Introduction

Airplane operation in adverse weather conditions may require additional considerations due to the effects of extreme temperatures, precipitation, turbulence and windshear. Procedures in this section supplement normal procedures and should be observed when applicable.

Takeoff - Wet or Contaminated Runway Conditions

The following information applies to takeoffs on wet or contaminated runways:

- For wet runways, reduced thrust (fixed derate, assumed temperature method, or both) is allowed provided suitable takeoff performance accountability is made for the increased stopping distance on a wet surface
- For runways contaminated by slush, snow, standing water, or ice, reduced thrust (fixed derate) is allowed provided takeoff performance accounts for the runway surface condition. Reduced thrust using assumed temperature method, whether alone or in combination with a fixed derate, is not allowed
- V1 may be reduced to minimum V1 to provide increased stopping margin provided the field length required for a continued takeoff from the minimum V1 and obstacle clearance meet the regulatory requirements. The determination of such minimum V1 may require a real-time performance calculation tool or other performance information supplied by dispatch
- Takeoffs are not recommended when slush, wet snow, or standing water depth is more than 1/2 inch (13 mm) or dry snow depth is more than 4 inches (102 mm).

Cold Weather Operations

Considerations associated with cold weather operation are primarily concerned with low temperatures and with ice, snow, slush and standing water on the airplane, ramps, taxiways, and runways.

Icing conditions exist when OAT (on the ground) or TAT (in flight) is 10°C or below and any of the following exist:

- visible moisture (clouds, fog with visibility of one statute mile (1600m) or less, rain, snow, sleet, ice crystals, and so on) is present, or
- ice, snow, slush or standing water is present on the ramps, taxiways, or runways.

CAUTION: Do not use engine or wing anti–ice when OAT (on the ground) or TAT (in flight) is above 10°C.

Exterior Inspection

Although removal of surface snow, ice and frost is normally a maintenance function, during preflight procedures, the captain or first officer should carefully inspect areas where surface snow, ice or frost could change or affect normal system operations.

Do the normal Exterior Inspection with the following additional steps:

Surfaces .... Check

YF048 - YV754

Takeoff with light coatings of frost, up to 1/8 inch (3 mm) in thickness, on lower wing surfaces due to cold fuel is allowable; however, all leading edge devices, all control surfaces, tab surfaces, upper wing surfaces, winglet surfaces and control surface balance panel cavities must be free of snow, ice and frost.

YA701 - YA710

Takeoff with light coatings of frost, up to 1/8 inch (3 mm) in thickness, on lower wing surfaces due to cold fuel is allowable; however, all leading edge devices, all control surfaces, tab surfaces, upper wing surfaces and control surface balance panel cavities must be free of snow, ice and frost.

Thin hoarfrost is acceptable on the upper surface of the fuselage provided all vents and ports are clear. Thin hoarfrost is a uniform white deposit of fine crystalline texture, which usually occurs on exposed surfaces on a cold and cloudless night, and which is thin enough to distinguish surface features underneath, such as paint lines, markings or lettering.

Control surface balance panel cavities .... Check

Check drainage after snow removal. Puddled water may freeze in flight.

Pitot probes and static ports .... Check

Verify that all pitot probes and static ports free of snow and ice. Water rundown after snow removal may freeze immediately forward of static ports and cause an ice buildup which disturbs airflow over the static ports resulting in erroneous static readings even when static ports are clear.

Air conditioning inlets and exits .... Check

Verify that the air inlets and exits, including the outflow valve, are free of snow and ice.

If the APU is operating, verify that the outflow valve is fully open.

Engine inlets .... Check

Verify that the inlet cowling is free of snow and ice.

Verify that the fan is free to rotate.

Snow or ice that accumulates on the fan spinner or fan blades during extended shutdown periods must be removed by maintenance or other means before engine start.

Snow or ice that accumulates on the fan spinner or fan blades as a result of operation in icing conditions, such as during approach or taxi in, is allowed if the fan is free to rotate and the snow or ice is removed using the ice shedding procedure during taxi out and before setting takeoff thrust.

Fuel tank vents .... Check

Verify all traces of ice and frost are removed.

Landing gear doors .... Check

Landing gear doors should be free of snow and ice.

APU air inlets .... Check

The APU inlet door and cooling air inlet must be free of snow and ice before APU start.

Preflight Procedure - First Officer

Do the following step after completing the normal Preflight Procedure - First Officer:

PROBE HEAT switches .... ON

Verify that all probe heat lights are extinguished.

Engine Start Procedure

Do the normal Engine Start Procedure with the following modifications:

- If the engine has been cold soaked for one or more hours at ambient temperatures below -40°C, do not start or motor the engine. Maintenance personnel should do appropriate procedures for adverse weather heating of the Hydro-Mechanical Unit.
- If the engine has been cold soaked for three or more hours at ambient temperatures below -40°C, do not start or motor the engine. Maintenance personnel should do appropriate procedures for adverse weather starter servicing.
- If ambient temperature is below -35°C, idle the engine for two minutes before changing thrust lever position.
- Several minutes may be needed for oil pressure to reach the normal operating pressure. During this period, oil pressure may go above the normal range and the OIL FILTER BYPASS light may illuminate. Operate the engine at idle thrust until oil pressure returns to the normal range.
- If the oil pressure remains above the normal range after the oil temperature has stabilized within limits, shut down the engine.
- Display units may require additional warm-up time before displayed engine indications accurately show changing values. Display units may appear less bright than normal.

Engine Anti-ice Operation - On the Ground

Engine anti-ice must be selected ON immediately after both engines are started and remain on during all ground operations when icing conditions exist or are anticipated.

WARNING: Do not rely on airframe visual icing cues before activating engine anti-ice. Use the temperature and visible moisture criteria because late activation of engine anti-ice may allow excessive ingestion of ice and result in engine damage or failure.

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

When engine anti-ice is needed:

ENGINE START switches ....CONT F/O

ENGINE ANTI-ICE switches ....ON F/O

Verify that the COWL VALVE OPEN lights illuminate bright, then dim.

Verify that the COWL ANTI-ICE lights are extinguished.

Note: If the COWL VALVE OPEN lights remain illuminated bright with engines at IDLE, position APU BLEED air switch to OFF and increase thrust slightly (up to a maximum of 30% N1).

When engine anti-ice is no longer needed:

ENGINE ANTI-ICE switches .... OFF F/O

Verify that the COWL VALVE OPEN lights illuminate bright, then extinguish.

Wing Anti-ice Operation - On the Ground

Use wing anti-ice during all ground operations between engine start and takeoff when icing conditions exist or are anticipated, unless the airplane is, or will be protected by the application of Type II or Type IV fluid in compliance with an approved ground de-icing program.

WARNING: Do not use wing anti-ice as an alternative for ground de-icing/anti-icing. Close inspection is still needed to ensure that no frost, snow or ice is adhering to the wing, leading edge devices, stabilizer, control surfaces or other critical airplane components at takeoff.

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

When wing anti-ice is needed:

WING ANTI-ICE switch ....ON F/O

Verify that the L and R VALVE OPEN lights illuminate bright, then dim.

Note: The wing anti-ice VALVE OPEN lights may cycle bright/dim due to the control valves cycling closed/open in response to thrust setting and duct temperature logic.

When wing anti-ice is no longer needed:

WING ANTI-ICE switch .... OFF F/O

Verify that the L and R VALVE OPEN lights illuminate bright, then extinguish.

Before Taxi Procedure

Do the normal Before Taxi Procedure with the following modifications:

GENERATOR 1 and 2 switches .... ON F/O

Normally the IDG's stabilize within one minute, although due to cold oil, up to five minutes can be needed to produce steady power.

If there is snow or ice accumulation on the wing, consider delaying the flight control check until after de-icing/anti-icing is accomplished.

Flight controls .... Check C

An increase in control forces can be expected at low temperatures.

CAUTION: The flap position indicator and the leading edge devices annunciator panel should be closely observed for positive movement. If the flaps should stop, the flap lever should be placed immediately in the same position as indicated.

Flaps .... Check F/O

Move the flaps from Flaps up to Flaps 40 back to Flaps up (i.e., full travel) to ensure freedom of movement.

If taxi route is through ice, snow, slush or standing water in low temperatures or if precipitation is falling with temperatures below freezing, taxi out with the flaps up. Taxiing with the flaps extended subjects the flaps and flap drives to contamination. Leading edge devices are also susceptible to slush accumulations.

Call “FLAPS ___” as needed. C

Flap lever... Set flaps, as needed F/O

Taxi–Out

CAUTION: Taxi at a reduced speed. Use smaller nose wheel steering wheel and rudder inputs and apply minimum thrust smoothly. Differential thrust may be used to help maintain airplane momentum during turns. At all other times, apply thrust evenly. Taxiing on slippery taxiways or runways at excessive speed or with high crosswinds may start a skid.

CAUTION: When operating the engines over significant amounts of standing de-icing or anti-icing fluid, limit thrust to the minimum required. Excessive ingestion of de-icing or anti-icing fluid can cause the fluid to build up on the engine compressor blades resulting in compressor stalls and engine surges.

When engine anti-ice is required and the OAT is 3°C or below, do an engine run up, as needed, to minimize ice build-up. Use the following procedure:

Check that the area behind the airplane is clear. C

Run-up to a minimum of 70% N1 for approximately 30 seconds duration at intervals no greater than 30 minutes. C

Note: Fan blade ice build up is cumulative. If the fan spinner and fan blades were not deiced prior to taxi out, the time the engines were operating during the taxi in should be included in the 30 minute interval.

If airport surface conditions and the concentration of aircraft do not allow the engine thrust level to be increased to 70% N1, then set a thrust level as high as practical and time at that thrust level. C

Note: When operating in conditions of freezing rain, freezing drizzle, freezing fog or heavy snow, run-ups to a minimum of 70% N1 for approximately 1 second duration at intervals no greater than 10 minutes enhance ice shedding.

De-icing/Anti-icing

Testing of undiluted de-icing/anti-icing fluids has shown that some of the fluid remains on the wing during takeoff rotation and initial climb. The residual fluid causes a temporary decrease in lift and increase in drag, however, the effects are temporary. Use the normal takeoff rotation rate.

CAUTION: Operate the APU during de-icing only if necessary. If the APU is running, ingestion of de-icing fluid causes objectionable fumes and odors to enter the airplane. Ingestion of snow, slush, ice, or de-icing/anti-icing fluid can also cause damage to the APU.

If de-icing/anti-icing is needed:

APU .... As needed F/O

The APU should be shut down unless APU operation is necessary.

Call “FLAPS UP”. C

Flaps .... UP F/O

Prevents ice and slush from accumulating in flap cavities during de-icing.

Thrust levers .... Idle C

Reduces the possibility of injury to personnel at inlet or exhaust areas.

WARNING: Ensure that the stabilizer trim wheel handles are stowed before using electric trim to avoid personal injury.

Stabilizer trim .... ___ UNITS C

Set the trim for takeoff.

Verify that the trim is in the green band.

Engine BLEED air switches .... OFF F/O

Reduces the possibility of fumes entering the air conditioning system.

APU BLEED air switch .... OFF F/O

Reduces the possibility of fumes entering the air conditioning system.

After de-icing/anti-icing is completed:

APU .... As needed F/O

CAUTION: After de-icing, the use of APU bleed air during takeoff can cause smoke in the airplane.

APU BLEED air switch .... As needed F/O

Wait approximately one minute after de-icing is completed to turn engine BLEED air switches on to ensure all de-icing fluid has been cleared from the engines:

Engine BLEED air switches .... ON F/O

Flight controls ....Check, as needed C

An increase in control forces can be expected at low temperatures.

Before Takeoff Procedure

Do the normal Before Takeoff Procedure with the following modifications:

Call “FLAPS ___” as needed for takeoff. PF

Flap lever .... Set takeoff flaps, as needed PM

Extend the flaps to the takeoff setting at this time if they have been held because of slush, or standing water, or icing conditions, or because of exterior de-icing/anti-icing.

Verify that the LE FLAPS EXT green light is illuminated.

Takeoff Procedure

Do the normal Takeoff Procedure with the following modification:

When engine anti-ice is required and the OAT is 3°C or below, the takeoff must be preceded by a static engine run-up. Use the following procedure:

Run-up to a minimum of 70% N1 and confirm stable engine operation before the start of the takeoff roll. A 30-second run-up is highly recommended whenever possible.

Engine Anti-Ice Operation - In Flight

Engine anti–ice must be ON during all flight operations when icing conditions exist or are anticipated, except during climb and cruise when the temperature is below -40°C SAT. Engine anti–ice must be ON before, and during descent in all icing conditions, including temperatures below -40°C SAT.

When operating in areas of possible icing, activate engine anti–ice before entering icing conditions.

WARNING: Do not rely on airframe visual icing cues before activating engine anti–ice. Use the temperature and visible moisture criteria because late activation of engine anti-ice may allow excessive ingestion of ice and result in engine damage or failure.

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

When engine anti-ice is needed:

ENGINE START switches .... CONT PM

ENGINE ANTI-ICE switches .... ON PM

Verify that the COWL VALVE OPEN lights illuminate bright, then dim.

Verify that the COWL ANTI-ICE lights are extinguished.

Note: If the COWL VALVE OPEN lights remain illuminated bright with engines at IDLE, increase thrust slightly (up to a minimum of 30% N1).

When engine anti-ice is no longer needed:

ENGINE ANTI-ICE switches ....OFF PM

Verify that the COWL VALVE OPEN lights illuminate bright, then extinguish.

ENGINE START switches ....OFF PM

Fan Ice Removal

CAUTION: Avoid prolonged operation in moderate to severe icing conditions.

Severe icing can usually be avoided by a change in altitude and/or airspeed. If flight in moderate to severe icing conditions cannot be avoided, do the following on both engines, one engine at a time at approximately 15 minute intervals:

Thrust ....Increase PF

Increase thrust to a minimum of 80% N1 for approximately 1 second to ensure the fan blades and spinner are clear of ice.

Engine vibration can occur due to fan blade/spinner icing. If engine vibration continues after increasing thrust, do the following on both engines, one engine at a time:

ENGINE START switch ....FLT PM

Thrust ....Adjust PF

Adjust thrust to 45% N1. After approximately five seconds, increase thrust lever slowly to a minimum of 80% N1.

Note: Engine vibration can reduce to a low level before 80% N1 is reached, however, thrust increase must continue to a minimum of 80% N1 to remove ice from the fan blades.

Note: Engine vibration can indicate full scale before shedding ice, however, this has no adverse effect on the engine.

If vibration does not decrease, accomplish the Engine High Vibration checklist “If not in icing conditions.”

Wing Anti-ice Operation - In Flight

Ice accumulation on the flight deck window frames, windshield center post, or on the windshield wiper arm may be used as an indication of structural icing conditions and the need to turn on wing anti-ice.

In flight, the wing anti-ice system may be used as a de-icer or as an anti-icer. The primary method is to use it as a de-icer by allowing ice to accumulate before turning wing anti-ice on. This procedure provides the cleanest airfoil surface, the least possible runback ice formation, and the least thrust and fuel penalty. Normally it is not necessary to shed ice periodically unless extended flight through icing conditions is necessary (holding).

The secondary method is to use wing anti-ice before ice accumulation. Operate the wing anti-ice system as an anti-icer only during extended operations in moderate or severe icing conditions, such as holding.

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

CAUTION: Use of wing anti-ice above approximately FL350 may cause bleed trip off and possible loss of cabin pressure.

Note: Prolonged operation in icing conditions with the leading edge and trailing edge flaps extended is not recommended. Holding in icing conditions with flaps extended is prohibited.

When wing anti-ice is needed:

WING ANTI-ICE switch .... ON PM

Verify that the L and R VALVE OPEN lights illuminate bright, then dim.

When wing anti-ice is no longer needed:

WING ANTI-ICE switch ....OFF PM

Verify that the L and R VALVE OPEN lights illuminate bright, then extinguish.

Cold Temperature Altitude Corrections

Extremely low temperatures create significant altimeter errors and greater potential for reduced terrain clearance. When the temperature is colder than ISA, true altitude will be lower than indicated altitude. Altimeter errors become significantly larger when the surface temperature approaches -30°C or colder, and also become larger with increasing height above the altimeter reference source.

Apply the altitude correction table when needed:

- apply corrections to all published minimum departure, en route and approach altitudes, including missed approach altitudes, according to the table below. Advise ATC of the corrections
- MDA/DA settings should be set at the corrected minimum altitudes for the approach
- corrections apply to QNH and QFE operations.

To determine the correction from the Altitude Correction Table:

- subtract the elevation of the altimeter barometric reference setting source (normally the departure or destination airport elevation) from the published minimum altitude to be flown to determine “height above altimeter reference source”
- if the corrected indicated altitude to be flown is between 100 foot increments, set the MCP altitude to the closest 100 foot increment above the corrected indicated altitude to be flown.

- enter the table with Airport Temperature and with "height above altimeter reference source". Read the correction where these two entries intersect. Add the correction to the published minimum altitude to be flown to determine the corrected indicated altitude to be flown. To correct an altitude above the altitude in the last column, use linear extrapolation (e.g., to correct 6000 feet or 1800 meters, use twice the correction for 3000 feet or 900 meters, respectively.) The corrected altitude must always be greater than the published minimum altitude
- do not correct altimeter barometric reference settings.

An altitude correction due to cold temperature is not needed for the following conditions:

- While under ATC radar vectors
- When maintaining an ATC assigned flight level (FL)
- When the reported airport temperature is above 0°C or if the airport temperature is at or above the minimum published temperature for the procedure being flown.

Note: Regulatory authorities may have other requirements for cold temperature altitude corrections.

Altitude Correction Table (Heights and Altitudes in Feet)

Airport Temp °C	Height Above Altimeter Reference Source											
	200 feet	300 feet	400 feet	500 feet	600 feet	700 feet	800 feet	900 feet	1000 feet	1500 feet	2000 feet	3000 feet
0°	20	20	30	30	40	40	50	50	60	90	120	170
-10°	20	30	40	50	60	70	80	90	100	150	200	290
-20°	30	50	60	70	90	100	120	130	140	210	280	420
-30°	40	60	80	100	120	140	150	170	190	280	380	570
-40°	50	80	100	120	150	170	190	220	240	360	480	720
-50°	60	90	120	150	180	210	240	270	300	450	590	890

Altitude Correction Table (Heights and Altitudes in Meters)

Airport Temp °C	Height Above Altimeter Reference Source											
	60 m	90 m	120 m	150 m	180 m	210 m	240 m	270 m	300 m	450 m	600 m	900 m
0°	5	5	10	10	10	15	15	15	20	25	35	50
-10°	10	10	15	15	20	20	25	30	30	45	60	90
-20°	10	15	20	25	25	30	35	40	45	65	85	130
-30°	15	20	25	30	35	40	45	55	60	85	115	170
-40°	15	25	30	40	45	50	60	65	75	110	145	220
-50°	20	30	40	45	55	65	75	80	90	135	180	270

Approach and Landing

Use normal procedures and reference speeds unless a flaps 15 landing is planned.

If a flaps 15 landing will be made:

Set VREF 15

If any of the following conditions apply, set VREF ICE = VREF 15 + 10:

- engine anti–ice will be used during landing
- wing anti–ice has been used any time during the flight
- icing conditions were encountered during the flight and the landing temperature is below 10°C.

After Landing Procedure

CAUTION: Taxi at a reduced speed. Use smaller nose wheel steering wheel and rudder inputs and apply minimum thrust smoothly. Differential thrust may be used to help maintain airplane momentum during turns. At all other times, apply thrust evenly. Taxiing on slippery taxiways or runways at excessive speed or with high crosswinds may start a skid.

CAUTION: When operating the engines over significant amounts of standing de-icing or anti-icing fluid, limit thrust to the minimum required. Excessive ingestion of de-icing or anti-icing fluid can cause the fluid to build up on the engine compressor blades resulting in compressor stalls and engine surges.

Do the normal After Landing Procedure with the following modifications:

After prolonged operation in icing conditions with the flaps extended, or when an accumulation of airframe ice is observed, or when operating on a runway or taxiway contaminated with ice, snow, slush or standing water:

Do not retract the flaps to less than flaps 15 until the flap areas have been checked to be free of contaminants.

Engine anti-ice must be selected ON and remain on during all ground operations when icing conditions exist or are anticipated.

WARNING: Do not rely on airframe visual icing cues before activating engine anti-ice. Use the temperature and visible moisture criteria because late activation of engine anti-ice may allow excessive ingestion of ice and result in engine damage or failure.

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

When engine anti-ice is needed:

ENGINE START switches ....CONT F/O

ENGINE ANTI-ICE switches ....ON F/O

Verify that the COWL VALVE OPEN lights illuminate bright, then dim.

Verify that the COWL ANTI-ICE lights are extinguished.

Note: If the COWL VALVE OPEN lights remain illuminated bright with engines at IDLE, increase thrust slightly (up to a maximum of 30% N1).

When engine anti-ice is no longer needed:

ENGINE ANTI-ICE switches .... OFF F/O

Verify that the COWL VALVE OPEN lights illuminate bright, then extinguish.

ENGINE START switches .... OFF F/O

When engine anti-ice is required and the OAT is 3°C or below, do an engine run up, as needed, to minimize ice build-up. Use the following procedure: C

Check that the area behind the airplane is clear.

Run-up to a minimum of 70% N1 for approximately 30 seconds duration at intervals no greater than 30 minutes.

If airport surface conditions and the concentration of aircraft do not allow the engine thrust level to be increased to 70% N1, then set a thrust level as high as practical and time at that thrust level.

Note: When operating in conditions of freezing rain, freezing drizzle, freezing fog or heavy snow, run-ups to a minimum of 70% N1 for approximately 1 second duration at intervals no greater than 10 minutes should be considered.

Shutdown Procedure

Do the following step before starting the normal Shutdown Procedure:

After landing in icing conditions:

WARNING: Ensure that the stabilizer trim wheel handles are stowed before using electric trim to avoid personal injury.

Stabilizer trim .... Set 5 units C

Prevents melting snow and ice from running into the tailcone. Excessive water in the tailcone can freeze and lock controls.

Secure Procedure

Do the normal Secure Procedure with the following modifications:

If the airplane will be attended and warm air circulation throughout the cargo E/E compartments is desired:

CAUTION: Do not leave the interior unattended with a pack operating and all doors closed. With the airplane in this configuration, accidental closure of the main outflow valve can cause unscheduled pressurization of the airplane.

APU .... Start F/O

APU GENERATOR bus switches .... ON F/O

PACK switches .... AUTO F/O

ISOLATION VALVE switch .... OPEN F/O

Pressurization mode selector .... MAN F/O

Outflow valve switch .... OPEN F/O

Prevents aircraft pressurization.

Note: The airplane must be parked into the wind when the outflow valve is full open.

APU BLEED air switch .... ON F/O

If the airplane will not be attended, or if staying overnight at off-line stations or at airports where normal support is not available, the flight crew must arrange for or verify that the following steps are done:

Pressurization mode selector .... MAN F/O

Outflow valve .... CLOSE F/O

Position the outflow valve fully closed to inhibit the intake of snow or ice.

Wheel chocks .... Verify in place C or F/O

Parking brake .... Released C

Reduces the possibility of frozen brakes.

Cold weather maintenance procedures for securing the airplane may be required. These procedures are normally done by maintenance personnel, and include, but are not limited to:

- protective covers and plugs installed
- water storage containers drained
- toilets drained
- doors and sliding windows closed

YA701 - YF049, YM482 - YM484

- battery removed. If the battery will be exposed to temperatures below -18°C, the battery should be removed and stored in an area warmer than -18°C, but below 40°C. Subsequent installation of the warm battery ensures the starting capability of the APU.

YF921 - YL551, YN531 - YV754

- batteries removed. If the batteries will be exposed to temperatures below -18°C, the batteries should be removed and stored in an area warmer than -18°C, but below 40°C. Subsequent installation of the warm batteries ensures the starting capability of the APU.

Hot Weather Operation

During ground operation the following considerations will help keep the airplane as cool as possible:

- While the airplane is electrically powered, packs should be run or cooling air supplied to the airplane when the OAT exceeds 40° C (103° F) to protect the reliability of electrical and electronic equipment in the airplane.
- If cooling air is available from an outside source, the supply should be plugged in immediately after engine shutdown and should not be removed until just prior to engine start.
- Keep all doors and windows, including cargo doors, closed as much as possible.
- Electronic components which contribute to a high temperature level in the flight deck should be turned off while not needed.
- Open all passenger cabin gasper outlets and close all window shades on the sun–exposed side of the passenger cabin.

If these actions do not reduce cabin temperatures sufficiently:

PASSENGER CABIN temperature selector .... AUTO COOL

PACK switches .... HIGH

YA701 - YA710, YM482 - YN534

If the cabin temperature remains high:

PASSENGER CABIN temperature selector .... MAN COOL

After engine start with the engines at ground idle, the pneumatic pressure available to the bleed air system may not be sufficient to provide adequate cooling during extended ground operations. Use of APU bleed air instead of engine bleed air to supply the packs while on the ground can significantly increase cabin cooling. If additional cooling is needed during extended ground operations:

Engine BLEED 1 air switch...OFF

Engine BLEED 2 air switch...OFF

ISOLATION VALVE switch .... OPEN

APU BLEED air switch ....ON

PACK switches .... HIGH

Temperature selectors ....AUTO COOL

Prior to takeoff:

PACK switches .... AUTO

Engine BLEED 2 air switch ....ON

APU BLEED air switch .... OFF

Engine BLEED 1 air switch ....ON

ISOLATION VALVE switch .... AUTO

Temperature selectors ....As needed

Brake temperature levels may be reached which can cause the wheel fuse plugs to melt and deflate the tires. Consider the following actions:

- Be aware of brake temperature buildup when operating a series of short flight sectors. The energy absorbed by the brakes from each landing is accumulative
- Extending the landing gear early during the approach provides additional cooling for tires and brakes.
- In–flight cooling time can be determined from the “Brake Cooling Schedule” in the Performance–Inflight section of the QRH.

During flight planning consider the following:

- High temperatures inflict performance penalties which must be taken into account on the ground before takeoff
- Alternate takeoff procedures (No Engine Bleed Takeoff, Improved Climb Performance, etc.)

Moderate to Heavy Rain, Hail or Sleet

Flights should be conducted to avoid thunderstorm or hail activity. If visible moisture is present at high altitude, avoid flight over the storm cell. (Storm cells that do not produce visible moisture at high altitude can be overflown safely.) To the maximum extent possible, moderate to heavy rain, hail or sleet should also be avoided.

If moderate to heavy rain, hail or sleet is encountered or anticipated:

ENGINE START switches ....CONT

Autothrottle .... Disengage

Thrust Levers .... Adjust Slowly

If thrust changes are necessary, move the thrust levers slowly. Avoid changing thrust lever direction until engines have stabilized at a selected setting. Maintain an increased minimum thrust setting.

IAS/MACH .... Use a slower speed

Using a slower speed improves engine tolerance to heavy precipitation intake.

Consider starting the APU (if available).

Operation in a Sandy or Dusty Environment

The main hazards of a sandy or dusty environment are erosion (especially of engine fan blades), accumulation of sand or dust on critical surfaces and blockage. The effects of sand ingestion occur predominantly during takeoff, landing and taxi operations. The adverse effects, however, can occur if the airplane's flight path was through a cloud of visible sand or dust or the airplane was parked during a sand or dust storm. Premature engine deterioration can result from sand or dust ingestion, causing increased fuel burn and reduced EGT margins.

CAUTION: After a sandstorm, if all taxiways and runways are not carefully inspected and swept for debris before flight ops are conducted, the risk of engine damage and wear is increased.

Exterior Inspection

Although removal of sand and dust contaminants is primarily a maintenance function, during the exterior inspection the captain or first officer should carefully inspect areas where accumulation of sand or dust could change or affect normal system operations.

Do the normal Exterior Inspection with the following additional steps:

Windshield .... Check

Verify that the windshield has been cleaned.

Note: Do not use windshield wipers for sand or dust removal. Wash deposits off with water and wipe residue off with a soft cloth.

Surfaces .... Check

Verify that the upper surfaces of the wings and other control surfaces are free of sand.

CAUTION: Particular care should be taken to ensure that the fuselage and all surfaces are clean after a sand storm that occurs with a rain storm.

Probes, sensors, ports, ram turbine doors,
vents, and drains (as applicable) .... Check

Verify that the left and right ram air inlets are free of sand and dust. Verify that the cabin pressure outflow valve and both positive pressure relief valves are free of sand and dust.

Leading edge flaps .... Check

Verify that all leading edges are undamaged.

Engine inlets .... Check

Verify that the inlet cowling is free of sand and dust.

Verify that the fan is free to rotate and fan blades are undamaged.

Fuel tank vents .... Check

Verify that all vents are free of sand and dust.

Landing gear .... Check

Verify that gear struts and doors are free of sand and dust build-up.

Vertical and horizontal stabilizers .... Check

Verify that all leading edges are undamaged.

APU air inlets .... Check

Ensure that the APU inlet door and cooling air inlet are free of sand and dust before APU start.

Preflight Procedure - First Officer

Do the normal Preflight Procedure - First Officer with the following modifications:

Note: Minimize the use of air conditioning, other than from a ground air conditioner, as much as possible. If the APU must be used for air conditioning, maintain a temperature as high as possible while still providing a tolerable flight deck and cabin environment.

APU BLEED air switch .... OFF F/O

If APU bleed air will be used and the APU is not operating:

APU switch .... START F/O

Note: Run the APU for one full minute before using it as a bleed air source.

Engine BLEED air switches .... OFF F/O

APU BLEED air switch .... ON F/O

Engine Start Procedure

Do the normal Engine Start Procedure with the following modifications:

Note: Use a filtered ground cart for pneumatic air for engine start, if available.

ENGINE START switch .... GRD F/O

Verify that the N2 RPM increases. C, F/O

Motor the engine for 2 minutes to help remove contaminants.

Caution: Do not apply rotational force when moving the engine start lever.

Engine start lever.. IDLE detent C

Before Taxi Procedure

Do the normal Before Taxi Procedure with special emphasis on the following steps:

If bleed air is needed to maintain tolerable flight deck and cabin temperatures, use APU bleed air rather than engine bleed air during the taxi out. Limit APU bleed air use as much as possible to reduce sand and dust ingestion.

If APU bleed air will be used and the APU is not operating:

APU switch .... START F/O

Note: Run the APU for one full minute before using it as a bleed air source.

Engine BLEED air switches .... OFF F/O

APU BLEED air switch .... ON F/O

Flight controls ....Check C

Verify that there is no increase in control forces due to sand or dust contaminants.

Taxi–Out

Do the following, conditions permitting, to minimize sand and dust ingestion by the engines and to improve visibility during taxi:

- Use all engines during taxi and taxi at low speed. Limit ground speed to 10 knots and maintain thrust below 40% N1 whenever possible to avoid creating engine vortices during ground operations.
- Maintain a greater than normal separation from other aircraft while taxiing and avoid the ingestion of another engine’s wake.
- Avoid engine overhang of unprepared surfaces.
- In the event of a crosswind during 180° turns, turn away from the wind if possible to minimize sand and dust ingestion.
- Whenever possible, avoid situations that would require the airplane to be brought to a complete stop.
- Avoid excessive braking. The presence of sand or dust will increase brake wear.

Takeoff

Do the following to minimize sand and dust ingestion by the engines during takeoff:

- Use the maximum fixed derate and/or assumed temperature thrust reduction that meets performance requirements.
- Make an No Engine Bleed Takeoff if operations permit. If cabin and flight deck temperatures can be maintained at a tolerable temperature, consider an Unpressurized Takeoff.
- Before takeoff, allow sand and dust to settle if conditions allow.
- Do not take off into a sand or dust cloud.
- Use a rolling takeoff. Whenever possible, avoid setting high thrust at low speed.
- When visible sand and dust exist, consider delaying flap retraction until above the dust cloud, if operations permit.

Approach

Do the following, conditions permitting, to minimize sand and dust ingestion:

- Make an No Engine Bleed Landing if operations permit. If cabin and flight deck temperatures can be maintained at a tolerable temperature, consider an Unpressurized Landing.

Landing

Do the following to minimize sand and dust ingestion by the engines during landing:

- Use autobrakes on landing to help minimize the need for reverse thrust.
- Performance permitting, minimize the use of reverse thrust to prevent ingestion of dust and sand and to prevent reduction of visibility. Reverse thrust is most effective at high speed.

After Landing Procedure

Do the normal After Landing Procedure with the following modifications:

If bleed air is needed to maintain tolerable flight deck and cabin temperatures, use APU bleed air rather than engine bleed air during the taxi in. Limit APU bleed air use as much as possible to reduce sand and dust ingestion.

If APU bleed air will be used and the APU is not operating:

APU switch .... START PM

Note: Run the APU for one full minute before using it as a bleed air source.

Engine BLEED air switches ....OFF PM

APU BLEED air switch .... ON PM

Taxi-In

Do the following, conditions permitting, to minimize sand and dust ingestion by the engines and to improve visibility during the taxi-in:

- Use all engines and taxi at low speed. Limit ground speed to 10 knots and maintain thrust below 40% N1 whenever possible.
- Maintain a greater than normal separation from other aircraft while taxiing and avoid the ingestion of another engine’s wake.
- Avoid engine overhang of unprepared surfaces.
- In the event of a crosswind during 180° turns, turn away from the wind if possible to minimize sand and dust ingestion.
- Whenever possible, avoid situations that would require the airplane to be brought to a complete stop.
- Avoid excessive braking. The presence of sand or dust will increase brake wear.

Secure Procedure

Do the normal Secure Procedure with the following modifications:

CAUTION: Do not leave the interior unattended with a pack operating and all doors closed. With the main outflow valve closed, an unscheduled pressurization of the airplane may occur.

PACK switches ....Verify OFF F/O

Pressurization mode selector ....MAN F/O

Outflow VALVE switch .... CLOSE F/O

Position the outflow valve fully closed to inhibit the intake of sand or dust.

Additional procedures for securing the airplane during sandy or dusty conditions may be needed. These procedures are normally done by maintenance personnel, and include, but are not limited to:

- engine covers installed, if applicable.
- protective covers and plugs installed (streamers should be used to remind personnel to remove before flight).
- doors and sliding windows closed.
- all compartments closed.

Turbulence

During flight in light to moderate turbulence, the autopilot and/or autothrottle may remain engaged unless performance is objectionable. Increased thrust lever activity can be expected when encountering wind, temperature changes and large pressure changes. Short–time airspeed excursions of 10 to 15 knots can be expected.

Passenger signs ....ON

Advise passengers to fasten seat belts prior to entering areas of reported or anticipated turbulence. Instruct flight attendants to check that all passengers' seat belts are fastened.

Severe Turbulence

Yaw Damper ....ON

Autothrottle ....Disengage

AUTOPILOT .... CWS

A/P status annunciators display CWS for pitch and roll.

Note: If sustained trimming occurs, disengage the autopilot.

ENGINE START switches .... FLT

Thrust .... Set

Set thrust as needed for the phase of flight. Change thrust setting only if needed to modify an unacceptable speed trend.

PHASE OF FLIGHT	AIRSPEED
CLIMB	280 knots or .76 Mach
CRUISE	Use FMC recommended thrust settings. If the FMC is inoperative, refer to the Unreliable Airspeed page in the Performance–Inflight section of the QRH for approximate N1 settings that maintain near optimum penetration airspeed.
DESCENT	.76 Mach/280/250 knots. If severe turbulence is encountered at altitudes below 15,000 feet and the airplane gross weight is less than the maximum landing weight, the airplane may be slowed to 250 knots in the clean configuration.

Note: If an approach must be made into an area of severe turbulence, delay flap extension as long as possible. The airplane can withstand higher gust loads in the clean configuration.

Windshear

Windshear is a change of wind speed and/or direction over a short distance along the flight path. Indications of windshear are listed in the Windshear non-normal maneuver in this manual.

Avoidance

The flight crew should search for any clues to the presence of windshear along the intended flight path. Presence of windshear may be indicated by:

- Thunderstorm activity
- Virga (rain that evaporates before reaching the ground)
- Pilot reports
- Low level windshear alerting system (LLWAS) warnings.

Stay clear of thunderstorm cells and heavy precipitation and areas of known windshear. If the presence of windshear is confirmed, delay takeoff or do not continue an approach.

Precautions

If windshear is suspected, be especially alert to any of the danger signals and be prepared for the possibility of an inadvertent encounter. The following precautionary actions are recommended if windshear is suspected:

Takeoff

- Takeoff with full rated takeoff thrust is recommended, unless the use of a fixed derate is required to meet a dispatch performance requirement
- For optimum takeoff performance, use flaps 5, 10 or 15 unless limited by obstacle clearance and/or climb gradient
- Use the longest suitable runway provided it is clear of areas of known windshear
- Consider increasing Vr speed to the performance limited gross weight rotation speed, not to exceed actual gross weight Vr + 20 knots. Set V speeds for the actual gross weight. Rotate at the adjusted (higher) rotation speed. This increased rotation speed results in an increased stall margin and meets takeoff performance requirements. If windshear is encountered at or beyond the actual gross weight Vr, do not attempt to accelerate to the increased Vr but rotate without hesitation
- Be alert for any airspeed fluctuations during takeoff and initial climb. Such fluctuations may be the first indication of windshear

- Know the all–engine initial climb pitch attitude. Rotate at the normal rate to this attitude for all non–engine failure takeoffs. Minimize reductions from the initial climb pitch attitude until terrain and obstruction clearance is assured, unless stick shaker activates
- Crew coordination and awareness are very important. Develop an awareness of normal values of airspeed, attitude, vertical speed, and airspeed buildup. Closely monitor vertical flight path instruments such as vertical speed and altimeters. The pilot monitoring should be especially aware of vertical flight path instruments and call out any deviations from normal
- Should airspeed fall below the trim airspeed, unusual control column forces may be required to maintain the desired pitch attitude. If stick shaker is encountered, reduce pitch attitude. Do not exceed the Pitch Limit Indication.

Approach and Landing

- Use flaps 30 for landing
- Establish a stabilized approach no lower than 1000 feet above the airport to improve windshear recognition capability
- Use the most suitable runway that avoids the areas of suspected windshear and is compatible with crosswind or tailwind limitations. Use ILS G/S, VNAV path or VASI/PAPI indications to detect flight path deviations and help with timely detection of windshear
- If the autothrottle is disengaged, or is planned to be disengaged prior to landing, add an appropriate airspeed correction (correction applied in the same manner as gust), up to a maximum of 20 knots
- Avoid large thrust reductions or trim changes in response to sudden airspeed increases as these may be followed by airspeed decreases
- Crosscheck flight director commands using vertical flight path instruments
- Crew coordination and awareness are very important, particularly at night or in marginal weather conditions. Closely monitor the vertical flight path instruments such as vertical speed, altimeters, and glideslope displacement. The pilot monitoring should call out any deviations from normal. Use of the autopilot and autothrottle for the approach may provide more monitoring and recognition time.

Recovery

Accomplish the Windshear Escape Maneuver found in the Non–Normal Maneuvers section of the QRH.

Ice Crystal Icing (ICI)

At temperatures below freezing near convective weather, the airplane can encounter visible moisture made up of high concentrations of small ice crystals. Ice crystals can accumulate aft of the engine fan in the engine core. Ice shedding can cause engine vibration, engine power loss and engine damage. CFM56-7 engines have experienced several power loss events resulting from ice accumulation in the engine.

Ice crystal icing is difficult to detect because ice crystals do not cause significant weather radar returns. They are often found in high concentrations above and near regions of heavy precipitation. Ice crystals do not stick to cold airplane surfaces.

Avoid ICI conditions. Flight in clouds containing high concentrations of ice crystals has been associated with engine vibration, engine power loss and engine damage.

Because these conditions can be difficult to recognize, careful preflight planning is a key component of in–flight situational awareness. When ICI is encountered or suspected, do the QRH Ice Crystal Icing NNC to mitigate the effect on the flight.

Recognizing Ice Crystal Icing

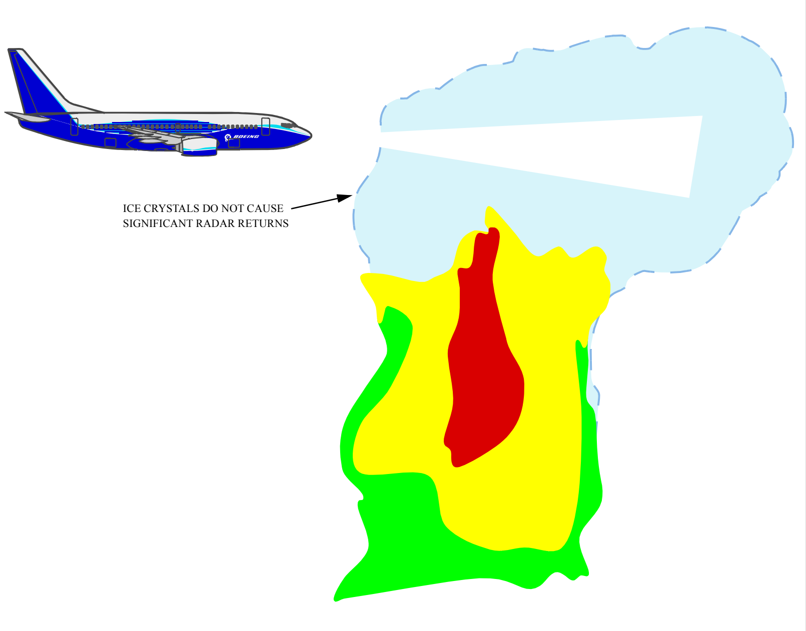
Ice crystals are most frequently found in areas of visible moisture and above altitudes normally associated with icing conditions. Their presence can be indicated by one or more of the following:

- appearance of rain on the windshield at temperatures too cold for liquid water to exist. This is due to ice crystals melting on the heated windows (sounds different than rain)
- Areas of light to moderate turbulence
- In IMC with:
  - No significant airframe icing and
  - no significant radar returns at airplane altitude and
  - heavy precipitation below the airplane, identified by amber and red radar returns on the weather radar.
- cloud tops above typical cruise levels (above the tropopause).
- Smell of ozone or sulfur
- Humidity increase
- Static discharge around the windshield (St. Elmo’s fire)

Avoiding Ice Crystal Icing

During flight in IMC, avoid flying directly over significant amber or red radar returns, even if there are no returns at airplane altitude.

Use the weather radar controls to assess weather radar reflectivity below the airplane flight path. Refer to weather radar operating instructions for additional information.



ICE CRYSTAL ICING WEATHER

Areas with a higher risk of High Ice Water Content (HIWC) are identified by some aviation weather vendors. In these areas, ICI should be suspected while operating in IMC. Use of this type of HIWC information is recommended for strategic preflight planning and in–flight adjustments in order to avoid potential ICI conditions.

Ice Crystal Icing Suspected

Exit the ice crystal icing conditions. Request a route change to minimize the time above red and amber radar returns.

Do the Ice Crystal Icing non-normal checklist.

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737-700 CFM56-7B22 KG M FAA CATA

Performance Dispatch Chapter PD

Pkg Model Identification Section 10

General

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

Serial and tabulation number are supplied by Boeing.

Registry Number	Serial Number	Tabulation Number
B-2998	29042	YA701
B-2999	29084	YA702
B-2991	29085	YA703
B-2992	29086	YA704
B-2658	30512	YA705
B-2659	30513	YA706
B-5029	30634	YA707

Registry Number	Serial Number	Tabulation Number
B-5028	30034	YA708
B-5038	30656	YA709
B-5039	28258	YA710

Performance Dispatch — Chapter PD

Takeoff — Section 10

Takeoff Field Corrections - Dry Runway

Slope Corrections

FIELD LENGTH AVAILABLE (M)	SLOPE CORRECTED FIELD LENGTH (M)								
	RUNWAY SLOPE (%)								
	-2.0	-1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	2.0
1200	1220	1220	1210	1210	1200	1180	1160	1140	1120
1400	1450	1440	1420	1410	1400	1360	1330	1290	1260
1600	1680	1660	1640	1620	1600	1550	1500	1450	1400
1800	1910	1880	1850	1830	1800	1740	1670	1610	1540
2000	2140	2100	2070	2030	2000	1920	1840	1770	1690
2200	2370	2320	2280	2240	2200	2110	2010	1920	1830
2400	2600	2550	2500	2450	2400	2290	2190	2080	1970
2600	2830	2770	2710	2660	2600	2480	2360	2240	2120
2800	3050	2990	2930	2860	2800	2660	2530	2390	2260
3000	3280	3210	3140	3070	3000	2850	2700	2550	2400
3200	3510	3430	3360	3280	3200	3040	2870	2710	2540
3400	3740	3660	3570	3490	3400	3220	3040	2860	2690
3600	3970	3880	3790	3690	3600	3410	3210	3020	2830
3800	4200	4100	4000	3900	3800	3590	3390	3180	2970
4000	4430	4320	4220	4110	4000	3780	3560	3340	3110
4200	4660	4540	4430	4310	4200	3960	3730	3490	3260
4400	4890	4770	4640	4520	4400	4150	3900	3650	3400
4600	5120	4990	4860	4730	4600	4340	4070	3810	3540
4800	5350	5210	5070	4940	4800	4520	4240	3960	3690
5000	5580	5430	5290	5140	5000	4710	4410	4120	3830

Wind Corrections

SLOPE CORR'D FIELD LENGTH (M)	SLOPE & WIND CORRECTED FIELD LENGTH (M)							
	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1200	860	980	1090	1200	1280	1350	1430	1500
1400	1030	1150	1280	1400	1480	1560	1640	1720
1600	1200	1330	1470	1600	1690	1770	1860	1940
1800	1370	1510	1660	1800	1890	1980	2070	2160
2000	1540	1690	1850	2000	2100	2190	2290	2380
2200	1710	1870	2040	2200	2300	2400	2500	2600
2400	1880	2050	2230	2400	2510	2610	2720	2820
2600	2050	2230	2420	2600	2710	2820	2930	3040
2800	2220	2410	2610	2800	2920	3030	3150	3260
3000	2380	2590	2790	3000	3120	3240	3360	3480
3200	2550	2770	2980	3200	3330	3450	3580	3700
3400	2720	2950	3170	3400	3530	3660	3790	3920
3600	2890	3130	3360	3600	3740	3870	4010	4140
3800	3060	3310	3550	3800	3940	4080	4220	4360
4000	3230	3490	3740	4000	4150	4300	4440	4580
4200	3400	3670	3930	4200	4350	4510	4650	4800
4400	3570	3850	4120	4400	4560	4720	4870	5020
4600	3740	4030	4310	4600	4760	4930	5080	5240
4800	3910	4200	4500	4800	4970	5140	5300	5460
5000	4080	4380	4690	5000	5170	5350	5510	5680

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 5

Sea Level Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1220	57.7	53.3	52.9	52.5	52.2	51.9	51.5	49.0	47.6	46.3	45.0
1400	62.0	57.2	56.8	56.4	56.0	55.7	55.3	52.6	51.1	49.7	48.4
1600	66.4	61.3	60.9	60.4	60.1	59.7	59.3	56.3	54.8	53.3	51.8
1800	70.5	65.0	64.6	64.2	63.8	63.3	62.9	59.8	58.2	56.5	55.0
2000	74.3	68.5	68.0	67.6	67.1	66.7	66.3	62.9	61.2	59.5	57.8
2200	77.9	71.8	71.4	70.9	70.4	70.0	69.5	66.0	64.2	62.4	60.6
2400	81.3	74.9	74.4	73.9	73.4	73.0	72.5	68.8	66.9	65.0	63.2
2600	81.5	77.4	76.9	76.4	75.9	75.4	74.9	71.1	69.1	67.1	65.2
2800	81.5	79.9	79.4	78.8	78.3	77.8	77.3	73.3	71.2	69.2	67.2
3000	81.5	81.5	81.5	81.2	80.7	80.1	79.6	75.5	73.3	71.2	69.1
3200	81.5	81.5	81.5	81.5	81.5	81.5	81.5	77.6	75.4	73.1	71.0
3400	81.5	81.5	81.5	81.5	81.5	81.5	81.5	79.6	77.3	75.0	72.8
3600	81.5	81.5	81.5	81.5	81.5	81.5	81.5	81.5	79.2	76.9	74.6
3800	81.5	81.5	81.5	81.5	81.5	81.5	81.5	81.5	81.0	78.5	76.2
4000	81.5	81.5	81.5	81.5	81.5	81.5	81.5	81.5	81.5	80.2	77.8
4200	81.5	81.5	81.5	81.5	81.5	81.5	81.5	81.5	81.5	81.5	79.4
4400	81.5	81.5	81.5	81.5	81.5	81.5	81.5	81.5	81.5	81.5	81.0
4600	81.5	81.5	81.5	81.5	81.5	81.5	81.5	81.5	81.5	81.5	81.5
CLIMB LIMIT WT (1000 KG)	69.5	69.1	69.0	68.9	68.8	68.7	68.5	63.4	60.9	58.6	56.2

2000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1220	55.1	50.6	50.2	49.9	49.6	49.3	48.1	45.6	44.4	43.2	42.0
1400	59.1	54.3	54.0	53.6	53.3	53.0	51.7	49.0	47.7	46.4	45.2
1600	63.4	58.2	57.8	57.5	57.1	56.8	55.4	52.6	51.1	49.8	48.4
1800	67.3	61.8	61.4	61.0	60.6	60.2	58.8	55.8	54.2	52.8	51.3
2000	70.9	65.0	64.6	64.2	63.8	63.4	61.9	58.7	57.0	55.5	54.0
2200	74.4	68.2	67.8	67.3	66.9	66.5	64.9	61.5	59.8	58.2	56.6
2400	77.6	71.1	70.7	70.2	69.8	69.3	67.7	64.1	62.3	60.7	59.0
2600	80.2	73.5	73.0	72.5	72.1	71.6	69.9	66.2	64.3	62.5	60.8
2800	81.5	75.8	75.3	74.8	74.3	73.8	72.0	68.2	66.2	64.4	62.6
3000	81.5	78.1	77.5	77.0	76.5	76.0	74.2	70.2	68.1	66.2	64.3
3200	81.5	80.3	79.7	79.2	78.7	78.2	76.2	72.1	70.0	68.0	66.0
3400	81.5	81.5	81.5	81.3	80.8	80.2	78.2	73.9	71.8	69.7	67.7
3600	81.5	81.5	81.5	81.5	81.5	81.5	80.1	75.7	73.5	71.4	69.3
3800	81.5	81.5	81.5	81.5	81.5	81.5	81.5	77.4	75.1	73.0	70.8
4000	81.5	81.5	81.5	81.5	81.5	81.5	81.5	79.0	76.7	74.5	72.3
4200	81.5	81.5	81.5	81.5	81.5	81.5	81.5	80.6	78.2	76.0	73.8
4400	81.5	81.5	81.5	81.5	81.5	81.5	81.5	81.5	79.8	77.5	75.2
4600	81.5	81.5	81.5	81.5	81.5	81.5	81.5	81.5	81.4	79.0	76.7
CLIMB LIMIT WT (1000 KG)	67.3	66.8	66.7	66.6	66.6	66.5	64.1	59.3	56.9	54.8	52.6

With engine bleed for packs off, increase field limit weight by 450 kg and climb limit weight by 1250 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 200 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 650 kg and climb limit weight by 1000 kg.

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 5

4000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1220	52.4	48.1	47.8	47.4	47.1	45.9	44.8	42.6	41.4	40.3	39.3
1400	56.2	51.6	51.3	51.0	50.6	49.4	48.2	45.7	44.5	43.3	42.2
1600	60.2	55.3	55.0	54.6	54.2	52.9	51.6	49.0	47.7	46.4	45.3
1800	64.0	58.7	58.3	58.0	57.6	56.1	54.8	52.0	50.6	49.2	48.0
2000	67.4	61.8	61.4	61.0	60.6	59.0	57.6	54.7	53.1	51.7	50.4
2200	70.6	64.8	64.4	63.9	63.5	61.9	60.4	57.3	55.7	54.2	52.8
2400	73.7	67.6	67.1	66.7	66.2	64.6	63.0	59.7	58.1	56.5	55.1
2600	76.1	69.8	69.3	68.8	68.4	66.6	65.0	61.6	59.8	58.2	56.7
2800	78.6	71.9	71.4	70.9	70.5	68.6	66.9	63.4	61.6	59.9	58.3
3000	80.9	74.1	73.5	73.0	72.5	70.6	68.9	65.2	63.3	61.5	59.9
3200	81.5	76.1	75.6	75.1	74.5	72.6	70.7	66.9	65.0	63.1	61.5
3400	81.5	78.1	77.6	77.0	76.5	74.4	72.6	68.6	66.6	64.7	63.0
3600	81.5	80.0	79.5	78.9	78.3	76.3	74.3	70.3	68.2	66.2	64.5
3800	81.5	81.5	81.2	80.6	80.1	77.9	75.9	71.8	69.7	67.7	65.8
4000	81.5	81.5	81.5	81.5	81.5	79.6	77.5	73.3	71.1	69.1	67.2
4200	81.5	81.5	81.5	81.5	81.5	81.2	79.1	74.8	72.5	70.5	68.6
4400	81.5	81.5	81.5	81.5	81.5	81.5	80.7	76.3	74.0	71.9	69.9
4600	81.5	81.5	81.5	81.5	81.5	81.5	81.5	77.8	75.4	73.3	71.3
CLIMB LIMIT WT (1000 KG)	65.2	64.7	64.6	64.5	64.4	62.0	59.8	55.3	53.1	51.1	49.3

6000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1220	49.4	45.3	45.0	44.8	43.8	42.7	41.6	39.4	38.3	37.4	36.5
1400	53.1	48.7	48.4	48.1	47.0	45.9	44.7	42.4	41.2	40.2	39.2
1600	56.9	52.2	51.9	51.6	50.4	49.1	47.9	45.4	44.2	43.1	42.0
1800	60.3	55.4	55.0	54.7	53.5	52.1	50.8	48.2	46.9	45.7	44.6
2000	63.5	58.3	57.9	57.5	56.2	54.8	53.4	50.6	49.2	48.0	46.8
2200	66.6	61.1	60.7	60.3	58.9	57.4	56.0	53.0	51.6	50.3	49.0
2400	69.5	63.7	63.3	62.9	61.4	59.9	58.3	55.3	53.8	52.4	51.1
2600	71.7	65.7	65.3	64.9	63.4	61.7	60.1	56.9	55.3	53.9	52.5
2800	74.0	67.7	67.3	66.8	65.3	63.6	61.9	58.5	56.9	55.4	54.0
3000	76.2	69.7	69.2	68.8	67.1	65.4	63.6	60.2	58.5	56.9	55.4
3200	78.3	71.6	71.1	70.6	68.9	67.1	65.3	61.7	59.9	58.4	56.8
3400	80.4	73.4	72.9	72.4	70.7	68.8	66.9	63.2	61.4	59.8	58.2
3600	81.5	75.2	74.7	74.2	72.4	70.4	68.5	64.7	62.8	61.1	59.5
3800	81.5	76.8	76.3	75.8	74.0	72.0	70.0	66.1	64.2	62.4	60.7
4000	81.5	78.4	77.9	77.4	75.5	73.5	71.4	67.5	65.5	63.7	62.0
4200	81.5	80.0	79.5	79.0	77.1	75.0	72.9	68.8	66.8	65.0	63.2
4400	81.5	81.5	81.1	80.6	78.6	76.5	74.3	70.2	68.1	66.3	64.5
4600	81.5	81.5	81.5	81.5	80.1	78.0	75.8	71.6	69.5	67.6	65.8
CLIMB LIMIT WT (1000 KG)	62.4	61.8	61.8	61.7	59.6	57.3	55.2	51.1	49.1	47.3	45.7

With engine bleed for packs off, increase field limit weight by 450 kg and climb limit weight by 1250 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 200 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 650 kg and climb limit weight by 1000 kg.

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 5

8000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1220	46.4	42.8	42.5	41.4	40.2	39.1	38.2	36.1	35.2	34.2	33.4
1400	49.8	46.0	45.7	44.5	43.2	42.1	41.0	38.8	37.8	36.9	35.9
1600	53.4	49.3	49.0	47.6	46.3	45.1	44.0	41.6	40.6	39.5	38.5
1800	56.7	52.3	52.0	50.5	49.1	47.8	46.6	44.1	43.0	41.9	40.8
2000	59.6	55.0	54.6	53.1	51.6	50.2	49.0	46.3	45.1	43.9	42.8
2200	62.5	57.6	57.3	55.7	54.1	52.6	51.3	48.5	47.3	46.0	44.8
2400	65.2	60.1	59.7	58.0	56.3	54.8	53.5	50.6	49.2	47.9	46.7
2600	67.2	61.9	61.5	59.8	58.0	56.5	55.1	52.0	50.6	49.3	47.9
2800	69.3	63.8	63.3	61.5	59.7	58.1	56.6	53.4	52.0	50.6	49.2
3000	71.3	65.6	65.1	63.3	61.4	59.7	58.1	54.8	53.3	51.9	50.4
3200	73.3	67.3	66.9	64.9	63.0	61.2	59.6	56.2	54.6	53.1	51.6
3400	75.2	69.0	68.6	66.6	64.5	62.7	61.1	57.5	55.9	54.4	52.8
3600	77.0	70.7	70.2	68.1	66.0	64.2	62.5	58.8	57.2	55.6	54.0
3800	78.7	72.2	71.7	69.6	67.5	65.5	63.8	60.1	58.4	56.7	55.1
4000	80.4	73.7	73.2	71.1	68.9	66.9	65.1	61.3	59.6	57.9	56.2
4200	81.5	75.2	74.7	72.5	70.3	68.3	66.5	62.5	60.8	59.1	57.4
4400	81.5	76.7	76.2	74.0	71.7	69.6	67.8	63.8	62.0	60.2	58.5
4600	81.5	78.2	77.7	75.4	73.1	71.0	69.1	65.0	63.2	61.4	59.6
CLIMB LIMIT WT (1000 KG)	59.5	59.1	59.0	56.4	54.0	52.0	50.1	46.2	44.5	42.8	41.2

10000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1220	43.6	40.3	39.2	38.1	37.1	36.2	35.2	33.3	32.5	31.6	30.7
1400	46.9	43.3	42.2	41.0	40.0	39.0	37.9	35.9	35.0	34.0	33.1
1600	50.3	46.5	45.2	43.9	42.8	41.8	40.7	38.5	37.5	36.5	35.5
1800	53.3	49.3	47.9	46.6	45.4	44.3	43.1	40.8	39.7	38.7	37.6
2000	56.1	51.8	50.4	48.9	47.7	46.5	45.2	42.8	41.6	40.5	39.4
2200	58.8	54.3	52.8	51.3	50.0	48.7	47.4	44.8	43.6	42.4	41.3
2400	61.3	56.6	55.0	53.4	52.1	50.7	49.4	46.6	45.4	44.2	43.0
2600	63.2	58.3	56.6	55.0	53.6	52.2	50.7	47.9	46.6	45.3	44.1
2800	65.1	59.9	58.2	56.6	55.1	53.6	52.1	49.2	47.8	46.5	45.2
3000	66.9	61.6	59.8	58.1	56.5	55.0	53.5	50.4	49.0	47.6	46.3
3200	68.7	63.2	61.4	59.6	58.0	56.4	54.8	51.6	50.2	48.7	47.3
3400	70.5	64.8	62.9	61.0	59.3	57.7	56.1	52.8	51.3	49.8	48.3
3600	72.2	66.3	64.4	62.4	60.7	59.0	57.3	54.0	52.4	50.9	49.4
3800	73.7	67.7	65.7	63.8	62.0	60.3	58.5	55.1	53.5	51.9	50.4
4000	75.3	69.1	67.1	65.1	63.3	61.5	59.7	56.2	54.6	53.0	51.4
4200	76.8	70.5	68.5	66.4	64.6	62.8	60.9	57.3	55.7	54.0	52.4
4400	78.4	72.0	69.8	67.7	65.8	64.0	62.2	58.5	56.8	55.1	53.5
4600	79.9	73.4	71.2	69.0	67.1	65.3	63.4	59.6	57.9	56.2	54.5
CLIMB LIMIT WT (1000 KG)	56.6	56.2	53.8	51.7	49.8	48.0	46.1	42.5	40.9	39.4	37.8

With engine bleed for packs off, increase field limit weight by 450 kg and climb limit weight by 1250 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 200 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 650 kg and climb limit weight by 1000 kg.

Takeoff Field Corrections - Wet Runway

Slope Corrections

FIELD LENGTH AVAILABLE (M)	SLOPE CORRECTED FIELD LENGTH (M)								
	RUNWAY SLOPE (%)								
	-2.0	-1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	2.0
1200	1210	1200	1200	1200	1200	1180	1170	1150	1140
1400	1440	1430	1420	1410	1400	1370	1350	1320	1290
1600	1680	1660	1640	1620	1600	1560	1520	1480	1450
1800	1910	1880	1860	1830	1800	1750	1700	1650	1600
2000	2150	2110	2070	2040	2000	1940	1880	1820	1760
2200	2380	2340	2290	2250	2200	2130	2060	1980	1910
2400	2620	2560	2510	2450	2400	2320	2230	2150	2060
2600	2850	2790	2730	2660	2600	2500	2410	2310	2220
2800	3090	3010	2940	2870	2800	2690	2590	2480	2370
3000	3320	3240	3160	3080	3000	2880	2760	2650	2530
3200	3560	3470	3380	3290	3200	3070	2940	2810	2680
3400	3790	3690	3600	3500	3400	3260	3120	2980	2840
3600	4030	3920	3810	3710	3600	3450	3300	3140	2990
3800	4260	4150	4030	3920	3800	3640	3470	3310	3150
4000	4500	4370	4250	4120	4000	3830	3650	3480	3300
4200	4730	4600	4470	4330	4200	4010	3830	3640	3460
4400	4970	4830	4680	4540	4400	4200	4010	3810	3610
4600	5200	5050	4900	4750	4600	4390	4180	3970	3770
4800	5440	5280	5120	4960	4800	4580	4360	4140	3920
5000	5670	5500	5340	5170	5000	4770	4540	4310	4080

Wind Corrections

SLOPE CORR'D FIELD LENGTH (M)	SLOPE & WIND CORRECTED FIELD LENGTH (M)							
	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1200	840	960	1080	1200	1280	1370	1450	1530
1400	1010	1140	1270	1400	1490	1580	1670	1760
1600	1180	1320	1460	1600	1700	1790	1890	1980
1800	1340	1500	1650	1800	1900	2010	2110	2210
2000	1510	1680	1840	2000	2110	2220	2330	2430
2200	1680	1850	2030	2200	2320	2430	2540	2660
2400	1850	2030	2220	2400	2520	2640	2760	2880
2600	2020	2210	2410	2600	2730	2860	2980	3110
2800	2190	2390	2600	2800	2940	3070	3200	3330
3000	2360	2570	2790	3000	3140	3280	3420	3560
3200	2520	2750	2970	3200	3350	3500	3640	3780
3400	2690	2930	3160	3400	3560	3710	3860	4010
3600	2860	3110	3350	3600	3760	3920	4080	4230
3800	3030	3290	3540	3800	3970	4130	4300	4460
4000	3200	3470	3730	4000	4180	4350	4520	4680
4200	3370	3650	3920	4200	4380	4560	4730	4910
4400	3540	3820	4110	4400	4590	4770	4950	5130
4600	3710	4000	4300	4600	4800	4990	5170	5360
4800	3870	4180	4490	4800	5000	5200	5390	5580
5000	4040	4360	4680	5000	5210	5410	5610	5810

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 5

Sea Level Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1360	60.8	55.6	55.2	54.8	54.4	54.1	53.7	50.8	49.4	48.2	46.9
1400	62.0	56.6	56.2	55.8	55.4	55.1	54.7	51.7	50.3	49.0	47.7
1600	66.3	60.5	60.1	59.7	59.3	58.9	58.4	55.3	53.8	52.4	51.0
1800	70.2	64.1	63.7	63.2	62.8	62.4	61.9	58.6	57.0	55.5	54.0
2000	73.9	67.5	67.0	66.5	66.0	65.6	65.1	61.6	59.9	58.4	56.8
2200	77.5	70.7	70.2	69.7	69.2	68.7	68.3	64.5	62.8	61.1	59.5
2400	80.9	73.8	73.2	72.7	72.2	71.7	71.2	67.3	65.4	63.8	62.0
2600	81.5	76.4	75.8	75.3	74.8	74.3	73.7	69.7	67.7	66.0	64.2
2800	81.5	79.1	78.5	77.9	77.4	76.9	76.3	72.1	70.0	68.2	66.3
3000	81.5	81.5	81.1	80.6	80.0	79.4	78.9	74.5	72.4	70.5	68.5
3200	81.5	81.5	81.5	81.5	81.5	81.5	81.3	76.8	74.6	72.6	70.6
3400	81.5	81.5	81.5	81.5	81.5	81.5	81.5	79.0	76.7	74.7	72.6
3600	81.5	81.5	81.5	81.5	81.5	81.5	81.5	81.1	78.7	76.6	74.5
3800	81.5	81.5	81.5	81.5	81.5	81.5	81.5	81.5	80.7	78.5	76.3
4000	81.5	81.5	81.5	81.5	81.5	81.5	81.5	81.5	81.5	80.4	78.1
4200	81.5	81.5	81.5	81.5	81.5	81.5	81.5	81.5	81.5	81.5	79.8
4400	81.5	81.5	81.5	81.5	81.5	81.5	81.5	81.5	81.5	81.5	81.5
4600	81.5	81.5	81.5	81.5	81.5	81.5	81.5	81.5	81.5	81.5	81.5
CLIMB LIMIT WT (1000 KG)	69.5	69.1	69.0	68.9	68.8	68.7	68.5	63.4	60.9	58.6	56.2

2000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1360	57.7	52.6	52.3	51.9	51.5	51.2	49.9	47.4	46.1	45.0	43.8
1400	58.8	53.6	53.2	52.8	52.5	52.1	50.8	48.2	47.0	45.8	44.6
1600	62.9	57.3	56.9	56.5	56.1	55.7	54.3	51.5	50.2	48.9	47.6
1800	66.6	60.7	60.3	59.9	59.4	59.0	57.6	54.6	53.2	51.8	50.4
2000	70.1	63.8	63.4	62.9	62.5	62.1	60.5	57.4	55.9	54.4	53.0
2200	73.5	66.9	66.4	65.9	65.5	65.0	63.4	60.1	58.5	57.0	55.5
2400	76.7	69.8	69.3	68.8	68.3	67.8	66.1	62.7	61.0	59.4	57.9
2600	79.5	72.2	71.7	71.2	70.7	70.2	68.4	64.8	63.1	61.4	59.8
2800	81.5	74.7	74.2	73.7	73.2	72.6	70.8	67.0	65.2	63.5	61.8
3000	81.5	77.2	76.7	76.1	75.6	75.1	73.1	69.2	67.4	65.6	63.8
3200	81.5	79.6	79.0	78.5	77.9	77.4	75.4	71.3	69.4	67.5	65.7
3400	81.5	81.5	81.3	80.7	80.2	79.6	77.5	73.3	71.3	69.4	67.5
3600	81.5	81.5	81.5	81.5	81.5	81.5	79.6	75.3	73.2	71.2	69.3
3800	81.5	81.5	81.5	81.5	81.5	81.5	81.5	77.1	75.0	73.0	71.0
4000	81.5	81.5	81.5	81.5	81.5	81.5	81.5	79.0	76.8	74.7	72.6
4200	81.5	81.5	81.5	81.5	81.5	81.5	81.5	80.7	78.5	76.3	74.2
4400	81.5	81.5	81.5	81.5	81.5	81.5	81.5	81.5	80.1	78.0	75.8
4600	81.5	81.5	81.5	81.5	81.5	81.5	81.5	81.5	81.5	79.5	77.3
CLIMB LIMIT WT (1000 KG)	67.3	66.8	66.7	66.6	66.6	66.5	64.1	59.3	56.9	54.8	52.6

With engine bleed for packs off, increase field limit weight by 450 kg and climb limit weight by 1250 kg.
With engine anti-ice on, decrease field limit weight by 150 kg and climb limit weight by 200 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 650 kg and climb limit weight by 1000 kg.

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 5

4000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1360	54.6	49.8	49.5	49.2	48.8	47.6	46.5	44.2	43.0	42.0	41.0
1400	55.6	50.7	50.4	50.0	49.7	48.5	47.3	45.0	43.8	42.7	41.7
1600	59.4	54.2	53.8	53.5	53.1	51.8	50.6	48.1	46.8	45.6	44.5
1800	63.0	57.4	57.0	56.7	56.3	54.9	53.6	50.9	49.5	48.3	47.1
2000	66.3	60.4	60.0	59.6	59.2	57.7	56.3	53.5	52.1	50.7	49.5
2200	69.4	63.3	62.8	62.4	62.0	60.4	59.0	56.0	54.5	53.1	51.8
2400	72.4	66.0	65.5	65.1	64.7	63.0	61.5	58.4	56.8	55.4	54.0
2600	75.0	68.3	67.8	67.3	66.9	65.2	63.6	60.3	58.7	57.2	55.8
2800	77.6	70.6	70.1	69.6	69.2	67.4	65.7	62.4	60.7	59.1	57.6
3000	80.3	73.0	72.5	72.0	71.5	69.6	67.9	64.4	62.6	61.0	59.5
3200	81.5	75.2	74.7	74.1	73.6	71.7	70.0	66.3	64.5	62.8	61.2
3400	81.5	77.4	76.8	76.2	75.7	73.8	71.9	68.1	66.3	64.5	62.9
3600	81.5	79.4	78.8	78.3	77.7	75.7	73.8	69.9	68.0	66.2	64.5
3800	81.5	81.4	80.8	80.2	79.7	77.6	75.6	71.6	69.6	67.8	66.1
4000	81.5	81.5	81.5	81.5	81.5	79.4	77.4	73.3	71.3	69.3	67.6
4200	81.5	81.5	81.5	81.5	81.5	81.2	79.1	74.9	72.8	70.9	69.1
4400	81.5	81.5	81.5	81.5	81.5	81.5	80.8	76.5	74.4	72.3	70.5
4600	81.5	81.5	81.5	81.5	81.5	81.5	81.5	78.0	75.8	73.8	71.9
CLIMB LIMIT WT (1000 KG)	65.2	64.7	64.6	64.5	64.4	62.0	59.8	55.3	53.1	51.1	49.3

6000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1360	51.3	47.0	46.7	46.4	45.3	44.2	43.1	41.0	39.9	39.0	38.1
1400	52.2	47.8	47.5	47.2	46.1	45.0	43.9	41.7	40.6	39.7	38.7
1600	55.8	51.1	50.8	50.4	49.3	48.0	46.9	44.5	43.4	42.3	41.3
1800	59.1	54.1	53.8	53.4	52.2	50.9	49.6	47.1	45.9	44.8	43.8
2000	62.2	56.9	56.5	56.2	54.9	53.5	52.1	49.5	48.2	47.1	45.9
2200	65.2	59.6	59.2	58.8	57.5	56.0	54.6	51.8	50.5	49.3	48.1
2400	68.0	62.1	61.7	61.3	59.9	58.4	56.9	54.0	52.6	51.3	50.1
2600	70.4	64.3	63.8	63.4	61.9	60.3	58.8	55.8	54.3	53.0	51.7
2800	72.8	66.5	66.0	65.6	64.0	62.3	60.8	57.6	56.1	54.7	53.3
3000	75.2	68.6	68.2	67.7	66.1	64.4	62.7	59.5	57.9	56.4	55.0
3200	77.5	70.7	70.2	69.8	68.1	66.3	64.6	61.2	59.6	58.1	56.6
3400	79.7	72.7	72.2	71.7	70.0	68.1	66.4	62.9	61.2	59.6	58.1
3600	81.5	74.6	74.1	73.6	71.8	69.9	68.1	64.5	62.7	61.1	59.6
3800	81.5	76.5	75.9	75.4	73.6	71.6	69.8	66.1	64.3	62.6	61.0
4000	81.5	78.3	77.7	77.2	75.3	73.3	71.4	67.6	65.7	64.1	62.4
4200	81.5	80.0	79.4	78.9	77.0	74.9	72.9	69.1	67.2	65.4	63.8
4400	81.5	81.5	81.1	80.6	78.6	76.5	74.5	70.5	68.6	66.8	65.1
4600	81.5	81.5	81.5	81.5	80.2	78.0	76.0	71.9	69.9	68.1	66.4
CLIMB LIMIT WT (1000 KG)	62.4	61.8	61.8	61.7	59.6	57.3	55.2	51.1	49.1	47.3	45.7

With engine bleed for packs off, increase field limit weight by 450 kg and climb limit weight by 1250 kg.
With engine anti-ice on, decrease field limit weight by 150 kg and climb limit weight by 200 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 650 kg and climb limit weight by 1000 kg.

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 5

8000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1360	48.2	44.3	44.0	42.8	41.6	40.6	39.6	37.6	36.7	35.8	34.9
1400	49.0	45.1	44.8	43.5	42.3	41.3	40.3	38.2	37.3	36.4	35.5
1600	52.4	48.1	47.8	46.5	45.2	44.1	43.1	40.8	39.8	38.8	37.9
1800	55.5	51.0	50.6	49.3	47.9	46.7	45.6	43.2	42.1	41.1	40.1
2000	58.4	53.6	53.2	51.7	50.3	49.0	47.9	45.4	44.2	43.1	42.1
2200	61.1	56.1	55.7	54.2	52.7	51.3	50.1	47.5	46.3	45.1	44.0
2400	63.8	58.5	58.1	56.5	54.9	53.5	52.2	49.5	48.2	47.0	45.8
2600	66.0	60.5	60.0	58.3	56.7	55.3	53.9	51.0	49.7	48.5	47.2
2800	68.2	62.5	62.0	60.3	58.6	57.1	55.7	52.7	51.3	50.0	48.7
3000	70.5	64.5	64.1	62.2	60.5	58.9	57.4	54.3	52.9	51.6	50.2
3200	72.6	66.4	66.0	64.1	62.2	60.6	59.1	55.9	54.4	53.0	51.6
3400	74.7	68.3	67.8	65.8	63.9	62.3	60.7	57.4	55.9	54.4	53.0
3600	76.6	70.1	69.6	67.6	65.6	63.9	62.3	58.8	57.3	55.8	54.3
3800	78.5	71.8	71.3	69.2	67.2	65.4	63.8	60.2	58.6	57.1	55.6
4000	80.4	73.5	72.9	70.8	68.7	66.9	65.2	61.6	60.0	58.4	56.8
4200	81.5	75.1	74.5	72.4	70.2	68.4	66.6	62.9	61.2	59.6	58.0
4400	81.5	76.7	76.1	73.9	71.7	69.8	68.0	64.2	62.5	60.9	59.2
4600	81.5	78.2	77.6	75.4	73.1	71.2	69.4	65.5	63.7	62.0	60.4
CLIMB LIMIT WT (1000 KG)	59.5	59.1	59.0	56.4	54.0	52.0	50.1	46.2	44.5	42.8	41.2

10000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1360	45.3	41.6	40.5	39.5	38.5	37.6	36.6	34.8	33.9	33.1	32.2
1400	46.1	42.4	41.2	40.2	39.2	38.2	37.3	35.3	34.5	33.6	32.8
1600	49.3	45.3	44.0	42.9	41.9	40.8	39.8	37.7	36.8	35.9	34.9
1800	52.2	47.9	46.6	45.4	44.3	43.2	42.1	39.9	38.9	37.9	37.0
2000	54.8	50.3	49.0	47.7	46.5	45.4	44.2	41.9	40.8	39.8	38.8
2200	57.4	52.7	51.3	49.9	48.7	47.5	46.3	43.8	42.7	41.6	40.6
2400	59.9	54.9	53.4	52.0	50.7	49.5	48.2	45.6	44.5	43.3	42.2
2600	61.9	56.7	55.2	53.7	52.3	51.0	49.7	47.0	45.8	44.6	43.5
2800	64.0	58.6	57.0	55.4	54.0	52.7	51.3	48.5	47.2	46.0	44.8
3000	66.1	60.5	58.8	57.2	55.8	54.3	52.9	50.0	48.7	47.4	46.1
3200	68.1	62.3	60.5	58.8	57.4	55.9	54.4	51.4	50.0	48.7	47.4
3400	70.0	64.0	62.2	60.4	58.9	57.4	55.8	52.7	51.3	50.0	48.6
3600	71.8	65.6	63.8	62.0	60.4	58.8	57.2	54.0	52.6	51.2	49.8
3800	73.6	67.2	65.3	63.5	61.8	60.2	58.6	55.3	53.8	52.4	50.9
4000	75.3	68.8	66.8	64.9	63.3	61.6	59.9	56.6	55.0	53.6	52.1
4200	76.9	70.3	68.3	66.3	64.6	62.9	61.2	57.8	56.2	54.7	53.2
4400	78.6	71.8	69.7	67.7	66.0	64.2	62.5	59.0	57.4	55.8	54.2
4600	80.2	73.2	71.1	69.1	67.3	65.5	63.7	60.1	58.5	56.9	55.3
CLIMB LIMIT WT (1000 KG)	56.6	56.2	53.8	51.7	49.8	48.0	46.1	42.5	40.9	39.4	37.8

With engine bleed for packs off, increase field limit weight by 450 kg and climb limit weight by 1250 kg.
With engine anti-ice on, decrease field limit weight by 150 kg and climb limit weight by 200 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 650 kg and climb limit weight by 1000 kg.

Takeoff Obstacle Limit Weight

Flaps 5

Sea Level, 30°C & Below, Zero Wind

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

Reference Obstacle Limit Weight (1000 KG)

OBSTACLE HEIGHT (M)	DISTANCE FROM BRAKE RELEASE (100 M)													
	25	30	35	40	45	50	55	60	65	70	75	80	85	90
5	67.3	70.7	73.0											
20	61.3	65.2	68.1	70.0	71.4	72.6	73.5							
40	56.3	60.2	63.2	65.6	67.5	68.9	70.0	70.9	71.7	72.4	72.9	73.4	73.9	74.2
60	52.7	56.5	59.6	62.1	64.1	65.7	67.1	68.3	69.2	70.0	70.7	71.3	71.8	72.3
80	49.7	53.5	56.6	59.2	61.3	63.0	64.5	65.8	66.9	67.9	68.7	69.4	70.0	70.5
100	47.1	50.9	54.1	56.7	58.8	60.7	62.3	63.6	64.8	65.8	66.8	67.6	68.3	68.9
120	44.8	48.7	51.8	54.5	56.7	58.6	60.2	61.7	62.9	64.0	65.0	65.8	66.6	67.3
140	42.8	46.7	49.8	52.5	54.8	56.7	58.4	59.9	61.2	62.3	63.4	64.3	65.1	65.8
160		44.9	48.0	50.7	53.0	55.0	56.7	58.2	59.6	60.8	61.9	62.8	63.7	64.5
180		43.2	46.4	49.1	51.4	53.4	55.2	56.7	58.1	59.3	60.4	61.4	62.3	63.2
200			44.8	47.6	49.9	51.9	53.7	55.3	56.7	58.0	59.1	60.2	61.1	61.9
220			43.4	46.1	48.5	50.6	52.4	54.0	55.4	56.7	57.9	58.9	59.9	60.8
240			42.1	44.8	47.2	49.3	51.1	52.7	54.2	55.5	56.7	57.8	58.8	59.7
260				43.6	46.0	48.0	49.9	51.5	53.0	54.3	55.6	56.7	57.7	58.6
280				42.5	44.8	46.9	48.8	50.4	51.9	53.3	54.5	55.6	56.6	57.6
300				41.4	43.7	45.8	47.7	49.3	50.9	52.2	53.5	54.6	55.7	56.6

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 KG)							
	46	50	54	58	62	66	70	74
30 & BELOW	0	0	0	0	0	0	0	0
32	-0.8	-0.9	-1.0	-1.1	-1.1	-1.2	-1.3	-1.4
34	-1.6	-1.8	-2.0	-2.1	-2.3	-2.5	-2.6	-2.8
36	-2.5	-2.7	-2.9	-3.2	-3.4	-3.7	-3.9	-4.2
38	-3.3	-3.6	-3.9	-4.3	-4.6	-4.9	-5.3	-5.6
40	-4.1	-4.5	-4.9	-5.3	-5.7	-6.2	-6.6	-7.0
42	-4.9	-5.3	-5.8	-6.3	-6.8	-7.3	-7.8	-8.3
44	-5.6	-6.2	-6.8	-7.3	-7.9	-8.5	-9.0	-9.6
46	-6.4	-7.0	-7.7	-8.3	-9.0	-9.6	-10.2	-10.9
48	-7.2	-7.9	-8.6	-9.3	-10.0	-10.7	-11.5	-12.2
50	-7.9	-8.7	-9.5	-10.3	-11.1	-11.9	-12.7	-13.5

Pressure Altitude Adjustments

ALT (FT)	OAT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)							
	46	50	54	58	62	66	70	74
S.L.& BELOW	0	0	0	0	0	0	0	0
1000	-1.6	-1.7	-1.9	-2.0	-2.1	-2.3	-2.4	-2.5
2000	-3.2	-3.5	-3.7	-4.0	-4.3	-4.5	-4.8	-5.0
3000	-4.7	-5.1	-5.5	-5.9	-6.3	-6.7	-7.0	-7.4
4000	-6.3	-6.8	-7.3	-7.8	-8.3	-8.8	-9.3	-9.8
5000	-7.9	-8.5	-9.2	-9.8	-10.4	-11.1	-11.7	-12.3
6000	-9.5	-10.3	-11.0	-11.8	-12.6	-13.3	-14.1	-14.9
7000	-11.1	-12.1	-13.0	-13.9	-14.9	-15.8	-16.7	-17.7
8000	-12.8	-13.9	-15.0	-16.1	-17.2	-18.3	-19.4	-20.5
9000	-14.0	-15.2	-16.5	-17.7	-19.0	-20.2	-21.4	-22.7
10000	-15.2	-16.6	-18.0	-19.4	-20.8	-22.1	-23.5	-24.9

Takeoff Obstacle Limit Weight

Flaps 5

Wind Adjustments

WIND (KTS)	OAT & ALT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)							
	46	50	54	58	62	66	70	74
15 TW	-7.7	-7.4	-7.1	-6.8	-6.5	-6.2	-5.9	-5.6
10 TW	-5.1	-4.9	-4.7	-4.5	-4.3	-4.1	-4.0	-3.8
5 TW	-2.6	-2.5	-2.4	-2.3	-2.2	-2.1	-2.0	-1.9
0	0	0	0	0	0	0	0	0
10 HW	0.9	0.8	0.8	0.7	0.6	0.6	0.5	0.4
20 HW	1.8	1.7	1.5	1.4	1.3	1.1	1.0	0.8
30 HW	2.8	2.6	2.4	2.1	1.9	1.7	1.5	1.2
40 HW	3.8	3.5	3.2	2.9	2.6	2.3	1.9	1.6

With engine bleed for packs off, increase weight by 750 kg.
With engine anti-ice on, decrease weight by 250 kg.
With engine and wing anti-ice on, decrease weight by 1150 kg (optional system).

Long Range Cruise Maximum Operating Altitude

Max Cruise Thrust

ISA + 10°C and Below

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
80	31000	-8	34400*	34400*	34400*	33500	32100
75	32400	-11	35900*	35900*	35900*	34800	33500
70	33900	-14	37300*	37300*	37300*	36300	34900
65	35500	-18	38700*	38700*	38700*	37800	36500
60	37100	-19	40200*	40200*	40200*	39500	38100
55	39000	-19	41000	41000	41000	41000	39900
50	40900	-19	41000	41000	41000	41000	41000
45	41000	-19	41000	41000	41000	41000	41000
40	41000	-19	41000	41000	41000	41000	41000
35	41000	-19	41000	41000	41000	41000	41000
30	41000	-19	41000	41000	41000	41000	41000

ISA + 15°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
80	31000	-2	33100*	33100*	33100*	33100*	32100
75	32400	-5	34900*	34900*	34900*	34800	33500
70	33900	-8	36400*	36400*	36400*	36300	34900
65	35500	-12	37900*	37900*	37900*	37800	36500
60	37100	-13	39400*	39400*	39400*	39400*	38100
55	39000	-13	40900*	40900*	40900*	40900*	39900
50	40900	-13	41000	41000	41000	41000	41000
45	41000	-13	41000	41000	41000	41000	41000
40	41000	-13	41000	41000	41000	41000	41000
35	41000	-13	41000	41000	41000	41000	41000
30	41000	-13	41000	41000	41000	41000	41000

ISA + 20°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
80	31000	4	30800*	30800*	30800*	30800*	30800*
75	32400	0	33300*	33300*	33300*	33300*	33300*
70	33900	-3	35200*	35200*	35200*	35200*	34900
65	35500	-6	36800*	36800*	36800*	36800*	36500
60	37100	-8	38300*	38300*	38300*	38300*	38100
55	39000	-8	39800*	39800*	39800*	39800*	39800*
50	40900	-8	41000	41000	41000	41000	41000
45	41000	-8	41000	41000	41000	41000	41000
40	41000	-8	41000	41000	41000	41000	41000
35	41000	-8	41000	41000	41000	41000	41000
30	41000	-8	41000	41000	41000	41000	41000

***Denotes altitude thrust limited in level flight, 100 fpm residual rate of climb.**

Long Range Cruise Trip Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
275	256	239	224	212	200	190	181	173	166	159
544	508	475	447	423	400	381	364	349	334	322
812	759	712	670	633	600	573	548	524	503	484
1081	1011	948	893	844	800	764	731	700	672	647
1348	1262	1184	1116	1055	1000	956	914	876	842	810
1614	1512	1419	1338	1266	1200	1147	1098	1052	1011	973
1880	1761	1654	1560	1476	1400	1338	1281	1228	1180	1136
2145	2011	1889	1782	1687	1600	1530	1464	1404	1349	1299
2409	2259	2123	2004	1897	1800	1721	1648	1580	1518	1462
2673	2507	2357	2225	2107	2000	1913	1831	1756	1688	1625
2936	2755	2591	2446	2317	2200	2104	2015	1932	1857	1788
3198	3002	2824	2667	2528	2400	2295	2198	2108	2026	1952
3460	3248	3057	2888	2738	2600	2487	2382	2285	2196	2115
3721	3495	3289	3109	2947	2800	2678	2565	2461	2365	2278
3982	3741	3522	3329	3157	3000	2870	2749	2637	2535	2442
4242	3986	3754	3550	3367	3200	3062	2933	2814	2705	2606
4501	4232	3987	3770	3577	3400	3253	3117	2991	2875	2770
4760	4477	4219	3991	3787	3600	3445	3301	3167	3045	2933
5019	4721	4451	4211	3996	3800	3637	3485	3344	3215	3097
5278	4966	4682	4431	4206	4000	3828	3668	3521	3385	3261
5536	5210	4914	4651	4416	4200	4020	3852	3697	3555	3425
5794	5455	5145	4871	4625	4400	4211	4036	3874	3725	3589
6052	5698	5376	5091	4835	4600	4403	4220	4050	3894	3752
6310	5942	5607	5310	5044	4800	4594	4403	4227	4064	3916
6567	6185	5838	5530	5253	5000	4786	4587	4403	4234	4080

Long Range Cruise Trip Fuel and Time

Reference Fuel and Time Required

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	29		31		33		35		37	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	1.3	0:38	1.3	0:37	1.3	0:36	1.3	0:36	1.4	0:36
400	2.3	1:09	2.3	1:08	2.2	1:07	2.2	1:05	2.2	1:04
600	3.3	1:41	3.2	1:39	3.2	1:37	3.1	1:35	3.1	1:33
800	4.3	2:13	4.2	2:10	4.1	2:07	4.0	2:04	3.9	2:01
1000	5.2	2:44	5.1	2:41	5.0	2:37	4.9	2:33	4.8	2:29
1200	6.3	3:15	6.1	3:10	6.0	3:06	5.8	3:01	5.7	2:57
1400	7.3	3:46	7.1	3:40	6.9	3:35	6.7	3:29	6.6	3:24
1600	8.3	4:16	8.1	4:10	7.9	4:04	7.7	3:57	7.5	3:52
1800	9.3	4:47	9.1	4:40	8.8	4:33	8.6	4:26	8.4	4:20
2000	10.4	5:18	10.1	5:10	9.8	5:02	9.5	4:54	9.3	4:48
2200	11.4	5:47	11.1	5:39	10.8	5:30	10.5	5:22	10.2	5:15
2400	12.5	6:17	12.2	6:07	11.8	5:58	11.5	5:49	11.2	5:42
2600	13.6	6:46	13.2	6:36	12.8	6:26	12.4	6:17	12.1	6:10
2800	14.7	7:16	14.2	7:05	13.8	6:54	13.4	6:45	13.1	6:37
3000	15.7	7:45	15.3	7:33	14.8	7:22	14.4	7:12	14.0	7:04
3200	16.9	8:14	16.4	8:01	15.9	7:49	15.4	7:39	15.1	7:31
3400	18.0	8:42	17.5	8:29	16.9	8:17	16.4	8:07	16.1	7:58
3600	19.1	9:10	18.6	8:57	18.0	8:44	17.5	8:34	17.1	8:25
3800	20.3	9:39	19.7	9:24	19.1	9:12	18.5	9:01	18.1	8:52
4000	21.4	10:07	20.8	9:52	20.1	9:39	19.5	9:28	19.1	9:19
4200	22.6	10:34	21.9	10:19	21.2	10:06	20.6	9:55	20.2	9:45
4400	23.8	11:02	23.1	10:47	22.4	10:33	21.7	10:22	21.3	10:12
4600	25.0	11:29	24.2	11:14	23.5	11:00	22.8	10:49	22.4	10:39
4800	26.2	11:57	25.4	11:41	24.6	11:27	23.9	11:15	23.5	11:05
5000	27.4	12:24	26.5	12:08	25.7	11:54	25.0	11:42	24.6	11:32

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	LANDING WEIGHT (1000 KG)				
	30	40	45	50	60
5	-0.7	-0.3	0.0	0.3	1.1
10	-1.4	-0.5	0.0	0.7	2.4
15	-2.1	-0.8	0.0	1.1	4.0
20	-2.9	-1.1	0.0	1.6	6.0
25	-3.7	-1.3	0.0	2.2	8.2
30	-4.6	-1.6	0.0	2.8	10.7

Based on 280/.78 climb, Long Range Cruise and .78/280/250 descent.

Long Range Cruise Step Climb

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
1320	1241	1170	1107	1051	1000	954	912	873	838	805
1837	1729	1633	1547	1470	1400	1336	1278	1225	1176	1131
2354	2217	2096	1987	1889	1800	1719	1645	1577	1515	1457
2870	2705	2558	2427	2308	2200	2102	2012	1930	1854	1784
3386	3193	3021	2866	2727	2600	2485	2379	2282	2193	2110
3902	3680	3483	3306	3145	3000	2867	2746	2635	2532	2437
4417	4168	3945	3745	3564	3400	3250	3113	2987	2871	2764
4932	4655	4407	4184	3983	3800	3633	3480	3340	3211	3091
5447	5141	4869	4623	4401	4200	4016	3848	3693	3550	3418
5961	5628	5330	5062	4820	4600	4399	4215	4046	3890	3745
6475	6114	5791	5501	5239	5000	4782	4583	4399	4229	4072

Trip Fuel and Time Required

AIR DIST (NM)	TRIP FUEL (1000 KG)					TIME (HRS:MIN)
	LANDING WEIGHT (1000 KG)					
	30	40	50	60	70	
1000	3.8	4.4	5.1	5.9	6.6	2:28
1400	5.2	6.0	7.0	8.1	9.1	3:23
1800	6.5	7.6	8.9	10.3	11.7	4:17
2200	8.0	9.3	10.9	12.7	14.4	5:12
2600	9.4	11.0	12.9	15.0	17.1	6:06
3000	10.9	12.7	15.1	17.5	20.0	7:00
3400	12.4	14.5	17.2	20.0	22.9	7:53
3800	14.0	16.4	19.5	22.7	25.9	8:47
4200	15.6	18.3	21.8	25.4	29.0	9:40
4600	17.2	20.3	24.2	28.1	32.2	10:34
5000	18.8	22.3	26.6	31.0	35.4	11:27

Based on 280/.78 climb, Long Range Cruise or .78 cruise and .78/280/250 descent.
Valid for all pressure altitudes with 4000 ft step climb to 2000 ft above optimum altitude.

Short Trip Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
92	79	69	61	55	50	46	42	39	37	34
158	142	128	117	108	100	93	87	82	77	73
224	204	187	173	161	150	141	133	125	119	113
288	265	245	228	213	200	188	178	169	161	153
351	325	302	283	265	250	236	224	213	203	194
415	385	360	337	318	300	284	270	257	246	235
478	445	417	392	370	350	332	316	302	288	276
541	506	474	447	422	400	380	362	346	331	317
606	567	532	502	474	450	428	408	390	373	358
672	629	591	557	527	500	476	453	433	415	398

Trip Fuel and Time Required

AIR DIST (NM)		LANDING WEIGHT (1000 KG)					TIME (HRS:MIN)
		30	40	50	60	70	
50	FUEL (1000 KG)	0.5	0.5	0.6	0.6	0.7	0:14
	ALT (FT)	13000	11000	11000	9000	9000	
100	FUEL (1000 KG)	0.7	0.8	0.9	1.0	1.1	0:22
	ALT (FT)	21000	19000	19000	17000	17000	
150	FUEL (1000 KG)	0.9	1.1	1.2	1.3	1.4	0:30
	ALT (FT)	29000	25000	25000	23000	23000	
200	FUEL (1000 KG)	1.1	1.3	1.5	1.6	1.8	0:37
	ALT (FT)	41000	35000	29000	27000	25000	
250	FUEL (1000 KG)	1.3	1.5	1.7	1.9	2.1	0:44
	ALT (FT)	41000	41000	37000	31000	29000	
300	FUEL (1000 KG)	1.4	1.7	1.9	2.1	2.4	0:50
	ALT (FT)	41000	41000	39000	35000	31000	
350	FUEL (1000 KG)	1.6	1.9	2.1	2.4	2.7	0:57
	ALT (FT)	41000	41000	39000	35000	33000	
400	FUEL (1000 KG)	1.8	2.1	2.4	2.7	3.0	1:04
	ALT (FT)	41000	41000	39000	35000	33000	
450	FUEL (1000 KG)	1.9	2.2	2.6	2.9	3.3	1:11
	ALT (FT)	41000	41000	39000	35000	33000	
500	FUEL (1000 KG)	2.1	2.4	2.8	3.2	3.6	1:19
	ALT (FT)	41000	41000	39000	35000	33000	

Based on 280/.78 climb, Long Range Cruise and .78/280/250 descent.

Holding Planning

Flaps Up

WEIGHT (1000 KG)	TOTAL FUEL FLOW (KG/HR)								
	PRESSURE ALTITUDE (FT)								
	1500	5000	10000	15000	20000	25000	30000	35000	41000
80	2890	2850	2830	2810	2770	2780	2850		
75	2720	2680	2650	2640	2590	2590	2650	2800	
70	2560	2510	2490	2470	2420	2400	2450	2540	
65	2400	2350	2320	2290	2260	2220	2270	2320	
60	2230	2190	2160	2130	2100	2040	2080	2110	
55	2070	2030	1990	1960	1930	1880	1900	1920	2100
50	1910	1860	1830	1800	1760	1720	1720	1760	1860
45	1760	1700	1660	1660	1620	1600	1570	1580	1650
40	1640	1580	1530	1490	1460	1440	1420	1400	1460
35	1480	1430	1380	1340	1310	1280	1270	1240	1280
30	1330	1290	1230	1190	1160	1140	1110	1100	1110

This table includes 5% additional fuel for holding in a racetrack pattern.

Flight Crew Oxygen Requirements

Required Pressure (PSI) for 76 Cu. Ft. Cylinder (YA701-YA706)

BOTTLE TEMPERATURE		NUMBER OF CREW USING OXYGEN		
°C	°F	2	3	4
50	122	735	1055	1360
45	113	725	1040	1340
40	104	715	1020	1320
35	95	700	1005	1300
30	86	690	990	1280
25	77	680	975	1255
20	68	670	960	1240
15	59	655	940	1215
10	50	645	925	1195
5	41	635	910	1175
0	32	620	890	1150
-5	23	610	875	1130
-10	14	600	860	1110

Required Pressure (PSI) for 114/115 Cu. Ft. Cylinder (YA707-YV754)

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

ENGINE INOP

MAX CONTINUOUS THRUST

Net Level Off Weight

PRESSURE ALTITUDE (1000 FT)	LEVEL OFF WEIGHT (1000 KG)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
30	43.0	41.7	
28	46.5	45.0	43.6
26	50.3	48.6	47.1
24	53.7	52.0	50.3
22	56.9	55.0	52.9
20	60.1	57.8	55.3
18	63.3	60.7	57.8
16	66.3	63.5	60.1
14	69.8	66.4	63.1
12	73.1	69.5	66.1
10	76.5	72.8	69.3
8	79.7	76.0	72.4

Anti-Ice Adjustments

ANTI-ICE CONFIGURATION	LEVEL OFF WEIGHT ADJUSTMENT (1000 KG)										
	PRESSURE ALTITUDE (1000 FT)										
	8	10	12	14	16	18	20	22	24	26	28
ENGINE ONLY	-2.2	-2.3	-2.4	-2.2	-1.9	-1.8	-1.8	-1.5	-1.4	-1.2	-1.1
ENGINE & WING	-8.6	-8.5	-8.4	-7.9	-7.4	-6.9	-6.5	-5.8	-5.2	-4.8	

Performance Dispatch Chapter PD

Landing Section 12

Landing Field Limit Weight - Dry Runway

Flaps 40

Based on anti-skid operative and automatic speedbrakes

Wind Corrected Field Length (M)

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1000			880	1000	1050	1110	1180	1250
1200	880	980	1080	1200	1260	1320	1400	1470
1400	1060	1160	1270	1400	1460	1540	1610	1700
1600	1230	1350	1460	1600	1670	1750	1830	1920
1800	1410	1530	1650	1800	1870	1960	2050	2140
2000	1590	1720	1840	2000	2080	2170	2270	2370
2200	1760	1900	2030	2200	2280	2380	2480	2590
2400	1940	2090	2230	2400	2490	2590	2700	2810
2600	2120	2270	2420	2600	2690	2800	2920	3040
2800	2220	2370	2520	2800	2900	3010	3140	
3000	2320	2470	2610	3000	3100			
3200	2420	2560	2710	3200				
3400	2510	2650	2800					
3600	2610	2740	2890					
3800	2710	2840	2990					
4000	2800	2930	3080					
4200	2900	3020	3170					
4400	3000	3120						
4600	3090							
4800	3190							

Field Limit Weight (1000 KG)

WIND CORR'D FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
1200	47.5	44.7	42.0	39.4		
1400	57.3	54.7	51.8	48.7	45.7	42.7
1600	65.7	62.6	59.7	56.8	54.1	50.8
1800	74.7	70.7	67.0	63.6	60.5	57.5
2000	81.8	78.8	74.7	70.7	66.9	63.4
2200			81.2	78.0	73.7	69.6
2400				83.0	79.8	76.0
2600						80.6

Decrease field limit weight by 4500 kg when using manual speedbrakes.

Landing Field Limit Weight - Dry Runway

Flaps 40

Based on anti-skid inoperative and manual speedbrakes

Wind Corrected Field Length (M)

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1800				1800	1940	2110	2250	2420
2000			1750	2000	2140	2320	2470	2650
2200		1700	1950	2200	2350	2530	2690	2870
2400	1640	1890	2140	2400	2560	2740	2910	3090
2600	1820	2080	2330	2600	2760	2950	3130	3320
2800	2000	2260	2530	2800	2970	3160	3350	3540
3000	2180	2450	2720	3000	3170	3380	3560	3760
3200	2360	2630	2910	3200	3380	3590	3780	3980
3400	2540	2820	3100	3400	3590	3800	4000	4210
3600	2720	3010	3300	3600	3790	4010	4220	4430
3800	2900	3190	3490	3800	4000	4220	4440	4650
4000	3080	3380	3680	4000	4200	4440	4650	4880
4200	3260	3570	3880	4200	4410	4650	4870	5100
4400	3440	3750	4070	4400	4620	4860	5090	5320
4600	3620	3940	4260	4600	4820	5070	5310	5550
4800	3800	4120	4450	4800	5030	5280	5530	5770
5000	3980	4310	4650	5000	5230	5490	5750	
5200	4160	4500	4840	5200	5440	5710		
5400	4340	4680	5030	5400	5650			
5600	4520	4870	5230	5600				

Field Limit Weight (1000 KG)

WIND CORR'D FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
2200	42.4	39.8				
2400	47.5	44.6	41.5	38.8		
2600	52.7	49.5	46.1	43.1	40.2	
2800	57.9	54.4	50.8	47.5	44.3	41.3
3000	63.0	59.3	55.4	51.8	48.5	45.1
3200	68.5	64.1	60.0	56.1	52.5	48.9
3400	74.2	69.2	64.4	60.3	56.4	52.6
3600	79.7	74.5	69.2	64.5	60.3	56.3
3800		79.6	74.1	68.9	64.2	59.9
4000			79.0	73.5	68.4	63.6
4200			83.5	78.2	72.6	67.4
4400				82.4	77.1	71.4
4600					81.1	75.5
4800						79.4
5000						83.1

Landing Field Limit Weight - Wet Runway

Flaps 40

Based on anti-skid operative and automatic speedbrakes

Wind Corrected Field Length (M)

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1000				1000	1060	1120	1190	1270
1200		960	1070	1200	1260	1330	1410	1490
1400	1030	1140	1260	1400	1470	1540	1630	1720
1600	1210	1330	1450	1600	1670	1760	1850	1940
1800	1380	1510	1640	1800	1880	1970	2060	2160
2000	1560	1700	1830	2000	2080	2180	2280	2390
2200	1740	1880	2020	2200	2290	2390	2500	2610
2400	1910	2070	2220	2400	2490	2600	2720	2830
2600	2090	2250	2410	2600	2700	2810	2930	3060
2800	2270	2440	2600	2800	2900	3020	3150	3280
3000	2440	2620	2790	3000	3110	3230	3370	3500
3200	2550	2720	2890	3200	3310	3450	3590	
3400	2640	2810	2980	3400	3510	3660		
3600	2740	2910	3080	3600				
3800	2840	3000	3170					
4000	2930	3090	3260					
4200	3030	3180	3350					
4400	3130	3280	3450					
4600	3220	3370	3540					
4800	3320	3460	3630					

Field Limit Weight (1000 KG)

WIND CORR'D FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
1200	39.1					
1400	48.5	45.6	42.9	40.2		
1600	57.0	54.4	51.4	48.3	45.3	42.4
1800	64.2	61.3	58.4	55.6	52.8	49.5
2000	71.9	68.2	64.7	61.5	58.5	55.6
2200	79.2	75.4	71.4	67.5	64.0	60.8
2400		81.2	78.1	73.8	69.8	66.0
2600			82.7	79.6	75.8	71.5
2800					80.6	77.1
3000						80.7

Decrease field limit weight by 4500 kg when using manual speedbrakes.

Landing Field Limit Weight - Wet Runway

Flaps 40

Based on anti-skid inoperative and manual speedbrakes

Wind Corrected Field Length (M)

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1800					1950	2140	2300	2490
2000				2000	2160	2350	2520	2710
2200			1920	2200	2360	2560	2730	2930
2400			2110	2400	2570	2770	2950	3150
2600		2020	2310	2600	2770	2980	3170	3380
2800	1920	2210	2500	2800	2980	3190	3390	3600
3000	2100	2400	2690	3000	3190	3410	3610	3820
3200	2280	2580	2880	3200	3390	3620	3830	4050
3400	2460	2770	3080	3400	3600	3830	4040	4270
3600	2640	2950	3270	3600	3800	4040	4260	4490
3800	2820	3140	3460	3800	4010	4250	4480	4720
4000	3000	3330	3660	4000	4220	4470	4700	4940
4200	3180	3510	3850	4200	4420	4680	4920	5160
4400	3360	3700	4040	4400	4630	4890	5130	5390
4600	3540	3890	4230	4600	4830	5100	5350	5610
4800	3720	4070	4430	4800	5040	5310	5570	5830
5000	3900	4260	4620	5000	5250	5520	5790	6050
5200	4080	4440	4810	5200	5450	5740	6010	6280
5400	4260	4630	5010	5400	5660	5950	6230	6500
5600	4440	4820	5200	5600	5860	6160	6440	

Field Limit Weight (1000 KG)

WIND CORR'D FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
2400	39.5					
2600	43.9	41.2	38.3			
2800	48.4	45.5	42.3	39.5		
3000	52.9	49.7	46.3	43.3	40.4	
3200	57.4	54.0	50.4	47.1	44.0	40.9
3400	61.9	58.2	54.4	50.9	47.6	44.3
3600	66.5	62.4	58.4	54.6	51.1	47.6
3800	71.5	66.7	62.3	58.3	54.5	50.9
4000	76.5	71.3	66.3	61.9	57.9	54.1
4200	81.0	75.9	70.5	65.6	61.3	57.2
4400		80.3	74.8	69.5	64.7	60.4
4600			79.0	73.5	68.4	63.6
4800			82.9	77.6	72.1	66.9
5000				81.3	75.9	70.4
5200					79.5	73.9
5400					82.9	77.5
5600						80.7

Landing Climb Limit Weight

Valid for approach with Flaps 15 and landing with Flaps 40

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

AIRPORT OAT		LANDING CLIMB LIMIT WEIGHT (1000 KG)					
		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	0	2000	4000	6000	8000	10000
54	129	54.6					
52	126	55.7					
50	122	56.8	53.1				
48	118	57.9	54.2				
46	115	59.1	55.3	51.6			
44	111	60.2	56.3	52.6			
42	108	61.4	57.4	53.6	49.5		
40	104	62.6	58.6	54.7	50.5		
38	100	63.8	59.7	55.8	51.5	46.7	
36	97	65.1	60.9	56.9	52.5	47.6	
34	93	66.4	62.1	58.0	53.6	48.6	44.6
32	90	67.7	63.3	59.1	54.6	49.5	45.6
30	86	69.0	64.4	60.1	55.5	50.5	46.5
28	82	69.0	65.6	61.2	56.5	51.4	47.4
26	79	69.1	66.7	62.3	57.5	52.3	48.3
24	75	69.1	66.7	63.4	58.7	53.2	49.2
22	72	69.2	66.8	64.5	59.7	54.2	50.0
20	68	69.3	66.8	64.6	60.8	55.3	50.9
18	64	69.3	66.9	64.6	61.7	56.5	51.8
16	61	69.3	66.9	64.7	61.8	57.8	52.7
14	57	69.4	67.0	64.7	61.8	58.9	53.9
12	54	69.4	67.0	64.8	61.8	59.0	55.1
10	50	69.5	67.1	64.8	61.9	59.0	56.1
-40	-40	70.0	67.6	65.3	62.4	59.4	56.4

With engine bleed for packs off, increase weight by 1000 kg.
With engine anti-ice on, decrease weight by 200 kg.
With engine and wing anti-ice on, decrease weight by 600 kg.
When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 4700 kg.

ENGINE INOP

ADVISORY INFORMATION

Go-Around Climb Gradient

Flaps 15

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

OAT (°C)	REFERENCE GO-AROUND GRADIENT (%)					
	PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
54	2.83					
50	3.38	2.47				
46	3.95	3.01	2.10			
42	4.53	3.54	2.59	1.61		
38	5.13	4.11	3.13	2.08	0.91	
34	5.76	4.69	3.67	2.59	1.37	0.43
30	6.39	5.27	4.19	3.06	1.84	0.88
26	6.43	5.83	4.73	3.57	2.28	1.31
22	6.45	5.85	5.29	4.10	2.76	1.75
18	6.48	5.88	5.31	4.60	3.31	2.19
14	6.50	5.90	5.34	4.62	3.93	2.68
10	6.53	5.92	5.36	4.63	3.95	3.26
6	6.55	5.94	5.37	4.65	3.96	3.27
2	6.57	5.96	5.39	4.67	3.97	3.28

Gradient Adjustment for Weight (%)

WEIGHT (1000 KG)	REFERENCE GO-AROUND GRADIENT (%)							
	0	1	2	3	4	5	6	7
70	-2.94	-3.14	-3.53	-3.87	-4.18	-4.48	-4.78	-5.09
65	-2.37	-2.55	-2.86	-3.14	-3.39	-3.63	-3.88	-4.12
60	-1.73	-1.86	-2.08	-2.28	-2.46	-2.63	-2.81	-2.99
55	-0.94	-1.02	-1.14	-1.25	-1.35	-1.44	-1.54	-1.64
50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
45	1.14	1.27	1.38	1.50	1.62	1.76	1.89	2.02
40	2.58	2.88	3.13	3.40	3.69	3.99	4.28	4.61

Gradient Adjustment for Speed (%)

SPEED (KIAS)	WEIGHT ADJUSTED GO-AROUND GRADIENT (%)										
	0	1	2	3	4	5	6	7	8	9	10
VREF40	-0.34	-0.36	-0.37	-0.38	-0.38	-0.38	-0.39	-0.39	-0.39	-0.39	-0.39
VREF40+5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VREF40+10	0.20	0.20	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21
VREF40+15	0.32	0.33	0.34	0.34	0.33	0.32	0.30	0.29	0.29	0.28	0.28
VREF40+20	0.39	0.39	0.39	0.36	0.33	0.31	0.28	0.27	0.26	0.26	0.25
VREF40+25	0.40	0.37	0.33	0.29	0.24	0.20	0.17	0.15	0.14	0.12	0.11
VREF40+30	0.34	0.28	0.21	0.14	0.07	0.01	-0.04	-0.06	-0.07	-0.09	-0.11

With engine bleed for packs off, increase gradient by 0.3%.
With engine anti-ice on, decrease gradient by 0.1%.
With engine and wing anti-ice on, decrease gradient by 0.3%.
When operating in icing conditions during any part of the flight with forecast landing temperatures below 10°C decrease gradient by 0.9%.

Quick Turnaround Limit Weight - Category A Steel and Carbon Brakes

Flaps 40

OAT (°C)	LIMIT WEIGHT (1000 KG)					
	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
54	71.8					
50	72.3	69.4				
45	72.9	70.0	67.1			
40	73.5	70.6	67.7	64.9		
35	74.2	71.2	68.3	65.5	62.8	
30	74.9	71.8	68.9	66.0	63.4	60.8
25	75.6	72.5	69.5	66.6	63.9	61.3
20	76.3	73.1	70.1	67.2	64.4	61.8
15	77.0	73.8	70.8	67.8	65.0	62.4
10	77.7	74.5	71.4	68.5	65.6	62.9
5	78.4	75.2	72.1	69.1	66.2	63.5
0	79.1	76.0	72.8	69.8	66.9	64.1
-5	79.9	76.7	73.5	70.5	67.5	64.6
-10	80.6	77.5	74.3	71.2	68.2	65.3
-15	81.4	78.3	75.1	71.9	68.9	65.9
-20	81.6	79.0	75.9	72.7	69.6	66.6
-30	81.6	80.7	77.5	74.2	71.1	68.0
-40	81.6	81.6	79.2	75.9	72.7	69.6
-50	81.6	81.6	80.9	77.7	74.4	71.2
-54	81.6	81.6	81.6	78.4	75.1	71.8

**Increase weight by 650 kg per 1% uphill slope. Decrease weight by 1150 kg per 1% downhill slope.
Increase weight by 1600 kg per 10 knots headwind. Decrease weight by 8000 kg per 10 knots tailwind.
After landing at weights exceeding those shown above, adjusted for slope and wind, wait at least 62 minutes and check that wheel thermal plugs have not melted before executing a subsequent takeoff.**

The following procedure is only applicable to steel brakes,

As an alternate procedure, ensure that each brake pressure plate surface temperature, without artificial cooling, is less than 218°C as follows: No sooner than 10 and no later than 15 minutes after parking, measure each brake pressure plate surface temperature at a minimum of two points per brake by an accurate method (using a Doric Microtemp 450 hand held thermometer or equivalent, hold temperature probe in place for 20 seconds or until reading stabilizes). If each measured temperature is less than 218°C, immediate dispatch is allowed; otherwise the required minimum ground wait period of 62 minutes applies.

The following procedure is applicable to steel and carbon brakes, if a Brake Temperature Monitoring System (BTMS) is installed:

No sooner than 10 and no later than 15 minutes after parking, check the BRAKE TEMP light. If the BRAKE TEMP light is not on, no ground waiting period is required. If the BRAKE TEMP light is on, do not dispatch until at least 62 minutes after landing, or until all the BTMS readings on the systems Display are below 3.5 and the BRAKE TEMP light is off. Check that wheel thermal plugs have not melted before making a subsequent takeoff.

Note: If any brake temperature display digit is blank or indicates 0.0 or 0.1, then this method cannot be used.

Intentionally
Blank

Performance Dispatch Chapter PD

Gear Down Section 13

GEAR DOWN

Takeoff Climb Limit Weight

Flaps 5

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

AIRPORT OAT		TAKEOFF CLIMB WEIGHT (1000 KG)					
		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	0	2000	4000	6000	8000	10000
54	129	49.2	46.2	43.3			
52	126	50.2	47.0	44.1	40.9		
50	122	51.3	47.9	44.9	41.6		
48	118	52.3	48.9	45.7	42.4		
46	115	53.4	49.9	46.5	43.1		
44	111	54.4	50.9	47.4	43.9		
42	108	55.4	51.8	48.3	44.7		
40	104	56.5	52.9	49.3	45.6	41.3	
38	100	57.7	53.9	50.3	46.5	42.1	
36	97	58.8	55.0	51.3	47.4	42.9	
34	93	60.0	56.1	52.3	48.4	43.8	
33	91	60.5	56.7	52.8	48.8	44.2	
32	90	61.1	57.2	53.3	49.3	44.7	41.1
30	86	62.3	58.3	54.3	50.1	45.6	41.9
28	82	62.4	59.3	55.3	51.0	46.4	42.8
26	79	62.4	60.3	56.3	52.0	47.2	43.6
24	75	62.5	60.4	57.4	53.0	48.1	44.4
22	72	62.5	60.4	58.4	54.0	49.0	45.2
20	68	62.6	60.5	58.5	55.0	50.0	46.0
18	64	62.6	60.5	58.5	55.9	51.1	46.9
16	61	62.6	60.6	58.6	56.0	52.4	47.7
14	57	62.7	60.6	58.6	56.0	53.5	48.8
12	54	62.7	60.6	58.6	56.0	53.5	50.0
10	50	62.8	60.7	58.7	56.1	53.5	50.9
0	32	62.9	60.9	58.8	56.2	53.7	51.0
-10	14	63.0	61.0	59.0	56.3	53.8	51.1
-20	-4	63.1	61.0	59.0	56.4	53.8	51.2
-30	-22	63.1	61.1	59.1	56.5	53.9	51.2
-40	-40	63.2	61.1	59.1	56.5	53.9	51.2

With engine bleed for packs off, increase weight by 1200 kg.
With engine anti-ice on, decrease weight by 300 kg.
With engine and wing anti-ice on, decrease weight by 4850 kg (optional system).

GEAR DOWN

Landing Climb Limit Weight

Valid for approach with Flaps 15 and landing with Flaps 30 or 40

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

AIRPORT OAT		LANDING CLIMB LIMIT WEIGHT (1000 KG)					
		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	0	2000	4000	6000	8000	10000
54	129	47.7					
52	126	48.7					
50	122	49.7	46.5				
48	118	50.7	47.4				
46	115	51.8	48.4	45.1			
44	111	52.7	49.3	46.0			
42	108	53.8	50.3	46.9	43.4		
40	104	54.8	51.3	47.9	44.2		
38	100	55.9	52.3	48.8	45.1	40.9	
36	97	57.0	53.4	49.8	46.0	41.7	
34	93	58.1	54.4	50.8	46.9	42.5	39.1
32	90	59.3	55.4	51.7	47.8	43.4	39.9
30	86	60.4	56.5	52.7	48.7	44.2	40.7
28	82	60.5	57.5	53.6	49.5	45.0	41.5
26	79	60.5	58.5	54.6	50.5	45.8	42.3
24	75	60.6	58.5	55.6	51.5	46.7	43.1
22	72	60.6	58.6	56.6	52.4	47.6	43.8
20	68	60.7	58.6	56.7	53.3	48.5	44.7
18	64	60.7	58.7	56.7	54.2	49.6	45.4
16	61	60.7	58.7	56.8	54.2	50.8	46.2
14	57	60.8	58.7	56.8	54.3	51.8	47.3
12	54	60.8	58.8	56.8	54.3	51.9	48.4
10	50	60.9	58.8	56.9	54.3	51.9	49.4
-40	-40	61.3	59.3	57.3	54.8	52.3	49.7

With engine bleed for packs off, increase weight by 1200 kg.
With engine anti-ice on, decrease weight by 200 kg.
With engine and wing anti-ice on, decrease weight by 950 kg (optional system).
When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 5300 kg.

GEAR DOWN

Takeoff Obstacle Limit Weight

Flaps 5

Sea Level, 30°C & Below, Zero Wind

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

Reference Obstacle Limit Weight (1000 KG)

OBSTACLE HEIGHT (M)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 KG)										
	DISTANCE FROM BRAKE RELEASE (100 M)										
	25	30	35	40	45	50	55	60	65	70	75
5	64.7										
20	59.1	61.9	63.7	65.0							
40	54.3	57.4	59.7	61.4	62.7	63.6	64.4	65.1	65.6		
60	50.8	54.0	56.4	58.3	59.9	61.1	62.1	62.9	63.6	64.1	64.6
80	47.9	51.2	53.8	55.8	57.5	58.8	60.0	60.9	61.7	62.4	63.0
100	45.5	48.8	51.4	53.6	55.3	56.8	58.1	59.1	60.0	60.8	61.5
120	43.4	46.7	49.4	51.6	53.5	55.0	56.3	57.4	58.4	59.3	60.0
140		44.8	47.6	49.8	51.7	53.4	54.7	55.9	57.0	57.9	58.7
160		43.2	45.9	48.2	50.2	51.8	53.3	54.5	55.6	56.6	57.4
180		41.6	44.4	46.7	48.7	50.4	51.9	53.2	54.3	55.3	56.2
200			43.0	45.3	47.4	49.1	50.6	51.9	53.1	54.2	55.1
220			41.7	44.1	46.1	47.9	49.4	50.8	52.0	53.0	54.0
240				42.9	44.9	46.7	48.3	49.7	50.9	52.0	53.0
260				41.7	43.8	45.6	47.2	48.6	49.9	51.0	52.0
280					42.7	44.6	46.2	47.6	48.9	50.0	51.1
300					41.8	43.6	45.2	46.7	48.0	49.1	50.2

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

OAT Adjustments

OAT (°C)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 KG)							
	40	44	48	52	56	60	64	68
30 & BELOW	0	0	0	0	0	0	0	0
32	-0.7	-0.8	-0.9	-1.0	-1.1	-1.1	-1.2	-1.3
34	-1.4	-1.6	-1.8	-1.9	-2.1	-2.3	-2.5	-2.7
36	-2.1	-2.4	-2.6	-2.9	-3.2	-3.5	-3.7	-4.0
38	-2.8	-3.2	-3.5	-3.9	-4.2	-4.6	-5.0	-5.3
40	-3.5	-4.0	-4.4	-4.8	-5.3	-5.8	-6.2	-6.7
42	-4.1	-4.6	-5.2	-5.7	-6.2	-6.8	-7.3	-7.9
44	-4.7	-5.3	-5.9	-6.6	-7.2	-7.8	-8.4	-9.1
46	-5.3	-6.0	-6.7	-7.4	-8.1	-8.9	-9.6	-10.3
48	-5.9	-6.7	-7.5	-8.3	-9.1	-9.9	-10.7	-11.5
50	-6.5	-7.4	-8.3	-9.2	-10.0	-10.9	-11.8	-12.7

GEAR DOWN

Takeoff Obstacle Limit Weight

Flaps 5

Pressure Altitude Adjustments

ALT (FT)	OAT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)							
	40	44	48	52	56	60	64	68
S.L. & BELOW	0	0	0	0	0	0	0	0
1000	-1.4	-1.5	-1.7	-1.8	-1.9	-2.0	-2.2	-2.3
2000	-2.8	-3.1	-3.3	-3.6	-3.8	-4.1	-4.3	-4.6
3000	-4.2	-4.6	-5.0	-5.3	-5.7	-6.1	-6.5	-6.9
4000	-5.6	-6.1	-6.6	-7.1	-7.6	-8.1	-8.6	-9.1
5000	-6.9	-7.6	-8.3	-8.9	-9.6	-10.3	-11.0	-11.7
6000	-8.2	-9.1	-9.9	-10.8	-11.6	-12.5	-13.3	-14.2
7000	-9.5	-10.5	-11.6	-12.6	-13.6	-14.6	-15.7	-16.7
8000	-10.8	-12.0	-13.2	-14.4	-15.6	-16.8	-18.0	-19.2
9000	-10.2	-11.8	-13.4	-15.0	-16.6	-18.2	-19.9	-21.5
10000	-9.7	-11.7	-13.7	-15.7	-17.7	-19.7	-21.7	-23.7

Wind Adjustments

WIND (KTS)	OAT & ALT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)							
	40	44	48	52	56	60	64	68
15 TW	-4.5	-4.5	-4.5	-4.5	-4.5	-4.5	-4.5	-4.5
10 TW	-3.0	-3.0	-3.0	-3.0	-3.0	-3.0	-3.0	-3.0
5 TW	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5	-1.5
0	0	0	0	0	0	0	0	0
10 HW	1.0	0.9	0.8	0.7	0.6	0.5	0.3	0.2
20 HW	2.0	1.8	1.6	1.4	1.1	0.9	0.7	0.5
30 HW	3.0	2.7	2.4	2.0	1.7	1.4	1.1	0.7
40 HW	4.0	3.6	3.1	2.7	2.3	1.8	1.4	1.0

With engine bleed for packs off, increase weight by 700 kg.
With engine anti-ice on, decrease weight by 1450 kg.
With engine and wing anti-ice on, decrease weight by 6150 kg (optional system).

GEAR DOWN

Long Range Cruise Altitude Capability

Max Cruise Thrust, 100 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
85	12100	9400	6600
80	14800	12300	9600
75	19000	15100	12600
70	22500	19300	15700
65	25400	23300	19600
60	27900	26400	24400
55	30200	29100	27400
50	32400	31400	30200
45	34600	33600	32500
40	37000	36100	35000

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
340	300	266	239	218	200	186	174	163	153	145
676	598	531	479	437	400	372	347	325	306	289
1007	892	794	717	654	600	559	521	488	460	435
1333	1183	1055	954	872	800	745	696	652	614	581
1655	1472	1315	1190	1089	1000	932	871	817	769	728
1973	1758	1573	1426	1305	1200	1119	1046	981	925	876
2288	2041	1829	1660	1521	1400	1306	1221	1146	1081	1025
2599	2323	2084	1894	1737	1600	1493	1397	1312	1238	1174
2907	2602	2338	2127	1953	1800	1681	1574	1479	1395	1323
3211	2878	2591	2359	2168	2000	1869	1751	1646	1553	1473

Reference Fuel and Time Required

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)							
	10		14		20		24	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	2.6	0:53	2.5	0:52	2.3	0:49	2.3	0:48
400	5.1	1:42	4.8	1:37	4.4	1:31	4.2	1:27
600	7.6	2:29	7.2	2:22	6.6	2:12	6.2	2:06
800	10.3	3:15	9.6	3:06	8.8	2:53	8.3	2:44
1000	12.9	4:02	12.1	3:50	11.0	3:33	10.3	3:23
1200	15.7	4:46	14.7	4:32	13.3	4:12	12.5	4:00
1400	18.4	5:30	17.3	5:14	15.6	4:51	14.7	4:36
1600	21.3	6:13	19.9	5:55	18.0	5:29	16.9	5:13
1800	24.2	6:55	22.7	6:35	20.5	6:06	19.3	5:49
2000	27.2	7:37	25.4	7:15	22.9	6:44	21.6	6:24

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	LANDING WEIGHT (1000 KG)					
	40	45	50	55	60	65
2	-0.2	-0.1	0.0	0.1	0.2	0.4
4	-0.4	-0.2	0.0	0.2	0.4	0.7
6	-0.6	-0.3	0.0	0.3	0.7	1.0
8	-0.8	-0.4	0.0	0.4	0.9	1.3
10	-1.0	-0.5	0.0	0.5	1.1	1.6
12	-1.2	-0.6	0.0	0.6	1.3	1.9
14	-1.4	-0.7	0.0	0.7	1.5	2.2
16	-1.6	-0.8	0.0	0.9	1.7	2.6
18	-1.8	-0.9	0.0	1.0	1.9	2.9
20	-2.0	-1.0	0.0	1.1	2.1	3.2
22	-2.2	-1.1	0.0	1.2	2.3	3.5
24	-2.4	-1.2	0.0	1.3	2.5	3.8
26	-2.6	-1.3	0.0	1.4	2.7	4.1
28	-2.8	-1.4	0.0	1.5	2.9	4.4

GEAR DOWN

Holding Planning

Flaps Up

WEIGHT (1000 KG)	TOTAL FUEL FLOW (KG/HR)							
	PRESSURE ALTITUDE (FT)							
	1500	5000	10000	15000	20000	25000	30000	35000
80	4270	4250	4240	4260	4300			
75	4030	4000	3980	3990	4010			
70	3790	3760	3730	3730	3730	3830		
65	3560	3510	3490	3470	3470	3520		
60	3320	3270	3240	3220	3200	3220	3440	
55	3080	3030	3000	2970	2940	2950	3050	
50	2850	2800	2760	2730	2690	2690	2740	
45	2620	2580	2530	2500	2450	2430	2470	2600
40	2390	2350	2320	2270	2220	2190	2220	2260

This table includes 5% additional fuel for holding in a racetrack pattern.

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Net Level Off Weight

PRESSURE ALTITUDE (1000 FT)	LEVEL OFF WEIGHT (1000 KG)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
20	41.6		
18	44.1	42.5	40.8
16	46.5	44.9	42.9
14	49.3	47.6	45.6
12	51.8	49.9	47.8
10	54.5	52.2	50.1
8	56.8	54.7	52.9
6	59.2	57.3	55.7
4	61.7	59.9	58.3
2	64.3	62.5	60.8
0	66.6	63.6	60.8

Anti-Ice Adjustments

ANTI-ICE CONFIGURATION	LEVEL OFF WEIGHT ADJUSTMENT (1000 KG)								
	PRESSURE ALTITUDE (1000 FT)								
	0	2	4	6	8	10	12	14	16
ENGINE ONLY	-1.2	-1.3	-1.4	-1.5	-1.5	-1.5	-1.3	-1.2	-1.2
ENGINE & WING*	-5.9	-5.9	-5.8	-5.8	-5.8	-5.6	-5.3	-4.9	

Performance Dispatch

Text

Introduction

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

Takeoff

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

Brake Energy or Tire Speed Limit Weight tables are only provided if they are limiting for the range of conditions covered in the FCOM Section PD.

Field Limit Weight - Slope and Wind Corrections

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

Field and Climb Limit Weight

Tables are presented for selected airport pressure altitudes and runway conditions and show both Field and Climb Limit Weights. Enter the appropriate table for pressure altitude and runway condition with “Slope and Wind Corrected Field Length” determined above and airport OAT to obtain Field Limit Weight. Also read Climb Limit Weight for the same OAT. Intermediate altitudes may be interpolated or use next higher altitude. When finding a maximum weight for a wet runway, the dry runway limit weight must also be determined and the lower of the two weights used.

Obstacle Limit Weight

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

Tire Speed Limit

Tire Speed Limit Weight tables are only provided if they are limiting for the range of conditions covered in the FCOM Section PD.

Maximum tire speed limited weights are presented for 225 MPH tires. To determine the tire speed limit weight, enter the table with OAT and airport pressure altitude. Adjust the tire speed limit weight according to the notes below the table to account for wind.

Brake Energy Limit VMBE

Brake Energy Limit Weight tables are only provided if they are limiting for the range of conditions covered in the FCOM Section PD.

The Maximum Brake Energy Speed table provides the Reference VMBE for a variety of airport pressure altitudes and temperatures. Enter the Weight Adjusted VMBE table to adjust the Reference VMBE for the actual brake release gross weight. Correct VMBE for slope and wind. If V1 exceeds VMBE, decrease brake release weight as indicated for each knot that V1 exceeds VMBE and determine V1, VR, and V2 for the lower brake release weight.

Enroute

Long Range Cruise Maximum Operating Altitude

These tables provide the maximum operating altitude in the same manner as the FMC. Maximum altitudes are shown for a given cruise weight and maneuver capability. Note that this table considers both thrust and buffet limits, providing the more limiting of the two. Any data that is thrust limited is denoted by an asterisk and represents only a thrust limited condition in level flight with 100 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 15° may cause the airplane to lose speed and/or altitude. The altitudes shown in the table are limited to the maximum certified altitude of 41000 ft.

Long Range Cruise Trip Fuel and Time

Long Range Cruise Trip Fuel and Time tables are provided to determine trip time and fuel required to destination.

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

Long Range Cruise Step Climb Trip Fuel and Time

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

Short Trip Fuel and Time

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

Holding Planning

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

Flight Crew Oxygen Requirements

This airplane is equipped with a chemical passenger oxygen system. Regulations require that sufficient oxygen be provided to the flight crew to account for the greater of supplemental breathing oxygen in the event of a cabin depressurization or protective breathing in the event of smoke or harmful fumes in the flight deck. The oxygen quantity associated with the above requirements is achieved with the minimum dispatch oxygen cylinder pressure.

To determine the minimum dispatch oxygen cylinder pressure enter the appropriate flight crew oxygen table with the number of crew plus observers using oxygen and read the minimum cylinder pressure required for the appropriate cylinder temperature.

Net Level Off Weight

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

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

Landing

Tables are provided for determining the maximum landing weight as limited by field length or climb requirements for a single landing flap.

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

Landing Field Limit Weight

For the expected runway condition and anti-skid system configuration, obtain wind corrected field length by entering the Wind Corrected Field Length table with field length available and wind component along the runway. Now enter the Field Limit Weight table with wind corrected field length and pressure altitude to read field limit weight.

Landing Climb Limit Weight

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

Go-Around Climb Gradient

Enter the Reference Go-Around Gradient table with airport OAT and pressure altitude to determine the reference go-around gradient. Then adjust the reference gradient for airplane weight and speed using the tables provided to determine the weight and speed adjusted go-around gradient. Apply the necessary corrections for engine bleed configuration and icing conditions as noted.

Quick Turnaround Limit Weight

Enter the appropriate table (Steel or Carbon Brakes) with airport pressure altitude and OAT to read maximum quick turnaround weight. Apply the noted adjustments as required.

If the landing weight exceeds the maximum quick turnaround weight, wait the specified time and then check that the wheel thermal plugs have not melted before executing a subsequent takeoff. For Steel Brakes, the alternate procedures on the charts can be used to ensure the brake temperature is within limits. These procedures cannot be used for carbon brakes.

Gear Down

This section provides flight planning data for revenue operation with gear down. Unless otherwise noted, the gear down tables in this section are identical in format and usage to the corresponding gear up tables previously described.

To eliminate erroneous displays the flight crew should enter only gross weight data on the PERF INIT page of the Control Display Unit (CDU). Omission of the cost index and cruise altitude entries on the PERF INIT page will render the VNAV function unavailable during flight. As a result, the following information will not be provided: VNAV guidance and speed schedules, trip fuel and ETA predictions, optimum and maximum altitude data, step climb and top of descent predictions, and the VNAV descent guidance path.

The gross weight entry allows the FMCS takeoff and approach speed schedules to be generated. In addition, the flap maneuver speed and VREF speed bugs will be available for display on the primary flight display speed tape. Except for VNAV, normal autopilot and autothrottle modes will remain available for use during the flight, as will the LNAV mode.

Takeoff/Landing Climb Limit Weight

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

Performance Dispatch — Chapter PD

Table of Contents — Section 20

737-700W CFM56-7B22 KG FAA CATA

General

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

Serial and tabulation number are supplied by Boeing.

Registry Number	Serial Number	Tabulation Number
B-5216	34026	YM482
B-5218	34027	YM483
B-5219	34028	YM484

Intentionally
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Takeoff Field Corrections - Dry Runway

Slope Corrections

FIELD LENGTH AVAILABLE (M)	SLOPE CORRECTED FIELD LENGTH (M)								
	RUNWAY SLOPE (%)								
	-2.0	-1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	2.0
1200	1240	1230	1220	1210	1200	1160	1110	1070	1020
1400	1460	1450	1430	1420	1400	1340	1280	1230	1170
1600	1680	1660	1640	1620	1600	1530	1460	1390	1310
1800	1890	1870	1850	1820	1800	1710	1630	1540	1460
2000	2110	2080	2050	2030	2000	1900	1800	1700	1610
2200	2340	2300	2270	2230	2200	2090	1980	1860	1750
2400	2560	2520	2480	2440	2400	2270	2150	2020	1900
2600	2790	2740	2690	2650	2600	2460	2320	2180	2040
2800	3010	2960	2910	2850	2800	2650	2490	2340	2190
3000	3240	3180	3120	3060	3000	2830	2670	2500	2330
3200	3470	3400	3330	3270	3200	3020	2840	2660	2480
3400	3690	3620	3550	3470	3400	3210	3010	2820	2630
3600	3920	3840	3760	3680	3600	3390	3190	2980	2770
3800	4150	4060	3970	3890	3800	3580	3360	3140	2920
4000	4370	4280	4190	4090	4000	3770	3530	3300	3060
4200	4600	4500	4400	4300	4200	3950	3700	3460	3210
4400	4820	4720	4610	4510	4400	4140	3880	3620	3360
4600	5050	4940	4830	4710	4600	4330	4050	3780	3500
4800	5280	5160	5040	4920	4800	4510	4220	3940	3650
5000	5500	5380	5250	5130	5000	4700	4400	4090	3790

Wind Corrections

SLOPE CORR'D FIELD LENGTH (M)	SLOPE & WIND CORRECTED FIELD LENGTH (M)							
	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1200	840	960	1080	1200	1260	1320	1390	1460
1400	1000	1140	1270	1400	1460	1530	1600	1680
1600	1170	1310	1460	1600	1670	1740	1820	1900
1800	1340	1490	1650	1800	1870	1950	2030	2120
2000	1500	1670	1830	2000	2080	2160	2250	2340
2200	1670	1850	2020	2200	2280	2370	2460	2560
2400	1840	2020	2210	2400	2490	2580	2680	2780
2600	2000	2200	2400	2600	2690	2790	2890	3000
2800	2170	2380	2590	2800	2900	3000	3110	3220
3000	2340	2560	2780	3000	3100	3210	3320	3440
3200	2500	2740	2970	3200	3310	3420	3540	3670
3400	2670	2910	3160	3400	3510	3630	3760	3890
3600	2840	3090	3350	3600	3720	3840	3970	4110
3800	3000	3270	3530	3800	3920	4050	4190	4330
4000	3170	3450	3720	4000	4130	4260	4400	4550
4200	3340	3620	3910	4200	4330	4470	4620	4770
4400	3500	3800	4100	4400	4540	4680	4830	4990
4600	3670	3980	4290	4600	4740	4890	5050	5210
4800	3840	4160	4480	4800	4950	5100	5260	5430
5000	4000	4340	4670	5000	5150	5310	5480	5650

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 5

Sea Level Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1200	57.3	52.8	52.5	52.1	51.8	51.4	51.1	48.6	47.2	45.9	44.6
1400	62.0	57.2	56.8	56.4	56.0	55.7	55.3	52.6	51.1	49.7	48.4
1600	66.4	61.3	60.9	60.4	60.1	59.7	59.3	56.3	54.8	53.3	51.8
1800	70.5	65.0	64.6	64.2	63.8	63.3	62.9	59.8	58.2	56.5	55.0
2000	74.3	68.5	68.0	67.6	67.1	66.7	66.3	62.9	61.2	59.5	57.8
2200	77.9	71.8	71.4	70.9	70.4	69.9	69.5	66.0	64.2	62.4	60.6
2400	81.3	74.9	74.4	73.9	73.4	73.0	72.5	68.8	66.9	65.0	63.2
2600	81.6	77.4	76.9	76.4	75.9	75.4	74.9	71.1	69.1	67.1	65.2
2800	81.6	79.9	79.4	78.8	78.3	77.8	77.2	73.3	71.2	69.2	67.2
3000	81.6	81.6	81.6	81.2	80.7	80.1	79.6	75.5	73.3	71.2	69.1
3200	81.6	81.6	81.6	81.6	81.6	81.6	81.6	77.6	75.4	73.1	71.0
3400	81.6	81.6	81.6	81.6	81.6	81.6	81.6	79.6	77.3	75.0	72.8
3600	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	79.2	76.9	74.6
3800	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.0	78.5	76.2
4000	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	80.2	77.8
4200	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	79.4
4400	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.0
4600	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6
CLIMB LIMIT WT (1000 KG)	73.3	72.8	72.7	72.6	72.5	72.4	72.2	66.7	64.1	61.7	59.2

2000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1200	54.7	50.2	49.8	49.5	49.2	48.9	47.7	45.3	44.0	42.8	41.7
1400	59.1	54.3	54.0	53.6	53.3	53.0	51.7	49.0	47.7	46.4	45.2
1600	63.4	58.2	57.8	57.5	57.1	56.8	55.4	52.6	51.1	49.8	48.4
1800	67.3	61.8	61.4	61.0	60.6	60.2	58.8	55.8	54.2	52.8	51.3
2000	70.9	65.0	64.6	64.2	63.8	63.4	61.9	58.7	57.0	55.5	54.0
2200	74.3	68.2	67.8	67.3	66.9	66.5	64.9	61.5	59.8	58.2	56.6
2400	77.6	71.1	70.7	70.2	69.8	69.3	67.7	64.1	62.3	60.7	59.0
2600	80.2	73.5	73.0	72.5	72.1	71.6	69.9	66.2	64.3	62.5	60.8
2800	81.6	75.8	75.3	74.8	74.3	73.8	72.0	68.2	66.2	64.4	62.6
3000	81.6	78.1	77.5	77.0	76.5	76.0	74.2	70.2	68.1	66.2	64.3
3200	81.6	80.3	79.7	79.2	78.7	78.2	76.2	72.1	70.0	68.0	66.0
3400	81.6	81.6	81.6	81.3	80.8	80.2	78.2	73.9	71.8	69.7	67.7
3600	81.6	81.6	81.6	81.6	81.6	81.6	80.1	75.7	73.5	71.4	69.3
3800	81.6	81.6	81.6	81.6	81.6	81.6	81.6	77.4	75.1	73.0	70.8
4000	81.6	81.6	81.6	81.6	81.6	81.6	81.6	79.0	76.7	74.5	72.3
4200	81.6	81.6	81.6	81.6	81.6	81.6	81.6	80.6	78.2	76.0	73.8
4400	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	79.8	77.5	75.2
4600	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.4	79.0	76.7
CLIMB LIMIT WT (1000 KG)	70.9	70.4	70.3	70.3	70.2	70.0	67.6	62.5	60.0	57.7	55.4

With engine bleed for packs off, increase field limit weight by 450 kg and climb limit weight by 1350 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 200 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 650 kg and climb limit weight by 1150 kg.

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 5

4000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1200	51.9	47.7	47.4	47.1	46.7	45.6	44.5	42.2	41.0	39.9	38.9
1400	56.2	51.6	51.3	51.0	50.6	49.4	48.2	45.7	44.5	43.3	42.2
1600	60.2	55.3	55.0	54.6	54.2	52.9	51.6	49.0	47.7	46.4	45.3
1800	64.0	58.7	58.3	58.0	57.6	56.1	54.8	52.0	50.6	49.2	48.0
2000	67.4	61.8	61.4	61.0	60.6	59.0	57.6	54.7	53.1	51.7	50.4
2200	70.6	64.8	64.4	63.9	63.5	61.9	60.4	57.3	55.7	54.2	52.8
2400	73.7	67.6	67.1	66.7	66.2	64.6	63.0	59.7	58.1	56.5	55.1
2600	76.1	69.8	69.3	68.8	68.4	66.6	65.0	61.6	59.8	58.2	56.7
2800	78.5	71.9	71.4	70.9	70.5	68.6	66.9	63.4	61.6	59.9	58.3
3000	80.9	74.1	73.5	73.0	72.5	70.6	68.9	65.2	63.3	61.5	59.9
3200	81.6	76.1	75.6	75.1	74.5	72.6	70.7	66.9	65.0	63.2	61.5
3400	81.6	78.1	77.6	77.0	76.5	74.4	72.6	68.6	66.6	64.7	63.0
3600	81.6	80.0	79.5	78.9	78.3	76.3	74.3	70.3	68.2	66.2	64.5
3800	81.6	81.6	81.2	80.6	80.1	77.9	75.9	71.8	69.7	67.7	65.8
4000	81.6	81.6	81.6	81.6	81.6	79.6	77.5	73.3	71.1	69.1	67.2
4200	81.6	81.6	81.6	81.6	81.6	81.2	79.1	74.8	72.6	70.5	68.6
4400	81.6	81.6	81.6	81.6	81.6	81.6	80.7	76.3	74.0	71.9	69.9
4600	81.6	81.6	81.6	81.6	81.6	81.6	81.6	77.8	75.4	73.3	71.3
CLIMB LIMIT WT (1000 KG)	68.7	68.2	68.1	68.0	67.9	65.4	63.0	58.3	55.9	53.8	51.8

6000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1200	49.0	45.0	44.7	44.4	43.4	42.3	41.2	39.1	38.0	37.1	36.2
1400	53.1	48.7	48.4	48.1	47.0	45.9	44.7	42.4	41.2	40.2	39.2
1600	56.9	52.2	51.9	51.6	50.4	49.1	47.9	45.4	44.2	43.1	42.0
1800	60.3	55.4	55.0	54.7	53.5	52.1	50.8	48.2	46.9	45.7	44.6
2000	63.5	58.3	57.9	57.5	56.2	54.8	53.4	50.6	49.2	48.0	46.8
2200	66.6	61.1	60.7	60.3	58.9	57.4	55.9	53.0	51.6	50.3	49.0
2400	69.5	63.7	63.3	62.9	61.4	59.9	58.3	55.3	53.8	52.4	51.1
2600	71.7	65.7	65.3	64.9	63.4	61.7	60.1	56.9	55.3	53.9	52.5
2800	74.0	67.7	67.3	66.8	65.3	63.6	61.9	58.5	56.9	55.4	54.0
3000	76.2	69.7	69.2	68.8	67.1	65.4	63.6	60.2	58.5	56.9	55.4
3200	78.3	71.6	71.1	70.6	68.9	67.1	65.3	61.7	59.9	58.4	56.8
3400	80.4	73.4	72.9	72.4	70.7	68.8	66.9	63.2	61.4	59.8	58.2
3600	81.6	75.2	74.7	74.2	72.4	70.5	68.5	64.7	62.8	61.1	59.5
3800	81.6	76.8	76.3	75.8	74.0	72.0	70.0	66.1	64.2	62.4	60.7
4000	81.6	78.4	77.9	77.4	75.5	73.5	71.4	67.5	65.5	63.7	62.0
4200	81.6	80.0	79.5	79.0	77.1	75.0	72.9	68.8	66.8	65.0	63.2
4400	81.6	81.6	81.1	80.6	78.6	76.5	74.4	70.2	68.1	66.3	64.5
4600	81.6	81.6	81.6	81.6	80.1	78.0	75.8	71.6	69.5	67.6	65.8
CLIMB LIMIT WT (1000 KG)	65.8	65.2	65.2	65.1	62.8	60.4	58.2	53.8	51.7	49.9	48.1

With engine bleed for packs off, increase field limit weight by 450 kg and climb limit weight by 1350 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 200 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 650 kg and climb limit weight by 1150 kg.

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 5

8000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1200	46.0	42.4	42.2	41.0	39.8	38.8	37.8	35.8	34.9	34.0	33.1
1400	49.8	46.0	45.7	44.5	43.2	42.1	41.0	38.8	37.8	36.9	35.9
1600	53.4	49.3	49.0	47.6	46.3	45.1	44.0	41.6	40.6	39.5	38.5
1800	56.7	52.3	52.0	50.5	49.1	47.8	46.6	44.1	43.0	41.9	40.8
2000	59.6	55.0	54.6	53.1	51.6	50.2	49.0	46.3	45.1	43.9	42.8
2200	62.5	57.6	57.3	55.7	54.1	52.6	51.3	48.5	47.2	46.0	44.8
2400	65.2	60.1	59.7	58.0	56.3	54.9	53.5	50.6	49.2	47.9	46.7
2600	67.2	61.9	61.5	59.8	58.0	56.5	55.1	52.0	50.6	49.3	47.9
2800	69.3	63.8	63.3	61.5	59.7	58.1	56.6	53.4	52.0	50.6	49.2
3000	71.3	65.6	65.1	63.3	61.4	59.7	58.1	54.8	53.3	51.9	50.4
3200	73.3	67.3	66.9	64.9	63.0	61.2	59.6	56.2	54.6	53.1	51.6
3400	75.2	69.0	68.6	66.6	64.5	62.7	61.1	57.5	55.9	54.4	52.8
3600	77.0	70.7	70.2	68.1	66.0	64.2	62.5	58.8	57.2	55.6	54.0
3800	78.7	72.2	71.7	69.6	67.5	65.5	63.8	60.1	58.4	56.7	55.1
4000	80.4	73.7	73.2	71.1	68.9	66.9	65.1	61.3	59.6	57.9	56.2
4200	81.6	75.2	74.7	72.5	70.3	68.3	66.5	62.6	60.8	59.1	57.4
4400	81.6	76.7	76.2	74.0	71.7	69.6	67.8	63.8	62.0	60.2	58.5
4600	81.6	78.2	77.7	75.4	73.1	71.0	69.1	65.0	63.2	61.4	59.6
CLIMB LIMIT WT (1000 KG)	62.8	62.3	62.3	59.5	57.0	54.8	52.8	48.7	46.9	45.1	43.4

10000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1200	43.3	40.0	38.9	37.8	36.8	35.9	34.9	33.1	32.2	31.3	30.5
1400	46.9	43.4	42.2	41.0	40.0	39.0	37.9	35.9	35.0	34.0	33.1
1600	50.3	46.5	45.2	43.9	42.8	41.8	40.7	38.5	37.5	36.5	35.5
1800	53.3	49.3	47.9	46.6	45.4	44.3	43.1	40.8	39.7	38.7	37.6
2000	56.1	51.8	50.4	48.9	47.7	46.5	45.2	42.8	41.6	40.5	39.4
2200	58.8	54.3	52.8	51.3	50.0	48.7	47.4	44.8	43.6	42.4	41.3
2400	61.3	56.6	55.0	53.4	52.1	50.7	49.4	46.6	45.4	44.2	43.0
2600	63.2	58.3	56.6	55.0	53.6	52.2	50.7	47.9	46.6	45.3	44.1
2800	65.1	59.9	58.2	56.6	55.1	53.6	52.1	49.2	47.8	46.5	45.2
3000	66.9	61.6	59.8	58.1	56.5	55.0	53.5	50.4	49.0	47.6	46.3
3200	68.7	63.2	61.4	59.6	58.0	56.4	54.8	51.6	50.2	48.7	47.3
3400	70.5	64.8	62.9	61.0	59.4	57.7	56.1	52.8	51.3	49.8	48.4
3600	72.2	66.3	64.4	62.4	60.7	59.0	57.3	54.0	52.4	50.9	49.4
3800	73.7	67.7	65.7	63.8	62.0	60.3	58.5	55.1	53.5	51.9	50.4
4000	75.3	69.1	67.1	65.1	63.3	61.5	59.7	56.2	54.6	53.0	51.4
4200	76.8	70.5	68.5	66.4	64.6	62.8	60.9	57.3	55.7	54.1	52.4
4400	78.4	72.0	69.8	67.7	65.8	64.0	62.2	58.5	56.8	55.1	53.5
4600	79.9	73.4	71.2	69.0	67.1	65.3	63.4	59.6	57.9	56.2	54.5
CLIMB LIMIT WT (1000 KG)	59.7	59.3	56.8	54.5	52.5	50.6	48.6	44.8	43.1	41.5	39.8

With engine bleed for packs off, increase field limit weight by 450 kg and climb limit weight by 1350 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 200 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 650 kg and climb limit weight by 1150 kg.

Takeoff Field Corrections - Wet Runway

Slope Corrections

FIELD LENGTH AVAILABLE (M)	SLOPE CORRECTED FIELD LENGTH (M)								
	RUNWAY SLOPE (%)								
	-2.0	-1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	2.0
1200	1250	1240	1230	1210	1200	1160	1110	1070	1020
1400	1470	1450	1430	1420	1400	1350	1300	1240	1190
1600	1680	1660	1640	1620	1600	1540	1480	1420	1360
1800	1900	1870	1850	1820	1800	1730	1670	1600	1530
2000	2110	2080	2060	2030	2000	1930	1850	1780	1700
2200	2330	2300	2270	2230	2200	2120	2040	1950	1870
2400	2570	2530	2480	2440	2400	2310	2220	2130	2040
2600	2800	2750	2700	2650	2600	2500	2410	2310	2210
2800	3040	2980	2920	2860	2800	2700	2590	2490	2380
3000	3280	3210	3140	3070	3000	2890	2780	2660	2550
3200	3510	3430	3360	3280	3200	3070	2950	2820	2690
3400	3750	3660	3570	3490	3400	3260	3110	2970	2830
3600	3980	3890	3790	3700	3600	3440	3280	3120	2960
3800	4220	4110	4010	3900	3800	3620	3450	3270	3090
4000	4450	4340	4230	4110	4000	3810	3610	3420	3230
4200	4690	4570	4440	4320	4200	3990	3780	3570	3360
4400	4920	4790	4660	4530	4400	4170	3950	3720	3490
4600	5160	5020	4880	4740	4600	4360	4110	3870	3630
4800	5400	5250	5100	4950	4800	4540	4280	4020	3760
5000	5630	5470	5320	5160	5000	4720	4450	4170	3890

Wind Corrections

SLOPE CORR'D FIELD LENGTH (M)	SLOPE & WIND CORRECTED FIELD LENGTH (M)							
	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1200	780	920	1060	1200	1260	1320	1380	1440
1400	950	1100	1250	1400	1470	1530	1600	1660
1600	1120	1280	1440	1600	1670	1740	1820	1890
1800	1290	1460	1630	1800	1880	1960	2030	2110
2000	1460	1640	1820	2000	2080	2170	2250	2330
2200	1630	1820	2010	2200	2290	2380	2470	2550
2400	1800	2000	2200	2400	2500	2590	2680	2770
2600	1970	2180	2390	2600	2700	2800	2900	2990
2800	2140	2360	2580	2800	2910	3010	3120	3220
3000	2310	2540	2770	3000	3110	3230	3330	3440
3200	2480	2720	2960	3200	3320	3440	3550	3660
3400	2650	2900	3150	3400	3530	3650	3770	3880
3600	2820	3080	3340	3600	3730	3860	3980	4100
3800	2990	3260	3530	3800	3940	4070	4200	4320
4000	3160	3440	3720	4000	4140	4280	4420	4550
4200	3330	3620	3910	4200	4350	4500	4630	4770
4400	3500	3800	4100	4400	4560	4710	4850	4990
4600	3670	3980	4290	4600	4760	4920	5070	5210
4800	3840	4160	4480	4800	4970	5130	5290	5430
5000	4010	4340	4670	5000	5180	5340	5500	5650

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 5

Sea Level Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1400	62.0	56.6	56.2	55.8	55.4	55.1	54.7	51.7	50.3	49.0	47.7
1600	66.3	60.5	60.1	59.7	59.3	58.9	58.4	55.3	53.8	52.4	51.0
1800	70.2	64.1	63.7	63.2	62.8	62.4	61.9	58.6	57.0	55.5	54.0
2000	73.9	67.5	67.0	66.5	66.0	65.6	65.1	61.6	59.9	58.4	56.8
2200	77.5	70.7	70.2	69.7	69.2	68.7	68.3	64.5	62.7	61.1	59.5
2400	80.9	73.8	73.2	72.7	72.2	71.7	71.2	67.3	65.4	63.8	62.0
2600	81.6	76.5	75.9	75.4	74.8	74.3	73.8	69.7	67.8	66.0	64.2
2800	81.6	79.1	78.5	78.0	77.4	76.9	76.3	72.1	70.1	68.2	66.4
3000	81.6	81.6	81.1	80.6	80.0	79.5	78.9	74.5	72.4	70.5	68.5
3200	81.6	81.6	81.6	81.6	81.6	81.6	81.3	76.8	74.6	72.6	70.6
3400	81.6	81.6	81.6	81.6	81.6	81.6	81.6	79.0	76.7	74.7	72.6
3600	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.1	78.7	76.6	74.5
3800	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	80.7	78.5	76.3
4000	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	80.4	78.1
4200	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	79.9
4400	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.5
4600	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6
CLIMB LIMIT WT (1000 KG)	73.3	72.8	72.7	72.6	72.5	72.4	72.2	66.7	64.1	61.7	59.2

2000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1400	58.8	53.6	53.2	52.8	52.5	52.1	50.8	48.2	47.0	45.8	44.6
1600	62.9	57.3	56.9	56.5	56.1	55.7	54.3	51.5	50.2	48.9	47.6
1800	66.6	60.7	60.3	59.9	59.4	59.0	57.6	54.6	53.2	51.8	50.4
2000	70.1	63.8	63.4	62.9	62.5	62.1	60.5	57.4	55.9	54.4	53.0
2200	73.5	66.9	66.4	65.9	65.5	65.0	63.4	60.1	58.5	57.0	55.5
2400	76.7	69.8	69.3	68.8	68.3	67.8	66.1	62.7	61.0	59.4	57.9
2600	79.5	72.3	71.8	71.3	70.8	70.3	68.5	64.9	63.1	61.5	59.8
2800	81.6	74.8	74.2	73.7	73.2	72.7	70.8	67.1	65.3	63.5	61.8
3000	81.6	77.2	76.7	76.1	75.6	75.1	73.1	69.2	67.4	65.6	63.8
3200	81.6	79.6	79.0	78.5	77.9	77.4	75.4	71.3	69.4	67.5	65.7
3400	81.6	81.6	81.3	80.7	80.2	79.6	77.5	73.3	71.3	69.4	67.5
3600	81.6	81.6	81.6	81.6	81.6	81.6	79.6	75.3	73.2	71.2	69.3
3800	81.6	81.6	81.6	81.6	81.6	81.6	81.6	77.2	75.0	73.0	71.0
4000	81.6	81.6	81.6	81.6	81.6	81.6	81.6	79.0	76.8	74.7	72.6
4200	81.6	81.6	81.6	81.6	81.6	81.6	81.6	80.7	78.5	76.3	74.2
4400	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	80.1	78.0	75.8
4600	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	79.5	77.3
CLIMB LIMIT WT (1000 KG)	70.9	70.4	70.3	70.3	70.2	70.0	67.6	62.5	60.0	57.7	55.4

With engine bleed for packs off, increase field limit weight by 450 kg and climb limit weight by 1350 kg.
With engine anti-ice on, decrease field limit weight by 150 kg and climb limit weight by 200 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 650 kg and climb limit weight by 1150 kg.

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 5

4000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1400	55.6	50.7	50.4	50.0	49.7	48.5	47.3	45.0	43.8	42.7	41.7
1600	59.4	54.2	53.8	53.5	53.1	51.8	50.6	48.1	46.8	45.6	44.5
1800	63.0	57.4	57.0	56.7	56.3	54.9	53.6	50.9	49.6	48.3	47.1
2000	66.3	60.4	60.0	59.6	59.2	57.7	56.3	53.5	52.1	50.7	49.5
2200	69.4	63.3	62.8	62.4	62.0	60.4	59.0	56.0	54.5	53.1	51.8
2400	72.4	66.0	65.5	65.1	64.7	63.0	61.5	58.4	56.8	55.4	54.0
2600	75.1	68.3	67.9	67.4	66.9	65.3	63.7	60.4	58.8	57.2	55.9
2800	77.7	70.7	70.2	69.7	69.2	67.5	65.8	62.4	60.7	59.1	57.7
3000	80.3	73.0	72.5	72.0	71.5	69.6	67.9	64.4	62.6	61.0	59.5
3200	81.6	75.2	74.7	74.1	73.6	71.7	70.0	66.3	64.5	62.8	61.2
3400	81.6	77.4	76.8	76.2	75.7	73.8	71.9	68.1	66.3	64.5	62.9
3600	81.6	79.4	78.8	78.3	77.8	75.7	73.8	69.9	68.0	66.2	64.5
3800	81.6	81.4	80.8	80.2	79.7	77.6	75.6	71.6	69.6	67.8	66.1
4000	81.6	81.6	81.6	81.6	81.5	79.4	77.4	73.3	71.3	69.3	67.6
4200	81.6	81.6	81.6	81.6	81.6	81.2	79.1	74.9	72.8	70.9	69.1
4400	81.6	81.6	81.6	81.6	81.6	81.6	80.8	76.5	74.4	72.3	70.5
4600	81.6	81.6	81.6	81.6	81.6	81.6	81.6	78.0	75.8	73.8	71.9
CLIMB LIMIT WT (1000 KG)	68.7	68.2	68.1	68.0	67.9	65.4	63.0	58.3	55.9	53.8	51.8

6000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1400	52.2	47.8	47.5	47.2	46.1	45.0	43.9	41.7	40.6	39.7	38.7
1600	55.8	51.1	50.8	50.4	49.3	48.0	46.9	44.5	43.4	42.3	41.3
1800	59.1	54.1	53.8	53.4	52.2	50.9	49.6	47.1	45.9	44.8	43.8
2000	62.2	56.9	56.5	56.2	54.9	53.5	52.1	49.5	48.2	47.1	45.9
2200	65.2	59.6	59.2	58.8	57.5	56.0	54.6	51.8	50.5	49.3	48.1
2400	68.0	62.2	61.7	61.3	59.9	58.4	56.9	54.0	52.6	51.3	50.1
2600	70.4	64.3	63.9	63.5	62.0	60.4	58.9	55.9	54.4	53.0	51.7
2800	72.8	66.5	66.1	65.6	64.1	62.4	60.8	57.7	56.1	54.7	53.4
3000	75.2	68.7	68.2	67.7	66.1	64.4	62.7	59.5	57.9	56.4	55.0
3200	77.5	70.7	70.2	69.8	68.1	66.3	64.6	61.2	59.6	58.1	56.6
3400	79.7	72.7	72.2	71.7	70.0	68.1	66.4	62.9	61.2	59.6	58.1
3600	81.6	74.6	74.1	73.6	71.8	69.9	68.1	64.5	62.7	61.1	59.6
3800	81.6	76.5	75.9	75.4	73.6	71.6	69.8	66.1	64.3	62.6	61.0
4000	81.6	78.3	77.7	77.2	75.3	73.3	71.4	67.6	65.7	64.1	62.4
4200	81.6	80.0	79.4	78.9	77.0	74.9	73.0	69.1	67.2	65.4	63.8
4400	81.6	81.6	81.1	80.6	78.6	76.5	74.5	70.5	68.6	66.8	65.1
4600	81.6	81.6	81.6	81.6	80.2	78.0	76.0	71.9	69.9	68.1	66.4
CLIMB LIMIT WT (1000 KG)	65.8	65.2	65.2	65.1	62.8	60.4	58.2	53.8	51.7	49.9	48.1

With engine bleed for packs off, increase field limit weight by 450 kg and climb limit weight by 1350 kg.
With engine anti-ice on, decrease field limit weight by 150 kg and climb limit weight by 200 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 650 kg and climb limit weight by 1150 kg.

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 5

8000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1400	49.0	45.1	44.8	43.5	42.3	41.3	40.3	38.2	37.3	36.4	35.5
1600	52.4	48.1	47.8	46.5	45.2	44.1	43.1	40.8	39.8	38.8	37.9
1800	55.5	51.0	50.6	49.3	47.9	46.7	45.6	43.2	42.1	41.1	40.1
2000	58.4	53.6	53.2	51.7	50.3	49.0	47.9	45.4	44.2	43.1	42.1
2200	61.1	56.1	55.7	54.2	52.7	51.3	50.1	47.5	46.3	45.1	44.0
2400	63.8	58.5	58.1	56.5	54.9	53.5	52.2	49.5	48.2	47.0	45.8
2600	66.0	60.5	60.1	58.4	56.8	55.3	54.0	51.1	49.8	48.5	47.3
2800	68.3	62.5	62.1	60.3	58.6	57.1	55.7	52.7	51.4	50.0	48.7
3000	70.5	64.5	64.1	62.2	60.5	58.9	57.4	54.3	52.9	51.6	50.2
3200	72.6	66.4	66.0	64.1	62.2	60.6	59.1	55.9	54.4	53.0	51.6
3400	74.7	68.3	67.8	65.8	63.9	62.3	60.7	57.4	55.9	54.4	53.0
3600	76.6	70.1	69.6	67.6	65.6	63.9	62.3	58.8	57.3	55.8	54.3
3800	78.5	71.8	71.3	69.2	67.2	65.4	63.8	60.2	58.6	57.1	55.6
4000	80.4	73.5	72.9	70.8	68.7	66.9	65.2	61.6	60.0	58.4	56.8
4200	81.6	75.1	74.5	72.4	70.2	68.4	66.6	62.9	61.2	59.6	58.0
4400	81.6	76.7	76.1	73.9	71.7	69.8	68.0	64.2	62.5	60.9	59.2
4600	81.6	78.2	77.6	75.4	73.1	71.2	69.4	65.5	63.7	62.0	60.4
CLIMB LIMIT WT (1000 KG)	62.8	62.3	62.3	59.5	57.0	54.8	52.8	48.7	46.9	45.1	43.4

10000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1400	46.1	42.4	41.2	40.2	39.2	38.3	37.3	35.4	34.5	33.6	32.8
1600	49.3	45.3	44.0	42.9	41.9	40.8	39.8	37.7	36.8	35.9	35.0
1800	52.2	47.9	46.6	45.4	44.3	43.2	42.1	39.9	38.9	37.9	37.0
2000	54.8	50.3	49.0	47.7	46.5	45.4	44.2	41.9	40.8	39.8	38.8
2200	57.4	52.7	51.3	49.9	48.7	47.5	46.3	43.8	42.7	41.6	40.5
2400	59.9	54.9	53.4	52.0	50.7	49.5	48.2	45.6	44.5	43.3	42.2
2600	62.0	56.8	55.2	53.7	52.4	51.1	49.8	47.1	45.9	44.7	43.5
2800	64.0	58.7	57.0	55.5	54.1	52.7	51.3	48.5	47.3	46.1	44.8
3000	66.1	60.5	58.8	57.2	55.8	54.3	52.9	50.0	48.7	47.4	46.1
3200	68.1	62.3	60.5	58.8	57.4	55.9	54.4	51.4	50.0	48.7	47.4
3400	70.0	64.0	62.2	60.4	58.9	57.4	55.8	52.7	51.3	50.0	48.6
3600	71.8	65.6	63.8	62.0	60.4	58.8	57.2	54.0	52.6	51.2	49.8
3800	73.6	67.2	65.3	63.5	61.8	60.2	58.6	55.3	53.8	52.4	50.9
4000	75.3	68.8	66.8	64.9	63.3	61.6	59.9	56.6	55.0	53.6	52.1
4200	76.9	70.3	68.3	66.3	64.6	62.9	61.2	57.8	56.2	54.7	53.2
4400	78.6	71.8	69.7	67.7	66.0	64.2	62.5	59.0	57.4	55.8	54.2
4600	80.2	73.2	71.1	69.1	67.3	65.5	63.7	60.1	58.5	56.9	55.3
CLIMB LIMIT WT (1000 KG)	59.7	59.3	56.8	54.5	52.5	50.6	48.6	44.8	43.1	41.5	39.8

With engine bleed for packs off, increase field limit weight by 450 kg and climb limit weight by 1350 kg.
With engine anti-ice on, decrease field limit weight by 150 kg and climb limit weight by 200 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 650 kg and climb limit weight by 1150 kg.

Takeoff Obstacle Limit Weight

Flaps 5

Sea Level, 30°C & Below, Zero Wind

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

Reference Obstacle Limit Weight (1000 KG)

OBSTACLE HEIGHT (M)	DISTANCE FROM BRAKE RELEASE (100 M)										
	25	30	35	40	45	50	55	60	65	70	75
5	68.5	72.8	75.7								
20	62.6	67.0	70.4	72.9	74.6	76.0	77.1				
40	57.6	61.8	65.2	68.0	70.2	71.9	73.3	74.3	75.3	76.1	76.7
60	53.9	58.0	61.4	64.1	66.5	68.4	70.0	71.4	72.5	73.4	74.2
80	50.8	54.9	58.3	61.1	63.4	65.4	67.2	68.6	69.9	71.0	71.9
100	48.1	52.2	55.6	58.4	60.9	62.9	64.7	66.2	67.6	68.8	69.8
120	45.8	49.9	53.3	56.1	58.6	60.7	62.5	64.1	65.5	66.7	67.9
140	43.8	47.8	51.2	54.1	56.5	58.7	60.5	62.2	63.6	64.9	66.1
160	41.9	45.9	49.3	52.2	54.7	56.8	58.7	60.4	61.9	63.2	64.4
180		44.2	47.6	50.5	53.0	55.1	57.0	58.8	60.3	61.6	62.9
200		42.7	46.0	48.9	51.4	53.6	55.5	57.2	58.8	60.2	61.4
220			44.5	47.4	49.9	52.1	54.1	55.8	57.4	58.8	60.1
240			43.2	46.0	48.5	50.7	52.7	54.5	56.1	57.5	58.8
260			41.9	44.7	47.3	49.5	51.4	53.2	54.8	56.3	57.6
280				43.5	46.0	48.3	50.2	52.0	53.6	55.1	56.4
300				42.4	44.9	47.1	49.1	50.9	52.5	54.0	55.4

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

OAT Adjustments

OAT (°C)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 KG)							
	44	48	52	56	60	64	68	72
30 & BELOW	0	0	0	0	0	0	0	0
32	-0.8	-0.9	-1.0	-1.0	-1.1	-1.2	-1.3	-1.4
34	-1.6	-1.8	-1.9	-2.1	-2.2	-2.4	-2.6	-2.7
36	-2.4	-2.6	-2.9	-3.1	-3.4	-3.6	-3.9	-4.1
38	-3.2	-3.5	-3.8	-4.2	-4.5	-4.8	-5.1	-5.5
40	-4.0	-4.4	-4.8	-5.2	-5.6	-6.0	-6.4	-6.8
42	-4.7	-5.2	-5.7	-6.2	-6.7	-7.1	-7.6	-8.1
44	-5.5	-6.0	-6.6	-7.1	-7.7	-8.3	-8.8	-9.4
46	-6.2	-6.8	-7.5	-8.1	-8.7	-9.4	-10.0	-10.7
48	-6.9	-7.6	-8.4	-9.1	-9.8	-10.5	-11.2	-11.9
50	-7.7	-8.5	-9.3	-10.0	-10.8	-11.6	-12.4	-13.2

Pressure Altitude Adjustments

ALT (FT)	OAT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)							
	44	48	52	56	60	64	68	72
S.L. & BELOW	0	0	0	0	0	0	0	0
1000	-1.6	-1.7	-1.8	-2.0	-2.1	-2.2	-2.4	-2.5
2000	-3.2	-3.4	-3.7	-4.0	-4.2	-4.5	-4.7	-5.0
3000	-4.6	-5.0	-5.4	-5.8	-6.2	-6.6	-7.0	-7.4
4000	-6.1	-6.6	-7.1	-7.6	-8.2	-8.7	-9.2	-9.7
5000	-7.7	-8.4	-9.0	-9.7	-10.3	-10.9	-11.6	-12.2
6000	-9.3	-10.1	-10.9	-11.7	-12.4	-13.2	-14.0	-14.8
7000	-10.9	-11.8	-12.8	-13.7	-14.6	-15.6	-16.5	-17.5
8000	-12.4	-13.5	-14.6	-15.7	-16.9	-18.0	-19.1	-20.2
9000	-13.6	-14.8	-16.1	-17.3	-18.6	-19.8	-21.1	-22.3
10000	-14.8	-16.1	-17.5	-18.9	-20.3	-21.7	-23.1	-24.5

Takeoff Obstacle Limit Weight
Flaps 5
Wind Adjustments

WIND (KTS)	OAT & ALT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)							
	44	48	52	56	60	64	68	72
15 TW	-8.3	-8.1	-7.8	-7.6	-7.3	-7.1	-6.9	-6.6
10 TW	-5.5	-5.4	-5.2	-5.1	-4.9	-4.7	-4.6	-4.4
5 TW	-2.8	-2.7	-2.6	-2.5	-2.4	-2.4	-2.3	-2.2
0	0	0	0	0	0	0	0	0
10 HW	1.0	0.9	0.9	0.8	0.7	0.7	0.6	0.6
20 HW	2.0	1.9	1.7	1.6	1.5	1.4	1.2	1.1
30 HW	3.0	2.9	2.7	2.5	2.3	2.1	1.9	1.7
40 HW	4.1	3.8	3.6	3.3	3.1	2.8	2.5	2.3

With engine bleed for packs off, increase weight by 750 kg.
With engine anti-ice on, decrease weight by 250 kg.
With engine and wing anti-ice on, decrease weight by 1200 kg (optional system).

Performance Dispatch — Chapter PD

Enroute — Section 21

Long Range Cruise Maximum Operating Altitude

Max Cruise Thrust

ISA + 10°C and Below

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
85	31000	-8	34200*	34200*	33800	32200	30800
80	32300	-10	35700*	35700*	35100	33500	32100
75	33700	-14	37000*	37000*	36500	34900	33500
70	35200	-17	38300*	38300*	37900	36400	35000
65	36700	-19	39700*	39700*	39400	37900	36500
60	38400	-19	41000	41000	41000	39600	38200
55	40200	-19	41000	41000	41000	41000	40000
50	41000	-19	41000	41000	41000	41000	41000
45	41000	-19	41000	41000	41000	41000	41000
40	41000	-19	41000	41000	41000	41000	41000

ISA + 15°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
85	31000	-2	32900*	32900*	32900*	32200	30800
80	32300	-5	34600*	34600*	34600*	33500	32100
75	33700	-8	36100*	36100*	36100*	34900	33500
70	35200	-11	37500*	37500*	37500*	36400	35000
65	36700	-13	38900*	38900*	38900*	37900	36500
60	38400	-13	40300*	40300*	40300*	39600	38200
55	40200	-13	41000	41000	41000	41000	40000
50	41000	-13	41000	41000	41000	41000	41000
45	41000	-13	41000	41000	41000	41000	41000
40	41000	-13	41000	41000	41000	41000	41000

ISA + 20°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
85	31000	4	30400*	30400*	30400*	30400*	30400*
80	32300	1	32900*	32900*	32900*	32900*	32100
75	33700	-2	34800*	34800*	34800*	34800*	33500
70	35200	-6	36300*	36300*	36300*	36300*	35000
65	36700	-8	37800*	37800*	37800*	37800*	36500
60	38400	-8	39200*	39200*	39200*	39200*	38200
55	40200	-8	40700*	40700*	40700*	40700*	40000
50	41000	-8	41000	41000	41000	41000	41000
45	41000	-8	41000	41000	41000	41000	41000
40	41000	-8	41000	41000	41000	41000	41000

***Denotes altitude thrust limited in level flight, 100 fpm residual rate of climb.**

Long Range Cruise Trip Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
279	259	241	226	212	200	190	181	173	166	159
555	516	481	451	424	400	381	364	348	334	321
830	772	720	675	636	600	572	547	524	503	484
1105	1028	959	900	847	800	764	731	700	672	646
1378	1283	1198	1124	1059	1000	955	914	875	840	808
1651	1538	1436	1348	1270	1200	1146	1097	1051	1009	971
1923	1792	1674	1572	1482	1400	1338	1280	1226	1178	1133
2194	2045	1912	1795	1693	1600	1529	1463	1402	1347	1296
2465	2299	2149	2019	1904	1800	1720	1646	1578	1516	1459
2735	2551	2386	2242	2115	2000	1912	1830	1754	1685	1622
3004	2803	2622	2465	2326	2200	2103	2013	1930	1854	1785
3273	3055	2859	2688	2537	2400	2295	2197	2106	2023	1948
3541	3306	3095	2911	2748	2600	2486	2380	2282	2193	2111
3808	3557	3330	3133	2959	2800	2678	2564	2459	2362	2275
4075	3807	3566	3356	3169	3000	2869	2747	2635	2532	2438
4341	4057	3801	3578	3380	3200	3061	2931	2811	2702	2602
4606	4306	4035	3800	3590	3400	3252	3115	2988	2871	2765
4870	4555	4270	4021	3801	3600	3444	3298	3164	3041	2929
5134	4803	4504	4243	4011	3800	3635	3482	3341	3211	3092
5397	5051	4738	4464	4221	4000	3827	3666	3517	3380	3256
5660	5298	4972	4686	4431	4200	4018	3850	3694	3550	3420
5922	5545	5205	4907	4642	4400	4210	4033	3870	3720	3583
6183	5792	5438	5128	4852	4600	4402	4217	4046	3890	3747
6444	6038	5671	5349	5062	4800	4593	4401	4223	4059	3910
6704	6284	5903	5569	5271	5000	4785	4584	4399	4229	4074

Long Range Cruise Trip Fuel and Time

Reference Fuel and Time Required

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	29		31		33		35		37	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	1.5	0:38	1.5	0:38	1.5	0:37	1.5	0:37	1.5	0:37
400	2.5	1:09	2.4	1:08	2.4	1:07	2.4	1:06	2.4	1:05
600	3.5	1:41	3.4	1:38	3.4	1:36	3.3	1:34	3.3	1:33
800	4.5	2:12	4.4	2:09	4.3	2:05	4.2	2:03	4.1	2:00
1000	5.5	2:42	5.4	2:38	5.3	2:34	5.1	2:31	5.0	2:28
1200	6.5	3:12	6.4	3:07	6.2	3:02	6.1	2:59	6.0	2:56
1400	7.6	3:42	7.4	3:37	7.2	3:31	7.0	3:27	6.9	3:23
1600	8.6	4:12	8.4	4:06	8.2	3:59	8.0	3:54	7.8	3:51
1800	9.7	4:42	9.4	4:35	9.2	4:28	8.9	4:22	8.8	4:18
2000	10.7	5:12	10.5	5:04	10.2	4:56	9.9	4:50	9.7	4:46
2200	11.8	5:41	11.5	5:32	11.2	5:24	10.9	5:18	10.7	5:13
2400	12.9	6:10	12.6	6:00	12.2	5:51	11.9	5:45	11.6	5:40
2600	14.0	6:39	13.7	6:29	13.3	6:19	12.9	6:12	12.6	6:07
2800	15.1	7:08	14.7	6:57	14.3	6:47	13.9	6:40	13.6	6:34
3000	16.2	7:37	15.8	7:25	15.3	7:15	14.9	7:07	14.6	7:01
3200	17.4	8:05	16.9	7:52	16.4	7:42	16.0	7:34	15.6	7:28
3400	18.5	8:33	18.0	8:20	17.5	8:09	17.0	8:01	16.7	7:55
3600	19.7	9:01	19.2	8:47	18.6	8:36	18.1	8:28	17.7	8:21
3800	20.9	9:29	20.3	9:15	19.7	9:03	19.1	8:55	18.8	8:48
4000	22.0	9:57	21.4	9:42	20.8	9:31	20.2	9:23	19.8	9:15
4200	23.2	10:24	22.6	10:09	21.9	9:57	21.3	9:49	21.0	9:42
4400	24.4	10:51	23.7	10:36	23.0	10:24	22.4	10:16	22.1	10:08
4600	25.7	11:18	24.9	11:03	24.2	10:51	23.5	10:43	23.3	10:35
4800	26.9	11:46	26.1	11:30	25.3	11:18	24.7	11:09	24.4	11:02
5000	28.1	12:13	27.3	11:57	26.5	11:45	25.8	11:36	25.5	11:28

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	LANDING WEIGHT (1000 KG)				
	30	40	50	60	70
2	-0.3	-0.2	0.0	0.3	0.5
4	-0.6	-0.3	0.0	0.5	1.1
6	-0.9	-0.5	0.0	0.8	1.9
8	-1.2	-0.7	0.0	1.0	2.7
10	-1.6	-0.8	0.0	1.4	3.6
12	-1.9	-1.0	0.0	1.7	4.6
14	-2.2	-1.2	0.0	2.1	5.6
16	-2.6	-1.4	0.0	2.6	6.8
18	-2.9	-1.6	0.0	3.0	8.0
20	-3.3	-1.7	0.0	3.5	9.3
22	-3.7	-1.9	0.0	4.0	10.7
24	-4.1	-2.1	0.0	4.6	12.2
26	-4.5	-2.3	0.0	5.2	13.8
28	-4.9	-2.5	0.0	5.8	15.4
30	-5.3	-2.7	0.0	6.4	17.1

Based on 280/.78 climb, Long Range Cruise speed and .78/280/250 descent.

Long Range Cruise Step Climb

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
1320	1241	1170	1108	1051	1000	954	912	873	837	805
1836	1729	1633	1547	1470	1400	1336	1278	1225	1176	1131
2352	2216	2095	1986	1889	1800	1719	1646	1578	1515	1458
2867	2703	2557	2426	2307	2200	2102	2013	1930	1855	1785
3382	3190	3019	2865	2726	2600	2485	2380	2283	2194	2112
3897	3677	3481	3304	3145	3000	2868	2747	2636	2534	2439
4411	4164	3942	3743	3563	3400	3251	3114	2989	2873	2766
4925	4650	4404	4182	3982	3800	3634	3482	3342	3213	3093
5439	5136	4865	4621	4401	4200	4017	3849	3695	3553	3421
5953	5622	5326	5060	4819	4600	4400	4217	4048	3892	3748
6466	6108	5787	5499	5238	5000	4783	4584	4401	4232	4076

Trip Fuel and Time Required

AIR DIST (NM)	TRIP FUEL (1000 KG)							TIME (HRS:MIN)
	LANDING WEIGHT (1000 KG)							
	40	45	50	55	60	65	70	
1000	4.3	4.6	4.9	5.4	5.7	6.1	6.4	2:26
1400	5.9	6.3	6.7	7.3	7.8	8.3	8.8	3:20
1800	7.5	8.0	8.6	9.3	9.9	10.6	11.2	4:13
2200	9.1	9.7	10.5	11.3	12.1	13.0	13.8	5:07
2600	10.7	11.5	12.4	13.4	14.4	15.4	16.4	6:01
3000	12.4	13.3	14.4	15.6	16.7	17.9	19.0	6:54
3400	14.1	15.2	16.5	17.8	19.1	20.5	21.8	7:48
3800	15.8	17.2	18.6	20.1	21.6	23.1	24.6	8:41
4200	17.7	19.1	20.7	22.5	24.1	25.8	27.5	9:34
4600	19.5	21.2	23.0	24.9	26.7	28.6	30.5	10:27
5000	21.5	23.3	25.3	27.4	29.4	31.5	33.6	11:20

Based on 280/.78 climb, Long Range Cruise speed and .78/280/250 descent.
Valid for all pressure altitudes with 4000 ft step climb to 2000 ft above optimum altitude.

Short Trip Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
95	81	70	62	55	50	46	42	39	36	34
161	144	130	118	108	100	93	87	81	77	72
227	206	188	174	161	150	140	132	125	118	112
291	267	246	229	213	200	188	178	168	160	152
354	327	304	283	266	250	236	224	212	202	193
417	387	361	338	318	300	284	270	257	245	234
480	447	418	393	370	350	332	316	301	288	275
543	507	475	447	422	400	380	362	345	330	316
608	568	533	502	475	450	428	408	389	373	357
675	631	592	558	527	500	475	453	433	414	397

Trip Fuel and Time Required

AIR DIST (NM)		LANDING WEIGHT (1000 KG)						TIME (HRS:MIN)
		40	45	50	55	60	65	
50	FUEL (1000 KG)	0.5	0.6	0.6	0.6	0.7	0.7	0:14
	ALT (FT)	11000	11000	11000	9000	9000	9000	
100	FUEL (1000 KG)	0.8	0.9	0.9	1.0	1.0	1.1	0:23
	ALT (FT)	17000	17000	17000	15000	15000	15000	
150	FUEL (1000 KG)	1.1	1.2	1.2	1.3	1.3	1.4	0:31
	ALT (FT)	25000	25000	23000	23000	23000	23000	
200	FUEL (1000 KG)	1.3	1.4	1.5	1.6	1.6	1.7	0:38
	ALT (FT)	31000	29000	27000	27000	25000	25000	
250	FUEL (1000 KG)	1.5	1.6	1.7	1.8	1.9	2.0	0:44
	ALT (FT)	41000	37000	35000	33000	31000	31000	
300	FUEL (1000 KG)	1.7	1.8	1.9	2.0	2.2	2.3	0:51
	ALT (FT)	41000	41000	37000	37000	35000	35000	
350	FUEL (1000 KG)	1.9	2.0	2.1	2.3	2.4	2.5	0:57
	ALT (FT)	41000	41000	39000	37000	37000	35000	
400	FUEL (1000 KG)	2.1	2.2	2.4	2.5	2.7	2.8	1:03
	ALT (FT)	41000	41000	41000	39000	37000	35000	
450	FUEL (1000 KG)	2.3	2.4	2.6	2.7	2.9	3.1	1:10
	ALT (FT)	41000	41000	41000	39000	37000	35000	
500	FUEL (1000 KG)	2.5	2.6	2.8	3.0	3.2	3.3	1:18
	ALT (FT)	41000	41000	41000	39000	37000	35000	

Based on 280/.78 climb, Long Range Cruise speed and .78/280/250 descent.

Holding Planning

Flaps Up

WEIGHT (1000 KG)	TOTAL FUEL FLOW (KG/HR)								
	PRESSURE ALTITUDE (FT)								
	1500	5000	10000	15000	20000	25000	30000	35000	41000
80	2810	2770	2740	2730	2670	2670	2710		
75	2650	2610	2580	2560	2500	2490	2530	2610	
70	2500	2450	2420	2390	2350	2310	2350	2400	
65	2340	2290	2260	2230	2190	2140	2180	2210	
60	2180	2130	2100	2070	2030	1970	2000	2020	
55	2030	1980	1940	1910	1870	1820	1830	1850	1960
50	1870	1820	1780	1750	1710	1710	1680	1690	1770
45	1720	1670	1650	1620	1580	1550	1530	1520	1580
40	1610	1550	1500	1460	1430	1400	1380	1360	1400

This table includes 5% additional fuel for holding in a racetrack pattern.

Flight Crew Oxygen Requirements

For Aircraft with Chemical Passenger Oxygen System

Required Pressure (PSI) for 76 Cubic Ft. Cylinder (YA701-YA706)

BOTTLE TEMPERATURE		NUMBER OF CREW USING OXYGEN		
°C	°F	2	3	4
50	122	735	1055	1360
45	113	725	1040	1340
40	104	715	1020	1320
35	95	700	1005	1300
30	86	690	990	1280
25	77	680	975	1255
20	68	670	960	1240
15	59	655	940	1215
10	50	645	925	1195
5	41	635	910	1175
0	32	620	890	1150
-5	23	610	875	1130
-10	14	600	860	1110

Required Pressure (PSI) for 114/115 Cubic Ft. Cylinder (YA707-YV754)

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

ENGINE INOP

MAX CONTINUOUS THRUST

Net Level Off Weight

PRESSURE ALTITUDE (1000 FT)	LEVEL OFF WEIGHT (1000 KG)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
30	44.5	43.1	41.6
28	48.1	46.5	44.9
26	51.9	50.1	48.5
24	55.4	53.6	51.8
22	58.6	56.6	54.4
20	61.9	59.5	56.8
18	65.1	62.4	59.4
16	68.1	65.1	61.7
14	71.6	68.2	64.7
12	75.0	71.3	67.8
10	78.5	74.6	71.0
8	81.6	77.9	74.2

Anti-Ice Adjustments

ANTI-ICE CONFIGURATION	LEVEL OFF WEIGHT ADJUSTMENT (1000 KG)									
	PRESSURE ALTITUDE (1000 FT)									
	10	12	14	16	18	20	22	24	26	28
ENGINE ONLY	-2.3	-2.3	-2.1	-1.9	-1.8	-1.8	-1.6	-1.4	-1.2	-1.1
ENGINE & WING	-8.8	-8.6	-8.2	-7.6	-7.2	-6.7	-6.0	-5.4	-5.0	-5.0

Landing Field Limit Weight - Dry Runway

Flaps 40

Based on anti-skid operative and automatic speedbrakes

Wind Corrected Field Length (M)

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1000			880	1000	1050	1110	1180	1250
1200	880	980	1080	1200	1260	1320	1400	1470
1400	1060	1160	1270	1400	1460	1540	1610	1700
1600	1230	1350	1460	1600	1670	1750	1830	1920
1800	1410	1530	1650	1800	1870	1960	2050	2140
2000	1590	1720	1840	2000	2080	2170	2270	2370
2200	1760	1900	2030	2200	2280	2380	2480	2590
2400	1940	2090	2230	2400	2490	2590	2700	2810
2600	2120	2270	2420	2600	2690	2800	2920	3040
2800	2220	2370	2520	2800	2900	3010	3140	
3000	2320	2470	2610	3000	3100			
3200	2420	2560	2710	3200				
3400	2510	2650	2800					
3600	2610	2740	2890					
3800	2710	2840	2990					
4000	2800	2930	3080					
4200	2900	3020	3170					
4400	3000	3120						
4600	3090							
4800	3190							

Field Limit Weight (1000 KG)

WIND CORR'D FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
1200	47.5	44.7	42.0	39.4		
1400	57.3	54.7	51.8	48.7	45.7	42.7
1600	65.7	62.6	59.7	56.8	54.1	50.8
1800	74.7	70.7	67.0	63.6	60.5	57.5
2000	81.8	78.8	74.7	70.7	66.9	63.4
2200			81.2	78.0	73.7	69.6
2400				83.0	79.8	76.0
2600						80.9

Decrease field limit weight by 4500 kg when using manual speedbrakes.

Landing Field Limit Weight - Dry Runway

Flaps 40

Based on anti-skid inoperative and manual speedbrakes

Wind Corrected Field Length (M)

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1800				1800	1940	2110	2250	2420
2000			1750	2000	2140	2320	2470	2650
2200		1700	1950	2200	2350	2530	2690	2870
2400	1640	1890	2140	2400	2560	2740	2910	3090
2600	1820	2080	2330	2600	2760	2950	3130	3320
2800	2000	2260	2530	2800	2970	3160	3350	3540
3000	2180	2450	2720	3000	3170	3380	3560	3760
3200	2360	2630	2910	3200	3380	3590	3780	3980
3400	2540	2820	3100	3400	3590	3800	4000	4210
3600	2720	3010	3300	3600	3790	4010	4220	4430
3800	2900	3190	3490	3800	4000	4220	4440	4650
4000	3080	3380	3680	4000	4200	4440	4650	4880
4200	3260	3570	3880	4200	4410	4650	4870	5100
4400	3440	3750	4070	4400	4620	4860	5090	5320
4600	3620	3940	4260	4600	4820	5070	5310	5550
4800	3800	4120	4450	4800	5030	5280	5530	5770
5000	3980	4310	4650	5000	5230	5490	5750	
5200	4160	4500	4840	5200	5440	5710		
5400	4340	4680	5030	5400	5650			
5600	4520	4870	5230	5600				

Field Limit Weight (1000 KG)

WIND CORR'D FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
2200	42.4	39.8				
2400	47.5	44.6	41.5	38.8		
2600	52.7	49.5	46.1	43.1	40.2	
2800	57.9	54.4	50.8	47.5	44.3	41.3
3000	63.0	59.3	55.4	51.8	48.5	45.1
3200	68.5	64.1	60.0	56.1	52.5	48.9
3400	74.2	69.2	64.4	60.3	56.4	52.6
3600	79.7	74.5	69.2	64.5	60.3	56.3
3800		79.6	74.1	68.9	64.2	59.9
4000			79.0	73.5	68.4	63.6
4200			83.5	78.2	72.6	67.4
4400				82.4	77.1	71.4
4600					81.1	75.5
4800						79.4
5000						83.1

Landing Field Limit Weight - Wet Runway

Flaps 40

Based on anti-skid operative and automatic speedbrakes

Wind Corrected Field Length (M)

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1000				1000	1060	1120	1190	1270
1200		960	1070	1200	1260	1330	1410	1490
1400	1030	1140	1260	1400	1470	1540	1630	1720
1600	1210	1330	1450	1600	1670	1760	1850	1940
1800	1380	1510	1640	1800	1880	1970	2060	2160
2000	1560	1700	1830	2000	2080	2180	2280	2390
2200	1740	1880	2020	2200	2290	2390	2500	2610
2400	1910	2070	2220	2400	2490	2600	2720	2830
2600	2090	2250	2410	2600	2700	2810	2930	3060
2800	2270	2440	2600	2800	2900	3020	3150	3280
3000	2440	2620	2790	3000	3110	3230	3370	3500
3200	2550	2720	2890	3200	3310	3450	3590	
3400	2640	2810	2980	3400	3510	3660		
3600	2740	2910	3080	3600				
3800	2840	3000	3170					
4000	2930	3090	3260					
4200	3030	3180	3350					
4400	3130	3280	3450					
4600	3220	3370	3540					
4800	3320	3460	3630					

Field Limit Weight (1000 KG)

WIND CORR'D FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
1200	39.1					
1400	48.5	45.6	42.9	40.2		
1600	57.0	54.4	51.4	48.3	45.3	42.4
1800	64.2	61.3	58.4	55.6	52.8	49.5
2000	71.9	68.2	64.7	61.5	58.5	55.6
2200	79.2	75.4	71.4	67.5	64.0	60.8
2400		81.2	78.1	73.8	69.8	66.0
2600			82.7	79.6	75.8	71.5
2800					80.6	77.1
3000						81.1

Decrease field limit weight by 4500 kg when using manual speedbrakes.

Landing Field Limit Weight - Wet Runway

Flaps 40

Based on anti-skid inoperative and manual speedbrakes

Wind Corrected Field Length (M)

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1800					1950	2140	2300	2490
2000				2000	2160	2350	2520	2710
2200			1920	2200	2360	2560	2730	2930
2400			2110	2400	2570	2770	2950	3150
2600		2020	2310	2600	2770	2980	3170	3380
2800	1920	2210	2500	2800	2980	3190	3390	3600
3000	2100	2400	2690	3000	3190	3410	3610	3820
3200	2280	2580	2880	3200	3390	3620	3830	4050
3400	2460	2770	3080	3400	3600	3830	4040	4270
3600	2640	2950	3270	3600	3800	4040	4260	4490
3800	2820	3140	3460	3800	4010	4250	4480	4720
4000	3000	3330	3660	4000	4220	4470	4700	4940
4200	3180	3510	3850	4200	4420	4680	4920	5160
4400	3360	3700	4040	4400	4630	4890	5130	5390
4600	3540	3890	4230	4600	4830	5100	5350	5610
4800	3720	4070	4430	4800	5040	5310	5570	5830
5000	3900	4260	4620	5000	5250	5520	5790	6050
5200	4080	4440	4810	5200	5450	5740	6010	6280
5400	4260	4630	5010	5400	5660	5950	6230	6500
5600	4440	4820	5200	5600	5860	6160	6440	

Field Limit Weight (1000 KG)

WIND CORR'D FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
2400	39.5					
2600	43.9	41.2	38.3			
2800	48.4	45.5	42.3	39.5		
3000	52.9	49.7	46.3	43.3	40.4	
3200	57.4	54.0	50.4	47.1	44.0	40.9
3400	61.9	58.2	54.4	50.9	47.6	44.3
3600	66.5	62.4	58.4	54.6	51.1	47.6
3800	71.5	66.7	62.3	58.3	54.5	50.9
4000	76.5	71.3	66.3	61.9	57.9	54.1
4200	81.0	75.9	70.5	65.6	61.3	57.2
4400		80.3	74.8	69.5	64.7	60.4
4600			79.0	73.5	68.4	63.6
4800			82.9	77.6	72.1	66.9
5000				81.3	75.9	70.4
5200					79.5	73.9
5400					82.9	77.5
5600						80.7

Landing Climb Limit Weight

Valid for approach with Flaps 15 and landing with Flaps 40

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

AIRPORT OAT (°C)	LANDING CLIMB LIMIT WEIGHT (1000 KG)					
	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
54	55.8					
52	56.9					
50	58.1	54.3				
48	59.3	55.4				
46	60.5	56.5	52.8			
44	61.6	57.6	53.8			
42	62.8	58.7	54.8	50.7		
40	64.0	59.9	55.9	51.7		
38	65.4	61.1	57.0	52.7	47.7	
36	66.7	62.4	58.2	53.8	48.7	
34	68.0	63.6	59.3	54.8	49.7	45.6
32	69.4	64.8	60.4	55.9	50.7	46.6
30	70.7	66.0	61.6	56.8	51.7	47.5
28	70.8	67.2	62.6	57.8	52.6	48.5
26	70.8	68.4	63.8	58.9	53.6	49.4
24	70.9	68.4	64.9	60.1	54.5	50.3
22	71.0	68.5	66.1	61.1	55.5	51.3
20	71.0	68.5	66.2	62.2	56.6	52.2
18	71.1	68.6	66.2	63.2	57.9	53.1
16	71.1	68.6	66.3	63.2	59.2	54.0
14	71.2	68.6	66.3	63.3	60.4	55.2
12	71.2	68.7	66.3	63.3	60.4	56.4
10	71.3	68.7	66.4	63.4	60.4	57.5
-40	71.8	69.3	66.9	63.8	60.8	57.8

With engine bleed for packs off, increase weight by 1050 kg.
With engine anti-ice on, decrease weight by 200 kg.
With engine and wing anti-ice on, decrease weight by 750 kg.
When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 6550 kg.

ENGINE INOP

ADVISORY INFORMATION

Go-Around Climb Gradient

Flaps 15

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

OAT (°C)	REFERENCE GO-AROUND GRADIENT (%)					
	PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
54	2.01					
50	2.50	1.69				
46	3.02	2.17	1.35			
42	3.54	2.65	1.80	0.92		
38	4.09	3.16	2.28	1.35		
34	4.65	3.69	2.77	1.80	0.71	
30	5.22	4.22	3.25	2.24	1.13	
26	5.25	4.72	3.73	2.70	1.54	0.66
22	5.28	4.74	4.25	3.18	1.97	1.06
18	5.30	4.77	4.26	3.63	2.47	1.45
14	5.32	4.78	4.28	3.65	3.03	1.90
10	5.35	4.80	4.30	3.66	3.05	2.43

Gradient Adjustment for Weight (%)

WEIGHT (1000 KG)	REFERENCE GO-AROUND GRADIENT (%)					
	1	2	3	4	5	6
80	-3.36	-3.70	-4.04	-4.37	-4.71	-5.05
75	-2.89	-3.18	-3.47	-3.76	-4.04	-4.33
70	-2.35	-2.58	-2.81	-3.04	-3.27	-3.51
65	-1.70	-1.87	-2.03	-2.20	-2.36	-2.53
60	-0.93	-1.02	-1.11	-1.20	-1.29	-1.38
55	0.00	0.00	0.00	0.00	0.00	0.00
50	1.05	1.17	1.29	1.40	1.52	1.64
45	2.38	2.64	2.90	3.16	3.42	3.68
40	4.06	4.51	4.95	5.39	5.84	6.28

Gradient Adjustment for Speed (%)

SPEED (KIAS)	WEIGHT ADJUSTED GO-AROUND GRADIENT (%)											
	0	1	2	3	4	5	6	7	8	9	10	11
VREF40	-0.26	-0.27	-0.27	-0.27	-0.28	-0.28	-0.29	-0.29	-0.30	-0.30	-0.31	-0.31
VREF40+5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VREF40+10	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.14	0.14	0.14	0.14
VREF40+20	0.25	0.23	0.21	0.20	0.18	0.17	0.15	0.13	0.12	0.10	0.09	0.07
VREF40+30	0.11	0.06	0.00	-0.04	-0.09	-0.14	-0.20	-0.25	-0.30	-0.36	-0.41	-0.46

With engine bleed for packs off, increase gradient by 0.3%.
With engine anti-ice on, decrease gradient by 0.1%.
With engine and wing anti-ice on, decrease gradient by 0.2%.
When operating in icing conditions during any part of the flight with forecast landing temperatures below 10°C, decrease gradient by 1.0%.

Quick Turnaround Limit Weight - Category A Steel and Carbon Brakes

Flaps 40

OAT (°C)	LIMIT WEIGHT (1000 KG)					
	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
54	71.8					
50	72.3	69.4				
45	72.9	70.0	67.1			
40	73.5	70.6	67.7	64.9		
35	74.2	71.2	68.3	65.5	62.8	
30	74.9	71.8	68.9	66.0	63.4	60.8
25	75.6	72.5	69.5	66.6	63.9	61.3
20	76.3	73.1	70.1	67.2	64.4	61.8
15	77.0	73.8	70.8	67.8	65.0	62.4
10	77.7	74.5	71.4	68.5	65.6	62.9
5	78.4	75.2	72.1	69.1	66.2	63.5
0	79.1	76.0	72.8	69.8	66.9	64.1
-5	79.9	76.7	73.5	70.5	67.5	64.6
-10	80.6	77.5	74.3	71.2	68.2	65.3
-15	81.4	78.3	75.1	71.9	68.9	65.9
-20	81.6	79.0	75.9	72.7	69.6	66.6
-30	81.6	80.7	77.5	74.2	71.1	68.0
-40	81.6	81.6	79.2	75.9	72.7	69.6
-50	81.6	81.6	80.9	77.7	74.4	71.2
-54	81.6	81.6	81.6	78.4	75.1	71.8

**Increase weight by 650 kg per 1% uphill slope. Decrease weight by 1150 kg per 1% downhill slope.
Increase weight by 1600 kg per 10 knots headwind. Decrease weight by 8000 kg per 10 knots tailwind.
After landing at weights exceeding those shown above, adjusted for slope and wind, wait at least 62 minutes and check that wheel thermal plugs have not melted before executing a subsequent takeoff.**

Braking data presented for the steel brakes is applicable to the corresponding Category M carbon brakes.

The following procedure is only applicable to steel brakes,

As an alternate procedure, ensure that each brake pressure plate surface temperature, without artificial cooling, is less than 218°C as follows: No sooner than 10 and no later than 15 minutes after parking, measure each brake pressure plate surface temperature at a minimum of two points per brake by an accurate method (using a Doric Microtemp 450 hand held thermometer or equivalent, hold temperature probe in place for 20 seconds or until reading stabilizes). If each measured temperature is less than 218°C, immediate dispatch is allowed; otherwise the required minimum ground wait period of 62 minutes applies.

The following procedure is applicable to steel and carbon brakes, if a Brake Temperature Monitoring System (BTMS) is installed:

No sooner than 10 and no later than 15 minutes after parking, check the BRAKE TEMP light. If the BRAKE TEMP light is not on, no ground waiting period is required. If the BRAKE TEMP light is on, do not dispatch until at least 62 minutes after landing, or until all the BTMS readings on the systems Display are below 3.5 and the BRAKE TEMP light is off. Check that wheel thermal plugs have not melted before making a subsequent takeoff.

Note: If any brake temperature display digit is blank or indicates 0.0 or 0.1, then this method cannot be used.

Intentionally
Blank

GEAR DOWN

Takeoff Climb Limit Weight

Flaps 5

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

AIRPORT OAT		TAKEOFF CLIMB WEIGHT (1000 KG)					
		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	0	2000	4000	6000	8000	10000
54	129	51.5	48.4	45.4	42.0		
52	126	52.6	49.2	46.2	42.8		
50	122	53.7	50.2	47.0	43.6		
48	118	54.8	51.2	47.9	44.4		
46	115	55.9	52.2	48.7	45.1	40.9	
44	111	57.0	53.2	49.7	46.0	41.7	
42	108	58.1	54.3	50.6	46.8	42.4	
40	104	59.2	55.4	51.7	47.7	43.2	
38	100	60.4	56.5	52.7	48.7	44.1	
36	97	61.6	57.6	53.8	49.7	45.0	41.3
34	93	62.8	58.8	54.8	50.7	45.9	41.6
32	90	64.0	59.9	55.9	51.6	46.8	42.6
30	86	65.3	61.0	56.9	52.5	47.8	43.5
28	82	65.3	62.1	57.9	53.5	48.6	44.5
26	79	65.4	63.2	59.0	54.5	49.5	45.5
24	75	65.4	63.3	60.2	55.6	50.4	46.5
22	72	65.5	63.3	61.3	56.6	51.4	47.4
20	68	65.6	63.4	61.3	57.7	52.4	48.3
18	64	65.6	63.4	61.3	58.6	53.6	49.1
16	61	65.6	63.5	61.4	58.7	54.9	50.0
14	57	65.7	63.5	61.4	58.7	56.1	51.2
12	54	65.7	63.5	61.5	58.8	56.1	52.3
10	50	65.8	63.6	61.5	58.8	56.1	53.3
0	32	66.0	63.8	61.7	58.9	56.3	53.5
-10	14	66.1	63.9	61.8	59.1	56.4	53.6
-20	-4	66.1	64.0	61.9	59.2	56.4	53.6
-30	-22	66.2	64.0	61.9	59.2	56.5	53.7
-40	-40	66.2	64.0	62.0	59.3	56.5	53.7
-50	-58	66.3	64.1	62.0	59.3	56.5	53.7
-54	-65	66.3	64.1	62.1	59.3	56.5	53.8

With engine bleed for packs off, increase weight by 450 kg.
With engine anti-ice on, decrease weight by 1650 kg.
With engine and wing anti-ice on, decrease weight by 6300 kg.

GEAR DOWN

Landing Climb Limit Weight

Valid for approach with Flaps 15 and landing with Flaps 30 or 40

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

AIRPORT OAT		LANDING CLIMB LIMIT WEIGHT (1000 KG)					
		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	0	2000	4000	6000	8000	10000
54	129	48.6					
52	126	49.6					
50	122	50.6	47.4				
48	118	51.7	48.3				
46	115	52.7	49.3	46.0			
44	111	53.7	50.3	46.9			
42	108	54.8	51.2	47.8	44.2		
40	104	55.8	52.2	48.8	45.1		
38	100	57.0	53.3	49.7	46.0	41.6	
36	97	58.1	54.4	50.7	46.9	42.5	
34	93	59.2	55.4	51.7	47.8	43.3	39.8
32	90	60.4	56.5	52.7	48.7	44.2	40.6
30	86	61.5	57.5	53.7	49.6	45.0	41.4
28	82	61.6	58.6	54.6	50.5	45.9	42.3
26	79	61.6	59.6	55.6	51.4	46.7	43.1
24	75	61.7	59.6	56.7	52.4	47.5	43.9
22	72	61.7	59.7	57.7	53.4	48.5	44.7
20	68	61.8	59.7	57.7	54.3	49.4	45.5
18	64	61.8	59.8	57.8	55.2	50.5	46.3
16	61	61.9	59.8	57.8	55.3	51.7	47.1
14	57	61.9	59.8	57.9	55.3	52.8	48.2
12	54	62.0	59.9	57.9	55.3	52.8	49.3
10	50	62.0	59.9	57.9	55.4	52.9	50.3
-40	-40	62.4	60.4	58.4	55.8	53.2	50.6

With engine bleed for packs off, increase weight by 1200 kg.
With engine anti-ice on, decrease weight by 200 kg.
With engine and wing anti-ice on, decrease weight by 950 kg.
When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 6500 kg.

GEAR DOWN

Takeoff Obstacle Limit Weight

Flaps 5

Sea Level, 30°C & Below, Zero Wind

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

Reference Obstacle Limit Weight (1000 KG)

OBSTACLE HEIGHT (M)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 KG)										
	DISTANCE FROM BRAKE RELEASE (100 M)										
	25	30	35	40	45	50	55	60	65	70	75
5	66.5										
20	60.6	63.9	66.2								
40	55.6	59.1	61.7	63.6	65.2	66.3	67.3				
60	52.0	55.5	58.2	60.4	62.1	63.5	64.7	65.6	66.4	67.1	
80	49.1	52.6	55.4	57.6	59.5	61.0	62.3	63.4	64.3	65.1	65.8
100	46.5	50.1	52.9	55.3	57.2	58.9	60.2	61.4	62.4	63.3	64.1
120	44.3	47.9	50.8	53.2	55.2	56.9	58.4	59.6	60.7	61.7	62.5
140	42.4	46.0	48.9	51.3	53.4	55.1	56.6	58.0	59.1	60.1	61.0
160		44.2	47.1	49.6	51.7	53.5	55.1	56.4	57.6	58.7	59.7
180		42.6	45.5	48.0	50.2	52.0	53.6	55.0	56.3	57.4	58.4
200			44.1	46.6	48.7	50.6	52.3	53.7	55.0	56.1	57.1
220			42.7	45.2	47.4	49.3	51.0	52.4	53.8	54.9	56.0
240			41.5	44.0	46.2	48.1	49.8	51.3	52.6	53.8	54.9
260				42.8	45.0	46.9	48.6	50.1	51.5	52.7	53.8
280				41.7	43.9	45.8	47.6	49.1	50.5	51.7	52.8
300					42.8	44.8	46.5	48.1	49.5	50.7	51.9

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

OAT Adjustments

OAT (°C)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 KG)							
	40	44	48	52	56	60	64	68
30 & BELOW	0	0	0	0	0	0	0	0
32	-0.7	-0.8	-0.9	-0.9	-1.0	-1.1	-1.2	-1.3
34	-1.4	-1.6	-1.7	-1.9	-2.0	-2.2	-2.4	-2.5
36	-2.1	-2.4	-2.6	-2.8	-3.1	-3.3	-3.5	-3.8
38	-2.8	-3.1	-3.5	-3.8	-4.1	-4.4	-4.7	-5.0
40	-3.5	-3.9	-4.3	-4.7	-5.1	-5.5	-5.9	-6.3
42	-4.2	-4.7	-5.2	-5.6	-6.1	-6.6	-7.0	-7.5
44	-4.9	-5.5	-6.0	-6.5	-7.1	-7.6	-8.2	-8.7
46	-5.6	-6.2	-6.8	-7.5	-8.1	-8.7	-9.3	-9.9
48	-6.3	-7.0	-7.7	-8.4	-9.1	-9.8	-10.4	-11.1
50	-7.0	-7.7	-8.5	-9.3	-10.0	-10.8	-11.6	-12.4

GEAR DOWN

Takeoff Obstacle Limit Weight

Flaps 5

Pressure Altitude Adjustments

ALT (FT)	OAT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)							
	40	44	48	52	56	60	64	68
S.L. & Below	0	0	0	0	0	0	0	0
1000	-1.4	-1.5	-1.7	-1.8	-1.9	-2.0	-2.2	-2.3
2000	-2.8	-3.0	-3.3	-3.6	-3.8	-4.1	-4.3	-4.6
3000	-4.1	-4.5	-4.9	-5.2	-5.6	-6.0	-6.4	-6.8
4000	-5.4	-5.9	-6.4	-6.9	-7.4	-7.9	-8.4	-8.9
5000	-6.8	-7.4	-8.1	-8.7	-9.3	-10.0	-10.6	-11.2
6000	-8.2	-9.0	-9.7	-10.5	-11.2	-12.0	-12.7	-13.5
7000	-9.6	-10.5	-11.5	-12.4	-13.3	-14.2	-15.2	-16.1
8000	-11.0	-12.1	-13.2	-14.3	-15.4	-16.5	-17.6	-18.7
9000	-10.9	-12.4	-13.8	-15.3	-16.7	-18.2	-19.6	-21.1
10000	-10.9	-12.7	-14.5	-16.3	-18.1	-19.9	-21.7	-23.5

Wind Adjustments

WIND (KTS)	OAT & ALT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)							
	40	44	48	52	56	60	64	68
15 TW	-7.1	-6.8	-6.5	-6.2	-6.0	-5.7	-5.4	-5.1
10 TW	-4.7	-4.5	-4.3	-4.2	-4.0	-3.8	-3.6	-3.4
5 TW	-2.4	-2.3	-2.2	-2.1	-2.0	-1.9	-1.8	-1.7
0	0	0	0	0	0	0	0	0
10 HW	1.0	0.9	0.8	0.8	0.7	0.6	0.5	0.4
20 HW	2.0	1.8	1.7	1.5	1.3	1.2	1.0	0.8
30 HW	3.0	2.7	2.5	2.2	2.0	1.7	1.5	1.2
40 HW	4.0	3.7	3.3	3.0	2.7	2.3	2.0	1.7

With engine bleed for packs off, increase weight by 400 kg.
With engine anti-ice on, decrease weight by 1750 kg.
With engine and wing anti-ice on, decrease weight by 6750 kg (optional system).

GEAR DOWN

Long Range Cruise Altitude Capability

Max Cruise Thrust, 100 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
85	12900	10300	7500
80	16000	13100	10400
75	20400	16300	13300
70	23500	20400	16700
65	26200	24400	20800
60	28700	27200	25400
55	30900	29700	28200
50	33000	32000	30800
45	35200	34200	33100
40	37600	36600	35500

GEAR DOWN

Long Range Cruise 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
340	300	266	239	218	200	187	174	164	155	147
676	598	531	479	437	400	374	350	329	311	295
1007	892	794	717	654	600	561	526	495	467	443
1333	1183	1055	954	872	800	749	702	661	624	593
1656	1472	1315	1190	1089	1000	936	878	827	782	743
1974	1758	1573	1426	1305	1200	1124	1056	995	941	894
2289	2042	1830	1661	1522	1400	1312	1233	1162	1100	1045
2600	2324	2086	1895	1737	1600	1501	1411	1330	1259	1197
2908	2603	2340	2128	1953	1800	1689	1588	1498	1419	1349
3213	2880	2592	2360	2168	2000	1877	1766	1667	1579	1502

Reference Fuel and Time Required

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)							
	10		14		20		24	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	2.6	0:53	2.4	0:52	2.3	0:49	2.2	0:48
400	5.0	1:42	4.7	1:37	4.3	1:31	4.1	1:27
600	7.5	2:29	7.1	2:22	6.4	2:12	6.1	2:06
800	10.1	3:16	9.5	3:06	8.6	2:53	8.1	2:45
1000	12.7	4:02	11.9	3:50	10.8	3:33	10.1	3:23
1200	15.4	4:46	14.4	4:32	13.0	4:12	12.2	4:00
1400	18.1	5:30	17.0	5:14	15.3	4:51	14.4	4:37
1600	21.0	6:14	19.6	5:55	17.6	5:29	16.6	5:13
1800	23.8	6:56	22.3	6:36	20.0	6:07	18.8	5:49
2000	26.7	7:38	24.9	7:16	22.4	6:44	21.0	6:25

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	LANDING WEIGHT (1000 KG)					
	40	45	50	55	60	65
2	-0.2	-0.1	0.0	0.1	0.3	0.4
4	-0.4	-0.2	0.0	0.2	0.5	0.7
6	-0.6	-0.3	0.0	0.4	0.7	1.1
8	-0.8	-0.4	0.0	0.5	0.9	1.4
10	-1.0	-0.5	0.0	0.6	1.2	1.7
12	-1.2	-0.6	0.0	0.7	1.4	2.1
14	-1.4	-0.7	0.0	0.8	1.6	2.4
16	-1.6	-0.8	0.0	0.9	1.8	2.7
18	-1.8	-0.9	0.0	1.0	2.0	3.0
20	-1.9	-1.0	0.0	1.1	2.2	3.4
22	-2.1	-1.1	0.0	1.2	2.5	3.7
24	-2.3	-1.2	0.0	1.3	2.7	4.0
26	-2.5	-1.3	0.0	1.5	2.9	4.3
28	-2.7	-1.3	0.0	1.6	3.1	4.6

Based on VREF40 + 70 climb, Long Range Cruise and VREF40 + 70 descent.

GEAR DOWN

Holding Planning

Flaps Up

WEIGHT (1000 KG)	TOTAL FUEL FLOW (KG/HR)							
	PRESSURE ALTITUDE (FT)							
	1500	5000	10000	15000	20000	25000	30000	35000
80	4190	4160	4140	4160	4170			
75	3950	3920	3900	3900	3900	4040		
70	3720	3680	3660	3650	3640	3710		
65	3490	3450	3420	3400	3390	3410		
60	3260	3210	3180	3150	3130	3140	3300	
55	3030	2990	2940	2910	2880	2880	2960	
50	2800	2760	2710	2680	2630	2630	2670	
45	2580	2540	2500	2460	2410	2380	2420	2510
40	2360	2320	2280	2240	2190	2150	2180	2200

This table includes 5% additional fuel for holding in a racetrack pattern.

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Net Level Off Weight

PRESSURE ALTITUDE (1000 FT)	LEVEL OFF WEIGHT (1000 KG)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
22	42.2	40.9	
20	44.9	43.3	41.8
18	47.5	45.8	43.9
16	50.1	48.3	46.2
14	53.1	51.2	49.0
12	55.8	53.7	51.4
10	58.6	56.2	53.9
8	61.1	58.9	56.8
6	63.6	61.6	59.8
4	66.4	64.4	62.6
2	69.1	67.1	65.3
0	71.6	68.4	65.4

Anti-Ice Adjustments

ANTI-ICE CONFIGURATION	LEVEL OFF WEIGHT ADJUSTMENT (1000 KG)									
	PRESSURE ALTITUDE (1000 FT)									
	0	2	4	6	8	10	12	14	16	18
ENGINE ONLY	-1.3	-1.4	-1.5	-1.6	-1.6	-1.6	-1.4	-1.3	-1.3	-1.2
ENGINE AND WING	-6.4	-6.3	-6.3	-6.3	-6.2	-6.1	-5.7	-5.3	-5.0	

Introduction

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

Takeoff

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

Brake Energy or Tire Speed Limit Weight tables are only provided if they are limiting for the range of conditions covered in the FCOM Section PD.

Field Limit Weight - Slope and Wind Corrections

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

Field and Climb Limit Weight

Tables are presented for selected airport pressure altitudes and runway conditions and show both Field and Climb Limit Weights. Enter the appropriate table for pressure altitude and runway condition with “Slope and Wind Corrected Field Length” determined above and airport OAT to obtain Field Limit Weight. Also read Climb Limit Weight for the same OAT. Intermediate altitudes may be interpolated or use next higher altitude. When finding a maximum weight for a wet runway, the dry runway limit weight must also be determined and the lower of the two weights used.

Obstacle Limit Weight

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

Tire Speed Limit

Tire Speed Limit Weight tables are only provided if they are limiting for the range of conditions covered in the FCOM Section PD.

Maximum tire speed limited weights are presented for 225 MPH tires. To determine the tire speed limit weight, enter the table with OAT and airport pressure altitude. Adjust the tire speed limit weight according to the notes below the table to account for wind.

Brake Energy Limit VMBE

Brake Energy Limit Weight tables are only provided if they are limiting for the range of conditions covered in the FCOM Section PD.

The Maximum Brake Energy Speed table provides the Reference VMBE for a variety of airport pressure altitudes and temperatures. Enter the Weight Adjusted VMBE table to adjust the Reference VMBE for the actual brake release gross weight. Correct VMBE for slope and wind. If V1 exceeds VMBE, decrease brake release weight as indicated for each knot that V1 exceeds VMBE and determine V1, VR, and V2 for the lower brake release weight.

Enroute

Long Range Cruise Maximum Operating Altitude

These tables provide the maximum operating altitude in the same manner as the FMC. Maximum altitudes are shown for a given cruise weight and maneuver capability. Note that this table considers both thrust and buffet limits, providing the more limiting of the two. Any data that is thrust limited is denoted by an asterisk and represents only a thrust limited condition in level flight with 100 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 15° may cause the airplane to lose speed and/or altitude. The altitudes shown in the table are limited to the maximum certified altitude of 41000 ft.

Long Range Cruise Trip Fuel and Time

Long Range Cruise Trip Fuel and Time tables are provided to determine trip time and fuel required to destination.

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

Long Range Cruise Step Climb Trip Fuel and Time

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

Short Trip Fuel and Time

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

Holding Planning

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

Flight Crew Oxygen Requirements

This airplane is equipped with a chemical passenger oxygen system. Regulations require that sufficient oxygen be provided to the flight crew to account for the greater of supplemental breathing oxygen in the event of a cabin depressurization or protective breathing in the event of smoke or harmful fumes in the flight deck. The oxygen quantity associated with the above requirements is achieved with the minimum dispatch oxygen cylinder pressure.

To determine the minimum dispatch oxygen cylinder pressure enter the appropriate flight crew oxygen table with the number of crew plus observers using oxygen and read the minimum cylinder pressure required for the appropriate cylinder temperature.

Net Level Off Weight

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

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

Landing

Tables are provided for determining the maximum landing weight as limited by field length or climb requirements for a single landing flap.

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

Landing Field Limit Weight

For the expected runway condition and anti-skid system configuration, obtain wind corrected field length by entering the Wind Corrected Field Length table with field length available and wind component along the runway. Now enter the Field Limit Weight table with wind corrected field length and pressure altitude to read field limit weight.

Landing Climb Limit Weight

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

Go-Around Climb Gradient

Enter the Reference Go-Around Gradient table with airport OAT and pressure altitude to determine the reference go-around gradient. Then adjust the reference gradient for airplane weight and speed using the tables provided to determine the weight and speed adjusted go-around gradient. Apply the necessary corrections for engine bleed configuration and icing conditions as noted.

Quick Turnaround Limit Weight

Enter the appropriate table (Steel or Carbon Brakes) with airport pressure altitude and OAT to read maximum quick turnaround weight. Apply the noted adjustments as required.

If the landing weight exceeds the maximum quick turnaround weight, wait the specified time and then check that the wheel thermal plugs have not melted before executing a subsequent takeoff. For Steel Brakes, the alternate procedures on the charts can be used to ensure the brake temperature is within limits. These procedures cannot be used for carbon brakes.

Gear Down

This section provides flight planning data for revenue operation with gear down. Unless otherwise noted, the gear down tables in this section are identical in format and usage to the corresponding gear up tables previously described.

To eliminate erroneous displays the flight crew should enter only gross weight data on the PERF INIT page of the Control Display Unit (CDU). Omission of the cost index and cruise altitude entries on the PERF INIT page will render the VNAV function unavailable during flight. As a result, the following information will not be provided: VNAV guidance and speed schedules, trip fuel and ETA predictions, optimum and maximum altitude data, step climb and top of descent predictions, and the VNAV descent guidance path.

The gross weight entry allows the FMCS takeoff and approach speed schedules to be generated. In addition, the flap maneuver speed and VREF speed bugs will be available for display on the primary flight display speed tape. Except for VNAV, normal autopilot and autothrottle modes will remain available for use during the flight, as will the LNAV mode.

Takeoff/Landing Climb Limit Weight

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

Performance Dispatch Chapter PD

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737-700W CFM56-7B24A+26B2_BUMP C M KG FAA CATF/M HIGH_ALT PAX GAS

Performance Dispatch Chapter PD

Pkg Model Identification Section 30

General

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

Serial and tabulation number are supplied by Boeing.

Registry Number	Serial Number	Tabulation Number
B-5277	38381	YN531
B-5279	38384	YN532
B-5278	38383	YN533
B-5280	38385	YN534

Intentionally
Blank

Minimum Takeoff Weight (26KB2 Bump)

Weight Limit (1000 KG)

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)								
	S.L. & BELOW	1000	2000	3000	4000	5000	6000	7000	8000 & ABOVE
50	51.4	49.9	48.6	47.1	45.7	43.8	42.3	41.0	39.6
45	53.3	51.7	50.1	48.6	47.2	45.5	47.8	42.6	41.3
40	54.8	53.2	51.6	50.1	48.6	47.0	45.3	44.1	42.9
35	55.6	54.3	53.0	51.4	49.9	48.2	46.6	45.3	44.0
30	56.2	55.1	53.9	52.4	50.8	49.2	47.5	46.2	44.9
25	56.5	55.3	54.1	52.9	51.3	49.8	48.2	46.9	45.5
20	56.7	55.3	54.1	52.9	51.3	50.1	48.6	47.1	45.8
15	56.7	55.3	54.1	52.9	51.3	50.1	48.6	47.1	45.9
10 & BELOW	56.7	55.3	54.1	52.9	51.3	50.1	48.6	47.1	45.9

Takeoff at the 26KB2 Bump thrust rating requires observance of a minimum takeoff weight in order to maintain airplane controllability during takeoff. For takeoff at weights below the minimum takeoff weight, use of a lower thrust rating (24K fullrate thrust or a certified derate) is required. Note that the assumed temperature method of reducing thrust may not be used as a means to comply with this restriction.

Takeoff Field Corrections - Dry Runway

Slope Corrections

FIELD LENGTH AVAILABLE (M)	SLOPE CORRECTED FIELD LENGTH (M)								
	RUNWAY SLOPE (%)								
	-2.0	-1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	2.0
1200	1250	1240	1230	1210	1200	1180	1170	1150	1130
1400	1470	1460	1440	1420	1400	1370	1340	1300	1270
1600	1700	1670	1650	1620	1600	1550	1510	1460	1410
1800	1920	1890	1860	1830	1800	1740	1680	1610	1550
2000	2140	2110	2070	2040	2000	1920	1850	1770	1690
2200	2370	2330	2280	2240	2200	2110	2020	1930	1830
2400	2590	2540	2500	2450	2400	2290	2190	2080	1970
2600	2820	2760	2710	2650	2600	2480	2360	2240	2120
2800	3040	2980	2920	2860	2800	2660	2530	2390	2260
3000	3260	3200	3130	3070	3000	2850	2700	2550	2400
3200	3490	3420	3340	3270	3200	3030	2870	2700	2540
3400	3710	3630	3560	3480	3400	3220	3040	2860	2680
3600	3930	3850	3770	3680	3600	3400	3210	3010	2820
3800	4160	4070	3980	3890	3800	3590	3380	3170	2960
4000	4380	4290	4190	4100	4000	3780	3550	3330	3100
4200	4610	4500	4400	4300	4200	3960	3720	3480	3240
4400	4830	4720	4610	4510	4400	4150	3890	3640	3380
4600	5050	4940	4830	4710	4600	4330	4060	3790	3520
4800	5280	5160	5040	4920	4800	4520	4230	3950	3660
5000	5500	5370	5250	5120	5000	4700	4400	4100	3810

Wind Corrections

SLOPE CORR'D FIELD LENGTH (M)	SLOPE & WIND CORRECTED FIELD LENGTH (M)							
	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1200	850	970	1080	1200	1290	1370	1440	1500
1400	1020	1140	1270	1400	1490	1580	1650	1720
1600	1180	1320	1460	1600	1690	1780	1860	1940
1800	1350	1500	1650	1800	1900	1990	2070	2150
2000	1510	1680	1840	2000	2100	2190	2280	2370
2200	1680	1850	2030	2200	2300	2400	2490	2590
2400	1850	2030	2220	2400	2500	2600	2710	2810
2600	2010	2210	2400	2600	2700	2810	2920	3020
2800	2180	2390	2590	2800	2910	3020	3130	3240
3000	2350	2560	2780	3000	3110	3220	3340	3460
3200	2510	2740	2970	3200	3310	3430	3550	3680
3400	2680	2920	3160	3400	3510	3630	3760	3890
3600	2840	3100	3350	3600	3720	3840	3970	4110
3800	3010	3270	3540	3800	3920	4040	4180	4330
4000	3180	3450	3730	4000	4120	4250	4390	4550
4200	3340	3630	3910	4200	4320	4460	4600	4760
4400	3510	3810	4100	4400	4520	4660	4810	4980
4600	3670	3980	4290	4600	4730	4870	5020	5200
4800	3840	4160	4480	4800	4930	5070	5240	5420
5000	4010	4340	4670	5000	5130	5280	5450	5630

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 5

Sea Level Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1200	58.1	54.2	53.8	53.5	53.2	52.9	52.6	50.3	49.0	47.6	46.3
1400	63.0	58.7	58.4	58.0	57.7	57.3	57.0	54.5	53.1	51.6	50.2
1600	67.5	62.9	62.5	62.1	61.8	61.4	61.0	58.4	56.9	55.3	53.8
1800	71.6	66.7	66.4	66.0	65.6	65.2	64.8	61.9	60.4	58.7	57.0
2000	75.6	70.4	70.0	69.6	69.2	68.8	68.4	65.3	63.6	61.9	60.1
2200	79.5	74.0	73.5	73.1	72.6	72.2	71.8	68.5	66.7	64.9	63.0
2400	81.6	77.3	76.8	76.4	75.9	75.4	75.0	71.6	69.7	67.7	65.7
2600	81.6	80.4	80.0	79.5	79.0	78.5	78.0	74.5	72.5	70.4	68.4
2800	81.6	81.6	81.6	81.6	81.6	81.5	81.0	77.3	75.2	73.1	70.9
3000	81.6	81.6	81.6	81.6	81.6	81.6	81.6	79.4	77.3	75.1	72.9
3200	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.5	79.3	77.0	74.7
3400	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.3	78.9	76.6
3600	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	80.9	78.4
3800	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	80.3
4000	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6
4200	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6
4400	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6
CLIMB LIMIT WT (1000 KG)	78.3	77.7	77.6	77.5	77.3	77.2	77.1	71.6	68.9	66.3	63.6

2000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1200	55.5	51.5	51.2	50.9	50.6	50.3	49.1	46.7	45.4	44.2	42.9
1400	60.2	55.9	55.5	55.2	54.9	54.5	53.2	50.6	49.2	47.9	46.5
1600	64.5	59.8	59.5	59.1	58.8	58.4	57.0	54.2	52.7	51.3	49.8
1800	68.4	63.5	63.1	62.7	62.4	62.0	60.5	57.5	55.9	54.4	52.9
2000	72.3	67.0	66.6	66.2	65.8	65.4	63.8	60.6	58.9	57.3	55.7
2200	75.9	70.3	69.9	69.4	69.0	68.6	66.9	63.5	61.7	60.0	58.3
2400	79.3	73.4	73.0	72.5	72.1	71.6	69.9	66.3	64.4	62.6	60.8
2600	81.6	76.4	75.9	75.5	75.0	74.5	72.7	68.9	67.0	65.1	63.2
2800	81.6	79.3	78.8	78.3	77.8	77.3	75.5	71.5	69.5	67.5	65.6
3000	81.6	81.5	81.0	80.5	80.0	79.5	77.5	73.4	71.4	69.3	67.3
3200	81.6	81.6	81.6	81.6	81.6	81.6	79.6	75.3	73.2	71.0	68.9
3400	81.6	81.6	81.6	81.6	81.6	81.6	81.6	77.2	75.0	72.8	70.6
3600	81.6	81.6	81.6	81.6	81.6	81.6	81.6	79.1	76.8	74.5	72.2
3800	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.0	78.6	76.3	74.0
4000	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	80.4	78.0	75.6
4200	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	79.7	77.3
4400	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.3	78.8
CLIMB LIMIT WT (1000 KG)	75.4	74.7	74.6	74.5	74.4	74.3	71.6	66.4	63.9	61.4	59.0

**With engine bleed for packs off, increase field limit weight by 400 kg and climb limit weight by 1500 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 700 kg and climb limit weight by 1450 kg.**

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 5

4000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1200	52.8	48.9	48.6	48.2	47.9	46.8	45.6	43.2	42.1	41.0	40.0
1400	57.2	53.0	52.6	52.3	52.0	50.7	49.4	46.8	45.6	44.4	43.4
1600	61.3	56.7	56.4	56.0	55.7	54.3	52.9	50.2	48.9	47.6	46.5
1800	65.1	60.2	59.8	59.4	59.1	57.6	56.2	53.2	51.8	50.5	49.3
2000	68.7	63.5	63.1	62.7	62.3	60.7	59.2	56.0	54.6	53.1	51.8
2200	72.1	66.6	66.1	65.7	65.3	63.7	62.0	58.7	57.1	55.6	54.2
2400	75.3	69.5	69.1	68.6	68.1	66.5	64.7	61.2	59.6	58.0	56.5
2600	78.4	72.3	71.8	71.4	70.9	69.1	67.3	63.6	61.9	60.2	58.7
2800	81.3	75.0	74.5	74.0	73.5	71.7	69.8	66.0	64.2	62.5	60.9
3000	81.6	77.1	76.6	76.1	75.6	73.7	71.7	67.7	65.9	64.1	62.5
3200	81.6	79.1	78.6	78.1	77.5	75.5	73.5	69.4	67.5	65.6	63.9
3400	81.6	81.1	80.6	80.0	79.5	77.4	75.3	71.1	69.1	67.2	65.4
3600	81.6	81.6	81.6	81.6	81.4	79.3	77.1	72.7	70.7	68.7	66.9
3800	81.6	81.6	81.6	81.6	81.6	81.2	79.0	74.5	72.4	70.3	68.4
4000	81.6	81.6	81.6	81.6	81.6	81.6	80.8	76.2	74.0	71.9	70.0
4200	81.6	81.6	81.6	81.6	81.6	81.6	81.6	77.8	75.6	73.4	71.5
4400	81.6	81.6	81.6	81.6	81.6	81.6	81.6	79.4	77.2	74.9	72.9
CLIMB LIMIT WT (1000 KG)	72.3	71.8	71.7	71.6	71.5	68.9	66.4	61.5	59.2	56.9	54.8

6000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1200	50.1	46.1	45.8	45.5	44.4	43.3	42.2	40.1	39.1	38.1	37.3
1400	54.3	50.0	49.7	49.4	48.2	46.9	45.7	43.4	42.4	41.4	40.4
1600	58.2	53.6	53.2	52.9	51.6	50.3	49.0	46.5	45.4	44.3	43.3
1800	61.7	56.8	56.5	56.1	54.7	53.3	51.9	49.3	48.1	47.0	45.9
2000	65.1	59.9	59.5	59.1	57.7	56.1	54.7	51.9	50.6	49.4	48.2
2200	68.3	62.8	62.4	61.9	60.4	58.8	57.3	54.3	52.9	51.6	50.4
2400	71.3	65.5	65.1	64.6	63.0	61.3	59.7	56.6	55.1	53.8	52.5
2600	74.2	68.1	67.7	67.2	65.5	63.7	62.0	58.8	57.3	55.9	54.5
2800	77.0	70.7	70.2	69.7	68.0	66.1	64.4	61.0	59.4	57.9	56.5
3000	79.1	72.6	72.1	71.6	69.8	67.9	66.0	62.6	60.9	59.4	57.9
3200	81.2	74.4	73.9	73.4	71.5	69.5	67.6	64.0	62.3	60.8	59.2
3400	81.6	76.3	75.7	75.2	73.3	71.2	69.2	65.5	63.7	62.1	60.6
3600	81.6	78.1	77.6	77.0	75.0	72.9	70.9	67.0	65.2	63.5	61.9
3800	81.6	80.0	79.4	78.9	76.8	74.6	72.5	68.6	66.7	64.9	63.3
4000	81.6	81.6	81.3	80.7	78.6	76.3	74.2	70.1	68.2	66.4	64.7
4200	81.6	81.6	81.6	81.6	80.3	78.0	75.8	71.6	69.6	67.8	66.0
4400	81.6	81.6	81.6	81.6	81.6	79.6	77.3	73.0	71.0	69.1	67.3
CLIMB LIMIT WT (1000 KG)	69.3	68.9	68.8	68.7	66.2	63.7	61.3	56.8	54.6	52.7	50.9

With engine bleed for packs off, increase field limit weight by 400 kg and climb limit weight by 1500 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 700 kg and climb limit weight by 1450 kg.

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 5

8000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1200	47.1	43.4	43.1	42.2	41.2	40.1	39.1	37.2	36.3	35.4	34.6
1400	51.1	47.1	46.8	45.7	44.6	43.5	42.4	40.3	39.4	38.4	37.5
1600	54.7	50.4	50.1	49.0	47.8	46.6	45.4	43.2	42.2	41.2	40.2
1800	58.1	53.5	53.1	52.0	50.7	49.4	48.2	45.8	44.7	43.6	42.6
2000	61.2	56.3	55.9	54.7	53.3	52.0	50.7	48.1	47.0	45.8	44.7
2200	64.2	59.0	58.6	57.3	55.8	54.4	53.0	50.3	49.1	47.9	46.7
2400	67.0	61.5	61.1	59.7	58.2	56.7	55.2	52.4	51.1	49.8	48.6
2600	69.7	64.0	63.5	62.1	60.5	58.9	57.4	54.4	53.0	51.7	50.5
2800	72.3	66.3	65.9	64.4	62.7	61.1	59.5	56.4	55.0	53.6	52.3
3000	74.3	68.1	67.6	66.1	64.4	62.6	61.0	57.8	56.3	54.9	53.5
3200	76.2	69.8	69.3	67.7	65.9	64.1	62.4	59.1	57.6	56.1	54.7
3400	78.1	71.5	71.0	69.3	67.5	65.6	63.8	60.4	58.8	57.3	55.8
3600	80.0	73.1	72.6	70.9	69.0	67.1	65.3	61.7	60.1	58.5	57.0
3800	81.6	74.9	74.4	72.6	70.6	68.7	66.8	63.1	61.5	59.8	58.3
4000	81.6	76.6	76.1	74.2	72.2	70.2	68.3	64.5	62.8	61.1	59.5
4200	81.6	78.3	77.7	75.8	73.8	71.7	69.7	65.9	64.1	62.4	60.7
4400	81.6	79.9	79.3	77.4	75.3	73.1	71.1	67.2	65.4	63.6	61.9
CLIMB LIMIT WT (1000 KG)	66.1	65.8	65.7	63.5	61.1	58.8	56.5	52.3	50.5	48.7	47.0

10000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1200	44.2	40.9	40.1	39.1	38.2	37.2	36.3	34.4	33.5	32.7	31.8
1400	47.9	44.3	43.4	42.4	41.4	40.3	39.3	37.3	36.4	35.4	34.5
1600	51.4	47.5	46.5	45.5	44.3	43.2	42.1	40.0	39.0	38.0	37.0
1800	54.5	50.3	49.3	48.2	47.0	45.8	44.6	42.4	41.3	40.2	39.2
2000	57.4	53.0	51.9	50.7	49.4	48.1	46.9	44.5	43.3	42.2	41.1
2200	60.1	55.4	54.3	53.0	51.7	50.3	49.0	46.5	45.2	44.0	42.9
2400	62.7	57.8	56.6	55.2	53.8	52.4	51.0	48.3	47.0	45.8	44.6
2600	65.2	60.0	58.8	57.4	55.9	54.4	53.0	50.2	48.8	47.5	46.2
2800	67.6	62.3	61.0	59.5	58.0	56.4	54.9	52.0	50.6	49.2	47.9
3000	69.4	63.9	62.5	61.0	59.4	57.8	56.3	53.2	51.8	50.3	49.0
3200	71.2	65.4	64.0	62.4	60.8	59.1	57.5	54.4	52.9	51.4	49.9
3400	72.9	66.9	65.5	63.9	62.1	60.4	58.8	55.5	53.9	52.4	50.9
3600	74.6	68.5	67.0	65.3	63.5	61.7	60.0	56.7	55.1	53.5	51.9
3800	76.4	70.1	68.6	66.8	65.0	63.1	61.4	57.9	56.3	54.6	53.0
4000	78.2	71.7	70.1	68.3	66.4	64.5	62.7	59.2	57.5	55.8	54.2
4200	79.9	73.2	71.6	69.7	67.8	65.9	64.0	60.4	58.6	56.9	55.2
4400	81.5	74.7	73.0	71.1	69.1	67.1	65.3	61.5	59.7	58.0	56.3
CLIMB LIMIT WT (1000 KG)	62.8	62.4	60.6	58.6	56.3	54.1	52.0	48.1	46.3	44.4	42.7

With engine bleed for packs off, increase field limit weight by 400 kg and climb limit weight by 1500 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 700 kg and climb limit weight by 1450 kg.

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 5

12000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	2	6	10	14	18	22	26	30	38	46
1200	41.7	38.7	38.4	37.7	36.9	36.0	34.9	33.9	32.9	31.1	29.3
1400	44.9	41.7	41.5	40.8	39.9	38.9	37.8	36.8	35.8	33.9	32.1
1600	48.1	44.8	44.6	43.8	42.9	41.9	40.8	39.7	38.6	36.7	34.7
1800	51.0	47.6	47.3	46.5	45.6	44.5	43.3	42.2	41.1	39.1	37.0
2000	53.7	50.1	49.8	49.0	48.1	46.9	45.7	44.5	43.3	41.2	39.0
2200	56.2	52.4	52.1	51.2	50.2	49.0	47.7	46.5	45.3	43.0	40.7
2400	58.5	54.5	54.2	53.3	52.2	51.0	49.6	48.3	47.0	44.7	42.3
2600	60.7	56.6	56.3	55.3	54.3	53.0	51.5	50.2	48.9	46.4	44.0
2800	63.0	58.7	58.3	57.4	56.2	54.9	53.4	52.1	50.7	48.1	45.6
3000	64.8	60.4	60.0	59.0	57.8	56.5	54.9	53.5	52.1	49.4	46.8
3200	66.6	62.0	61.6	60.5	59.3	57.9	56.3	54.8	53.3	50.6	47.9
3400	68.3	63.5	63.1	62.0	60.8	59.3	57.6	56.1	54.6	51.7	48.9
3600	69.9	65.0	64.6	63.5	62.2	60.6	58.9	57.4	55.8	52.8	49.9
3800	71.5	66.5	66.0	64.9	63.5	62.0	60.2	58.6	56.9	53.9	50.9
4000	73.0	67.9	67.4	66.2	64.9	63.2	61.4	59.7	58.1	55.0	51.9
4200	74.5	69.2	68.8	67.5	66.1	64.5	62.6	60.9	59.2	56.0	52.8
4400	76.0	70.5	70.1	68.8	67.4	65.7	63.8	62.0	60.2	57.0	53.8
4600	77.4	71.8	71.4	70.1	68.6	66.8	64.9	63.1	61.3	58.0	54.7
CLIMB LIMIT WT (1000 KG)	59.0	58.5	58.4	57.2	55.8	53.9	51.7	49.8	47.9	44.5	41.2

14000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	2	6	10	14	18	22	26	30	38	46
1200	38.5	35.7	35.1	34.4	33.7	32.9	31.9	31.0	30.2	28.6	26.9
1400	41.6	38.7	38.0	37.4	36.6	35.7	34.7	33.8	32.9	31.3	29.6
1600	44.7	41.6	40.9	40.3	39.5	38.5	37.5	36.6	35.6	33.9	32.1
1800	47.4	44.2	43.5	42.8	42.0	41.0	39.9	38.9	38.0	36.2	34.3
2000	50.0	46.6	45.9	45.1	44.3	43.2	42.1	41.0	40.1	38.1	36.2
2200	52.2	48.7	47.9	47.1	46.2	45.2	43.9	42.9	41.8	39.8	37.8
2400	54.3	50.6	49.8	49.0	48.1	46.9	45.6	44.5	43.4	41.3	39.2
2600	56.4	52.6	51.8	50.9	49.9	48.8	47.4	46.3	45.1	42.9	40.7
2800	58.5	54.5	53.7	52.8	51.8	50.5	49.2	48.0	46.8	44.5	42.2
3000	60.2	56.1	55.2	54.2	53.2	51.9	50.5	49.3	48.1	45.7	43.3
3200	61.8	57.5	56.6	55.6	54.5	53.2	51.7	50.4	49.2	46.7	44.3
3400	63.3	58.9	57.9	56.9	55.8	54.4	52.9	51.6	50.3	47.7	45.2
3600	64.8	60.2	59.2	58.2	57.0	55.6	54.1	52.7	51.3	48.7	46.1
3800	66.2	61.5	60.5	59.4	58.2	56.8	55.2	53.7	52.3	49.6	46.9
4000	67.6	62.8	61.7	60.6	59.4	57.9	56.2	54.8	53.4	50.6	47.8
4200	69.0	64.0	62.9	61.8	60.6	59.0	57.3	55.8	54.3	51.5	48.6
4400	70.3	65.2	64.1	62.9	61.7	60.1	58.3	56.8	55.3	52.4	49.5
4600	71.6	66.4	65.2	64.1	62.8	61.1	59.4	57.8	56.3	53.3	50.3
CLIMB LIMIT WT (1000 KG)	55.1	54.6	53.5	52.5	51.2	49.4	47.4	45.8	44.2	41.1	37.9

With engine bleed for packs off, increase field limit weight by 400 kg and climb limit weight by 1450 kg.
With engine anti-ice on, decrease field limit weight by 1700 kg and climb limit weight by 1900 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 2200 kg and climb limit weight by 2700 kg.

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 5

14500 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	2	6	10	14	18	22	26	30	38	46
1200	37.7	34.9	34.3	33.7	33.0	32.1	31.1	30.3	29.5	27.9	26.4
1400	40.8	37.8	37.2	36.6	35.8	34.9	33.9	33.1	32.2	30.6	29.0
1600	43.8	40.7	40.1	39.4	38.7	37.7	36.7	35.8	34.9	33.2	31.5
1800	46.6	43.3	42.6	42.0	41.1	40.2	39.1	38.1	37.2	35.4	33.6
2000	49.0	45.7	44.9	44.2	43.4	42.3	41.2	40.2	39.2	37.4	35.5
2200	51.3	47.7	46.9	46.2	45.3	44.2	43.0	42.0	41.0	39.0	37.0
2400	53.3	49.6	48.8	48.0	47.1	45.9	44.7	43.6	42.5	40.5	38.4
2600	55.4	51.5	50.7	49.9	48.9	47.7	46.4	45.3	44.2	42.1	39.9
2800	57.4	53.4	52.5	51.7	50.7	49.5	48.1	47.0	45.8	43.6	41.4
3000	59.1	54.9	54.0	53.1	52.1	50.8	49.5	48.3	47.1	44.8	42.5
3200	60.6	56.3	55.3	54.5	53.4	52.1	50.6	49.4	48.2	45.8	43.4
3400	62.1	57.6	56.6	55.7	54.6	53.3	51.8	50.5	49.2	46.7	44.3
3600	63.5	58.9	57.9	57.0	55.8	54.4	52.9	51.5	50.2	47.7	45.1
3800	64.9	60.2	59.1	58.2	57.0	55.5	53.9	52.6	51.2	48.6	45.9
4000	66.3	61.4	60.3	59.3	58.1	56.6	55.0	53.6	52.2	49.5	46.8
4200	67.6	62.6	61.5	60.5	59.2	57.7	56.0	54.6	53.1	50.4	47.6
4400	68.9	63.8	62.6	61.6	60.3	58.7	57.0	55.5	54.1	51.2	48.4
4600	70.1	64.9	63.7	62.7	61.4	59.8	58.0	56.5	55.0	52.1	49.2
CLIMB LIMIT WT (1000 KG)	54.1	53.4	52.3	51.4	50.1	48.4	46.4	44.8	43.2	40.2	37.1

With engine bleed for packs off, increase field limit weight by 400 kg and climb limit weight by 1450 kg.
With engine anti-ice on, decrease field limit weight by 1700 kg and climb limit weight by 1900 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 2200 kg and climb limit weight by 2700 kg.

Takeoff Field Corrections - Wet Runway

Slope Corrections

FIELD LENGTH AVAILABLE (M)	SLOPE CORRECTED FIELD LENGTH (M)								
	RUNWAY SLOPE (%)								
	-2.0	-1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	2.0
1200	1240	1230	1220	1210	1200	1190	1180	1160	1150
1400	1470	1450	1430	1420	1400	1380	1350	1330	1300
1600	1700	1670	1650	1620	1600	1560	1530	1490	1460
1800	1930	1890	1860	1830	1800	1750	1710	1660	1610
2000	2150	2120	2080	2040	2000	1940	1880	1820	1760
2200	2380	2340	2290	2250	2200	2130	2060	1990	1920
2400	2610	2560	2510	2450	2400	2320	2240	2150	2070
2600	2840	2780	2720	2660	2600	2510	2410	2320	2230
2800	3070	3000	2930	2870	2800	2690	2590	2480	2380
3000	3300	3220	3150	3070	3000	2880	2770	2650	2530
3200	3530	3440	3360	3280	3200	3070	2940	2820	2690
3400	3750	3670	3580	3490	3400	3260	3120	2980	2840
3600	3980	3890	3790	3700	3600	3450	3300	3150	2990
3800	4210	4110	4010	3900	3800	3640	3470	3310	3150
4000	4440	4330	4220	4110	4000	3830	3650	3480	3300
4200	4670	4550	4430	4320	4200	4010	3830	3640	3460
4400	4900	4770	4650	4520	4400	4200	4000	3810	3610
4600	5130	4990	4860	4730	4600	4390	4180	3970	3760
4800	5350	5220	5080	4940	4800	4580	4360	4140	3920
5000	5580	5440	5290	5150	5000	4770	4540	4300	4070

Wind Corrections

SLOPE CORR'D FIELD LENGTH (M)	SLOPE & WIND CORRECTED FIELD LENGTH (M)							
	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1200	840	960	1080	1200	1280	1360	1450	1530
1400	1010	1140	1270	1400	1490	1580	1670	1760
1600	1180	1320	1460	1600	1690	1790	1890	1990
1800	1350	1500	1650	1800	1900	2000	2110	2210
2000	1520	1680	1840	2000	2110	2220	2330	2440
2200	1690	1860	2030	2200	2310	2430	2550	2670
2400	1860	2040	2220	2400	2520	2640	2770	2890
2600	2030	2220	2410	2600	2730	2850	2990	3120
2800	2190	2400	2600	2800	2930	3070	3210	3350
3000	2360	2580	2790	3000	3140	3280	3430	3570
3200	2530	2760	2980	3200	3350	3490	3640	3800
3400	2700	2930	3170	3400	3550	3710	3860	4030
3600	2870	3110	3360	3600	3760	3920	4080	4250
3800	3040	3290	3550	3800	3960	4130	4300	4480
4000	3210	3470	3740	4000	4170	4350	4520	4710
4200	3380	3650	3930	4200	4380	4560	4740	4930
4400	3550	3830	4120	4400	4580	4770	4960	5160
4600	3720	4010	4310	4600	4790	4980	5180	5390
4800	3890	4190	4500	4800	5000	5200	5400	5610
5000	4060	4370	4690	5000	5200	5410	5620	5840

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 5

Sea Level Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1450	64.3	59.5	59.1	58.7	58.3	57.9	57.6	54.7	53.3	51.9	50.5
1600	67.6	62.5	62.1	61.6	61.2	60.9	60.5	57.5	55.9	54.5	53.0
1800	71.6	66.2	65.7	65.3	64.9	64.4	64.0	60.8	59.2	57.6	56.1
2000	75.4	69.6	69.2	68.7	68.2	67.8	67.4	64.0	62.3	60.6	59.0
2200	79.0	72.9	72.4	72.0	71.5	71.0	70.5	67.0	65.2	63.5	61.7
2400	81.6	76.1	75.6	75.1	74.6	74.1	73.6	69.9	68.0	66.2	64.3
2600	81.6	79.1	78.6	78.0	77.5	77.0	76.5	72.6	70.6	68.7	66.8
2800	81.6	81.6	81.5	80.9	80.4	79.9	79.3	75.3	73.2	71.3	69.3
3000	81.6	81.6	81.6	81.6	81.6	81.6	81.6	77.6	75.4	73.4	71.3
3200	81.6	81.6	81.6	81.6	81.6	81.6	81.6	79.9	77.7	75.6	73.5
3400	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	80.0	77.8	75.5
3600	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	79.9	77.6
3800	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	79.5
4000	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.4
4200	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6
4400	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6
CLIMB LIMIT WT (1000 KG)	78.3	77.7	77.6	77.5	77.3	77.2	77.1	71.6	68.9	66.3	63.6

2000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1450	61.1	56.3	55.9	55.5	55.1	54.7	53.3	50.7	49.4	48.1	46.8
1600	64.2	59.1	58.7	58.3	57.9	57.5	56.0	53.2	51.8	50.4	49.1
1800	68.0	62.6	62.2	61.7	61.3	60.9	59.3	56.3	54.8	53.4	52.0
2000	71.6	65.9	65.4	64.9	64.5	64.0	62.4	59.2	57.6	56.1	54.7
2200	75.0	69.0	68.5	68.0	67.5	67.0	65.3	62.0	60.3	58.7	57.2
2400	78.2	71.9	71.4	70.9	70.4	69.9	68.1	64.6	62.9	61.2	59.5
2600	81.4	74.8	74.2	73.7	73.2	72.6	70.7	67.1	65.3	63.5	61.8
2800	81.6	77.6	77.0	76.4	75.9	75.3	73.3	69.5	67.7	65.8	64.1
3000	81.6	79.9	79.3	78.8	78.2	77.6	75.6	71.6	69.7	67.8	66.0
3200	81.6	81.6	81.6	81.2	80.6	80.0	77.8	73.7	71.7	69.8	67.9
3400	81.6	81.6	81.6	81.6	81.6	81.6	80.1	75.8	73.8	71.7	69.8
3600	81.6	81.6	81.6	81.6	81.6	81.6	81.6	77.9	75.7	73.6	71.6
3800	81.6	81.6	81.6	81.6	81.6	81.6	81.6	79.8	77.6	75.4	73.4
4000	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	79.5	77.2	75.1
4200	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.3	79.0	76.8
4400	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	81.6	80.7	78.4
CLIMB LIMIT WT (1000 KG)	75.4	74.7	74.6	74.5	74.4	74.3	71.6	66.4	63.9	61.4	59.0

With engine bleed for packs off, increase field limit weight by 400 kg and climb limit weight by 1500 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 750 kg and climb limit weight by 1450 kg.

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 5

4000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1450	58.0	53.0	52.7	52.3	52.0	50.7	49.4	46.9	45.8	44.7	43.6
1600	61.0	55.7	55.3	54.9	54.5	53.2	51.8	49.2	48.1	46.9	45.8
1800	64.5	58.9	58.5	58.1	57.7	56.3	54.8	52.1	50.8	49.6	48.4
2000	67.9	62.0	61.6	61.1	60.7	59.2	57.7	54.8	53.4	52.1	50.9
2200	71.1	64.9	64.5	64.0	63.6	61.9	60.3	57.3	55.9	54.5	53.2
2400	74.2	67.7	67.2	66.7	66.3	64.6	62.9	59.7	58.2	56.7	55.4
2600	77.1	70.3	69.8	69.3	68.8	67.1	65.3	62.0	60.5	58.9	57.5
2800	80.0	72.9	72.4	71.9	71.4	69.5	67.7	64.2	62.6	61.0	59.6
3000	81.6	75.1	74.6	74.0	73.5	71.6	69.7	66.1	64.5	62.8	61.2
3200	81.6	77.4	76.8	76.3	75.7	73.7	71.8	68.0	66.3	64.6	63.0
3400	81.6	79.6	79.0	78.5	77.9	75.8	73.8	69.9	68.1	66.3	64.7
3600	81.6	81.6	81.2	80.6	80.0	77.9	75.8	71.8	69.9	68.1	66.4
3800	81.6	81.6	81.6	81.6	81.6	79.8	77.7	73.5	71.6	69.7	68.0
4000	81.6	81.6	81.6	81.6	81.6	81.6	79.5	75.3	73.3	71.3	69.5
4200	81.6	81.6	81.6	81.6	81.6	81.6	81.3	77.0	75.0	72.9	71.1
4400	81.6	81.6	81.6	81.6	81.6	81.6	81.6	78.6	76.6	74.5	72.6
CLIMB LIMIT WT (1000 KG)	72.3	71.8	71.7	71.6	71.5	68.9	66.4	61.5	59.2	56.9	54.8

6000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1450	54.7	49.9	49.6	49.3	48.0	46.9	45.7	43.5	42.5	41.5	40.6
1600	57.4	52.4	52.1	51.7	50.4	49.2	48.0	45.7	44.6	43.6	42.6
1800	60.8	55.5	55.1	54.7	53.3	52.0	50.8	48.3	47.1	46.1	45.0
2000	63.9	58.3	57.9	57.6	56.1	54.7	53.4	50.8	49.5	48.4	47.3
2200	66.9	61.0	60.6	60.2	58.7	57.2	55.8	53.1	51.8	50.6	49.4
2400	69.8	63.6	63.2	62.8	61.1	59.6	58.1	55.3	53.9	52.6	51.4
2600	72.5	66.1	65.6	65.2	63.5	61.9	60.4	57.4	55.9	54.6	53.4
2800	75.2	68.5	68.0	67.6	65.8	64.1	62.5	59.4	58.0	56.6	55.3
3000	77.5	70.5	70.0	69.6	67.7	66.0	64.3	61.1	59.6	58.2	56.8
3200	79.9	72.6	72.1	71.6	69.7	67.9	66.2	62.9	61.3	59.8	58.4
3400	81.6	74.7	74.2	73.7	71.7	69.8	68.0	64.6	62.9	61.4	59.9
3600	81.6	76.7	76.1	75.6	73.6	71.6	69.8	66.2	64.5	62.9	61.4
3800	81.6	78.6	78.1	77.5	75.4	73.4	71.5	67.8	66.1	64.4	62.9
4000	81.6	80.5	79.9	79.4	77.2	75.1	73.2	69.4	67.6	65.9	64.3
4200	81.6	81.6	81.6	81.2	79.0	76.8	74.8	70.9	69.0	67.3	65.7
4400	81.6	81.6	81.6	81.6	80.7	78.5	76.4	72.4	70.5	68.8	67.1
CLIMB LIMIT WT (1000 KG)	69.3	68.9	68.8	68.7	66.2	63.7	61.3	56.8	54.6	52.7	50.9

With engine bleed for packs off, increase field limit weight by 400 kg and climb limit weight by 1500 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 750 kg and climb limit weight by 1450 kg.

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 5

8000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1450	51.3	47.0	46.7	45.6	44.5	43.5	42.4	40.4	39.5	38.6	37.7
1600	53.8	49.3	49.0	47.9	46.7	45.6	44.5	42.4	41.4	40.4	39.5
1800	57.0	52.1	51.8	50.7	49.4	48.2	47.0	44.8	43.7	42.7	41.8
2000	59.9	54.8	54.5	53.3	52.0	50.7	49.4	47.0	46.0	44.9	43.9
2200	62.7	57.3	57.0	55.7	54.3	53.0	51.7	49.2	48.0	46.9	45.8
2400	65.4	59.7	59.3	58.0	56.6	55.1	53.8	51.1	49.9	48.8	47.6
2600	67.9	62.0	61.6	60.2	58.7	57.2	55.8	53.1	51.8	50.6	49.4
2800	70.4	64.3	63.9	62.4	60.9	59.3	57.8	55.0	53.7	52.4	51.1
3000	72.5	66.1	65.7	64.2	62.6	61.0	59.5	56.5	55.1	53.8	52.5
3200	74.7	68.1	67.6	66.1	64.4	62.7	61.1	58.0	56.6	55.3	53.9
3400	76.8	70.0	69.5	67.9	66.1	64.4	62.8	59.6	58.1	56.7	55.3
3600	78.9	71.8	71.3	69.7	67.9	66.1	64.4	61.1	59.6	58.1	56.7
3800	80.9	73.6	73.1	71.4	69.5	67.7	65.9	62.5	60.9	59.4	58.0
4000	81.6	75.3	74.8	73.0	71.1	69.2	67.4	63.9	62.3	60.7	59.2
4200	81.6	77.0	76.5	74.7	72.7	70.8	68.9	65.3	63.6	62.0	60.5
4400	81.6	78.7	78.1	76.3	74.3	72.3	70.4	66.7	65.0	63.3	61.7
CLIMB LIMIT WT (1000 KG)	66.1	65.8	65.7	63.5	61.1	58.8	56.5	52.3	50.5	48.7	47.0

10000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1450	48.0	44.2	43.3	42.3	41.3	40.3	39.3	37.4	36.5	35.6	34.7
1600	50.4	46.3	45.4	44.4	43.3	42.2	41.2	39.2	38.2	37.3	36.3
1800	53.3	49.0	48.0	46.9	45.8	44.6	43.5	41.4	40.4	39.4	38.4
2000	56.1	51.5	50.5	49.3	48.1	46.9	45.7	43.5	42.4	41.3	40.3
2200	58.7	53.8	52.8	51.6	50.3	49.0	47.8	45.4	44.3	43.1	42.1
2400	61.1	56.1	54.9	53.6	52.3	51.0	49.7	47.2	46.0	44.8	43.7
2600	63.5	58.2	57.0	55.7	54.3	52.9	51.6	49.0	47.7	46.5	45.3
2800	65.8	60.3	59.1	57.7	56.2	54.8	53.4	50.7	49.4	48.1	46.9
3000	67.7	62.0	60.7	59.3	57.8	56.3	54.9	52.0	50.7	49.4	48.1
3200	69.7	63.8	62.5	61.0	59.4	57.8	56.3	53.4	52.0	50.6	49.3
3400	71.7	65.5	64.2	62.6	61.0	59.3	57.8	54.8	53.3	51.9	50.5
3600	73.6	67.2	65.8	64.2	62.5	60.8	59.3	56.1	54.6	53.2	51.7
3800	75.4	68.9	67.4	65.7	64.0	62.3	60.6	57.4	55.9	54.3	52.9
4000	77.2	70.4	68.9	67.2	65.4	63.7	62.0	58.7	57.1	55.5	54.0
4200	78.9	72.0	70.5	68.7	66.9	65.0	63.3	59.9	58.3	56.7	55.1
4400	80.6	73.6	72.0	70.2	68.3	66.4	64.6	61.1	59.5	57.8	56.2
CLIMB LIMIT WT (1000 KG)	62.8	62.4	60.6	58.6	56.3	54.1	52.0	48.1	46.3	44.4	42.7

With engine bleed for packs off, increase field limit weight by 400 kg and climb limit weight by 1500 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 750 kg and climb limit weight by 1450 kg.

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 5

12000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	2	6	10	14	18	22	26	30	38	46
1450	45.0	41.7	41.4	40.7	39.9	39.0	38.0	37.0	36.1	34.3	32.6
1600	47.3	43.8	43.5	42.8	42.0	41.0	39.9	38.9	37.9	36.1	34.3
1800	50.0	46.4	46.1	45.3	44.5	43.4	42.3	41.3	40.2	38.3	36.4
2000	52.6	48.8	48.4	47.7	46.7	45.7	44.5	43.4	42.3	40.2	38.2
2200	54.9	50.9	50.6	49.8	48.8	47.7	46.4	45.3	44.1	42.0	39.9
2400	57.1	52.9	52.6	51.7	50.7	49.5	48.2	47.1	45.9	43.6	41.5
2600	59.2	54.9	54.5	53.6	52.6	51.4	50.0	48.8	47.5	45.3	43.0
2800	61.3	56.8	56.5	55.5	54.5	53.2	51.8	50.6	49.3	46.9	44.6
3000	63.1	58.6	58.2	57.2	56.1	54.8	53.4	52.1	50.7	48.3	45.9
3200	64.9	60.2	59.8	58.8	57.7	56.4	54.9	53.5	52.2	49.7	47.2
3400	66.7	61.9	61.4	60.4	59.3	57.9	56.4	55.0	53.6	51.0	48.4
3600	68.4	63.4	63.0	62.0	60.8	59.4	57.8	56.3	54.9	52.2	49.6
3800	70.1	64.9	64.5	63.4	62.2	60.7	59.1	57.6	56.1	53.4	50.7
4000	71.7	66.4	66.0	64.9	63.6	62.1	60.4	58.9	57.4	54.5	51.7
4200	73.3	67.8	67.4	66.3	65.0	63.4	61.7	60.1	58.6	55.7	52.8
4400	74.8	69.2	68.8	67.6	66.3	64.7	62.9	61.3	59.7	56.7	53.8
4600	76.3	70.6	70.1	68.9	67.6	66.0	64.2	62.5	60.9	57.8	54.8
4800	77.8	71.9	71.4	70.2	68.8	67.2	65.3	63.7	62.0	58.8	55.8
CLIMB LIMIT WT (1000 KG)	59.0	58.5	58.4	57.2	55.8	53.9	51.7	49.8	47.9	44.5	41.2

14000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	2	6	10	14	18	22	26	30	38	46
1450	41.8	38.7	38.0	37.4	36.7	35.9	34.9	34.1	33.3	31.7	30.1
1600	43.9	40.7	40.0	39.4	38.6	37.7	36.7	35.9	35.0	33.4	31.7
1800	46.5	43.1	42.4	41.7	40.9	40.0	38.9	38.0	37.1	35.4	33.7
2000	48.8	45.3	44.6	43.8	43.0	42.0	40.9	40.0	39.0	37.2	35.4
2200	51.0	47.3	46.5	45.8	44.9	43.9	42.7	41.7	40.8	38.9	37.0
2400	53.0	49.1	48.3	47.6	46.7	45.6	44.4	43.4	42.3	40.4	38.4
2600	55.0	50.9	50.1	49.3	48.4	47.3	46.0	45.0	43.9	41.8	39.8
2800	56.9	52.8	51.9	51.1	50.2	49.0	47.7	46.6	45.5	43.4	41.3
3000	58.6	54.4	53.5	52.6	51.7	50.5	49.1	48.0	46.9	44.7	42.5
3200	60.3	55.9	55.0	54.1	53.1	51.9	50.5	49.3	48.2	45.9	43.7
3400	61.9	57.4	56.5	55.6	54.5	53.3	51.9	50.6	49.4	47.1	44.8
3600	63.5	58.8	57.9	57.0	55.9	54.6	53.1	51.9	50.6	48.2	45.9
3800	65.0	60.2	59.3	58.3	57.2	55.8	54.3	53.0	51.8	49.3	46.8
4000	66.5	61.5	60.6	59.6	58.4	57.0	55.5	54.2	52.9	50.3	47.8
4200	67.9	62.9	61.8	60.8	59.7	58.2	56.6	55.3	53.9	51.3	48.7
4400	69.3	64.1	63.1	62.0	60.8	59.4	57.8	56.4	55.0	52.3	49.6
4600	70.7	65.4	64.3	63.2	62.0	60.5	58.8	57.4	56.0	53.3	50.5
4800	72.0	66.6	65.5	64.4	63.1	61.6	59.9	58.4	57.0	54.2	51.4
CLIMB LIMIT WT (1000 KG)	55.1	54.6	53.5	52.5	51.2	49.4	47.4	45.8	44.2	41.1	37.9

With engine bleed for packs off, increase field limit weight by 400 kg and climb limit weight by 1450 kg.
With engine anti-ice on, decrease field limit weight by 1400 kg and climb limit weight by 1900 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 1750 kg and climb limit weight by 2700 kg.

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 5

14500 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	2	6	10	14	18	22	26	30	38	46
1450	41.0	37.9	37.2	36.7	36.0	35.1	34.2	33.4	32.6	31.0	29.5
1600	43.1	39.8	39.2	38.6	37.8	36.9	36.0	35.1	34.3	32.7	31.1
1800	45.6	42.2	41.5	40.9	40.1	39.1	38.1	37.2	36.4	34.7	33.0
2000	47.9	44.3	43.6	43.0	42.2	41.2	40.1	39.2	38.2	36.5	34.7
2200	50.0	46.3	45.5	44.9	44.0	43.0	41.8	40.9	39.9	38.1	36.2
2400	52.0	48.1	47.3	46.6	45.7	44.6	43.5	42.5	41.5	39.5	37.6
2600	53.9	49.9	49.1	48.3	47.4	46.3	45.1	44.0	43.0	41.0	39.0
2800	55.9	51.7	50.8	50.1	49.1	48.0	46.7	45.6	44.6	42.5	40.4
3000	57.5	53.2	52.4	51.6	50.6	49.4	48.1	47.0	45.9	43.8	41.6
3200	59.2	54.8	53.9	53.0	52.0	50.8	49.5	48.3	47.2	45.0	42.8
3400	60.8	56.2	55.3	54.4	53.4	52.1	50.8	49.6	48.4	46.2	43.9
3600	62.3	57.6	56.7	55.8	54.7	53.4	52.0	50.8	49.6	47.3	44.9
3800	63.8	59.0	58.0	57.1	56.0	54.6	53.2	51.9	50.7	48.3	45.9
4000	65.2	60.3	59.2	58.3	57.2	55.8	54.3	53.0	51.8	49.3	46.8
4200	66.6	61.5	60.5	59.5	58.4	57.0	55.4	54.1	52.8	50.3	47.7
4400	68.0	62.8	61.7	60.7	59.5	58.1	56.5	55.2	53.8	51.2	48.6
4600	69.3	64.0	62.9	61.9	60.7	59.2	57.6	56.2	54.8	52.1	49.5
4800	70.6	65.1	64.0	63.0	61.8	60.3	58.6	57.2	55.8	53.1	50.3
CLIMB LIMIT WT (1000 KG)	54.1	53.4	52.3	51.4	50.1	48.4	46.4	44.8	43.2	40.2	37.1

With engine bleed for packs off, increase field limit weight by 400 kg and climb limit weight by 1450 kg.
With engine anti-ice on, decrease field limit weight by 1400 kg and climb limit weight by 1900 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 1750 kg and climb limit weight by 2700 kg.

Takeoff Obstacle Limit Weight

Flaps 5

Sea Level, 30°C & Below, Zero Wind

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

Reference Obstacle Limit Weight (1000 KG)

OBSTACLE HEIGHT (M)	DISTANCE FROM BRAKE RELEASE (100 M)										
	25	30	35	40	45	50	55	60	65	70	75
5	71.4	76.6	79.7								
20	65.4	70.3	74.2	77.0	79.0						
40	60.4	64.9	68.7	71.8	74.2	76.2	77.6	78.9	79.9	80.8	
60	56.5	61.0	64.7	67.7	70.3	72.4	74.1	75.7	76.9	78.0	78.8
80	53.4	57.8	61.4	64.5	67.1	69.3	71.0	72.8	74.1	75.4	76.4
100	50.6	55.0	58.6	61.7	64.3	66.6	68.4	70.2	71.6	73.0	74.1
120	48.2	52.6	56.2	59.3	61.9	64.2	66.1	67.9	69.4	70.9	72.0
140	46.1	50.4	54.0	57.1	59.7	62.0	64.0	65.9	67.4	68.9	70.1
160	44.2	48.4	52.0	55.1	57.8	60.1	62.0	64.0	65.5	67.1	68.3
180	42.4	46.7	50.2	53.3	56.0	58.3	60.3	62.2	63.8	65.4	66.7
200		45.0	48.6	51.6	54.3	56.7	58.6	60.6	62.2	63.8	65.1
220		43.5	47.0	50.1	52.8	55.1	57.1	59.1	60.7	62.3	63.7
240		42.1	45.6	48.7	51.3	53.7	55.7	57.7	59.3	61.0	62.3
260			44.3	47.3	50.0	52.3	54.3	56.4	58.0	59.6	61.0
280			43.1	46.0	48.7	51.1	53.1	55.1	56.8	58.4	59.8
300			41.9	44.9	47.5	49.9	51.9	53.9	55.6	57.2	58.6

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

OAT Adjustments

OAT (°C)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 KG)								
	40	45	50	55	60	65	70	75	80
30 & BELOW	0	0	0	0	0	0	0	0	0
32	-0.7	-0.8	-0.8	-0.9	-1.0	-1.1	-1.2	-1.3	-1.4
34	-1.3	-1.5	-1.7	-1.9	-2.0	-2.2	-2.4	-2.6	-2.8
36	-2.0	-2.3	-2.5	-2.8	-3.1	-3.3	-3.6	-3.9	-4.2
38	-2.6	-3.0	-3.4	-3.7	-4.1	-4.5	-4.8	-5.2	-5.6
40	-3.3	-3.8	-4.2	-4.7	-5.1	-5.6	-6.0	-6.5	-6.9
42	-3.9	-4.5	-5.0	-5.6	-6.1	-6.6	-7.2	-7.7	-8.3
44	-4.5	-5.2	-5.8	-6.4	-7.1	-7.7	-8.3	-9.0	-9.6
46	-5.2	-5.9	-6.6	-7.3	-8.1	-8.8	-9.5	-10.2	-11.0
48	-5.8	-6.6	-7.4	-8.2	-9.0	-9.9	-10.7	-11.5	-12.3
50	-6.4	-7.3	-8.2	-9.1	-10.0	-10.9	-11.8	-12.7	-13.6

Pressure Altitude Adjustments

ALT (FT)	OAT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)								
	40	45	50	55	60	65	70	75	80
S.L. & BELOW	0	0	0	0	0	0	0	0	0
1000	-1.5	-1.7	-1.9	-2.1	-2.3	-2.4	-2.6	-2.8	-3.0
2000	-3.1	-3.4	-3.8	-4.1	-4.5	-4.9	-5.2	-5.6	-5.9
3000	-4.4	-4.9	-5.5	-6.0	-6.5	-7.1	-7.6	-8.2	-8.7
4000	-5.7	-6.5	-7.2	-7.9	-8.6	-9.3	-10.0	-10.7	-11.4
5000	-7.0	-7.9	-8.8	-9.7	-10.5	-11.4	-12.3	-13.2	-14.0
6000	-8.3	-9.3	-10.4	-11.4	-12.5	-13.5	-14.5	-15.6	-16.6
7000	-9.5	-10.7	-11.9	-13.1	-14.3	-15.5	-16.7	-17.9	-19.1
8000	-10.6	-12.0	-13.3	-14.7	-16.1	-17.4	-18.8	-20.1	-21.5
9000	-11.7	-13.2	-14.7	-16.2	-17.8	-19.3	-20.8	-22.3	-23.8
10000	-12.8	-14.5	-16.1	-17.8	-19.5	-21.1	-22.8	-24.4	-26.1

Takeoff Obstacle Limit Weight

Flaps 5

Wind Adjustments

WIND (KTS)	OAT & ALT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)								
	40	45	50	55	60	65	70	75	80
15 TW	-8.5	-8.4	-8.2	-8.0	-7.8	-7.6	-7.4	-7.2	-7.0
10 TW	-5.7	-5.6	-5.4	-5.3	-5.2	-5.1	-4.9	-4.8	-4.7
5 TW	-2.8	-2.8	-2.7	-2.7	-2.6	-2.5	-2.5	-2.4	-2.3
0	0	0	0	0	0	0	0	0	0
10 HW	1.0	1.0	0.9	0.9	0.8	0.7	0.7	0.6	0.6
20 HW	2.0	1.9	1.8	1.7	1.6	1.5	1.4	1.3	1.1
30 HW	3.1	2.9	2.8	2.6	2.4	2.2	2.1	1.9	1.7
40 HW	4.2	3.9	3.7	3.5	3.2	3.0	2.8	2.5	2.3

With engine bleed for packs off, increase weight by 650 kg.
With engine anti-ice on, decrease weight by 300 kg.
With engine and wing anti-ice on, decrease weight by 1550 kg (optional system).

Takeoff Obstacle Limit Weight - High Altitude

Flaps 5

10000 ft, 10°C & Below, Zero Wind

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

Reference Obstacle Limit Weight (1000 KG)

OBSTACLE HEIGHT (M)	DISTANCE FROM BRAKE RELEASE (100 M)										
	25	30	35	40	45	50	55	60	65	70	75
5	55.2	59.4	62.5	64.6							
20	51.0	54.9	58.1	60.7	62.7	64.1	65.3				
40	47.2	51.0	54.1	56.6	58.7	60.5	61.9	63.1	64.0	64.8	65.5
60	44.3	48.0	51.0	53.5	55.7	57.5	59.0	60.3	61.5	62.4	63.2
80		45.5	48.5	51.0	53.1	55.0	56.6	58.0	59.2	60.2	61.1
100		43.3	46.3	48.8	51.0	52.8	54.5	55.9	57.1	58.2	59.2
120		41.4	44.4	46.9	49.0	50.9	52.6	54.0	55.3	56.5	57.5
140			42.6	45.1	47.3	49.2	50.9	52.4	53.7	54.9	55.9
160				43.6	45.7	47.6	49.3	50.8	52.2	53.4	54.5
180				42.1	44.3	46.2	47.9	49.4	50.8	52.0	53.1
200					42.9	44.9	46.6	48.1	49.5	50.7	51.9
220					41.7	43.6	45.3	46.9	48.3	49.5	50.7
240						42.5	44.2	45.7	47.1	48.4	49.6
260							43.1	44.6	46.1	47.3	48.5
280							42.1	43.6	45.0	46.3	47.5
300							41.1	42.6	44.1	45.4	46.5

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

Takeoff Obstacle Limit Weight - High Altitude

Flaps 5

OAT Adjustments

OAT (°C)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 KG)								
	40	44	48	52	56	60	64	68	72
10 & BELOW	0	0	0	0	0	0	0	0	0
12	-0.6	-0.7	-0.8	-0.8	-0.9	-1.0	-1.0	-1.1	-1.2
14	-1.2	-1.4	-1.5	-1.7	-1.8	-2.0	-2.1	-2.2	-2.4
16	-1.8	-2.1	-2.3	-2.5	-2.7	-2.9	-3.1	-3.4	-3.6
18	-2.5	-2.8	-3.0	-3.3	-3.6	-3.9	-4.2	-4.5	-4.8
20	-3.1	-3.4	-3.8	-4.2	-4.5	-4.9	-5.2	-5.6	-6.0
22	-3.7	-4.1	-4.6	-5.0	-5.5	-5.9	-6.3	-6.8	-7.2
24	-4.3	-4.8	-5.4	-5.9	-6.4	-6.9	-7.5	-8.0	-8.5
26	-4.9	-5.5	-6.1	-6.7	-7.4	-8.0	-8.6	-9.2	-9.8
28	-5.5	-6.2	-6.9	-7.6	-8.3	-9.0	-9.7	-10.4	-11.1
30	-6.1	-6.9	-7.7	-8.5	-9.2	-10.0	-10.8	-11.6	-12.3
32	-6.6	-7.4	-8.3	-9.2	-10.0	-10.9	-11.8	-12.6	-13.5
34	-7.0	-7.9	-8.9	-9.9	-10.8	-11.8	-12.8	-13.7	-14.7
36	-7.4	-8.4	-9.5	-10.6	-11.6	-12.7	-13.7	-14.8	-15.8
38	-7.8	-8.9	-10.1	-11.2	-12.4	-13.6	-14.7	-15.9	-17.0
40	-8.2	-9.5	-10.7	-11.9	-13.2	-14.4	-15.7	-16.9	-18.2
42	-8.2	-9.6	-11.0	-12.4	-13.8	-15.2	-16.6	-18.0	-19.4
44	-8.2	-9.7	-11.3	-12.8	-14.4	-16.0	-17.5	-19.1	-20.7
46	-8.1	-9.8	-11.6	-13.3	-15.0	-16.7	-18.5	-20.2	-21.9
48	-8.1	-10.0	-11.9	-13.7	-15.6	-17.5	-19.4	-21.3	-23.2
50	-8.1	-10.1	-12.2	-14.2	-16.2	-18.3	-20.3	-22.4	-24.4

Pressure Altitude Adjustments

ALT (FT)	OAT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)								
	40	44	48	52	56	60	64	68	72
10000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11000	-1.8	-2.0	-2.2	-2.3	-2.5	-2.7	-2.9	-3.1	-3.2
12000	-3.6	-3.9	-4.2	-4.6	-4.9	-5.2	-5.6	-5.9	-6.2
13000	-5.3	-5.8	-6.3	-6.7	-7.2	-7.7	-8.2	-8.7	-9.2
14000	-6.8	-7.5	-8.1	-8.8	-9.4	-10.1	-10.7	-11.4	-12.1
14500	-7.5	-8.3	-9.0	-9.8	-10.5	-11.3	-11.9	-12.7	-13.5

Wind Adjustments

WIND (KTS)	OAT & ALT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)								
	40	44	48	52	56	60	64	68	72
15 TW	-6.3	-6.1	-5.9	-5.7	-5.5	-5.3	-5.1	-4.9	-4.7
10 TW	-4.2	-4.1	-3.9	-3.8	-3.7	-3.5	-3.4	-3.2	-3.1
5 TW	-2.1	-2.0	-2.0	-1.9	-1.8	-1.8	-1.7	-1.6	-1.6
0	0	0	0	0	0	0	0	0	0
10 HW	0.8	0.7	0.7	0.6	0.6	0.5	0.5	0.4	0.4
20 HW	1.6	1.5	1.4	1.3	1.2	1.0	0.9	0.8	0.7
30 HW	2.4	2.2	2.1	1.9	1.7	1.6	1.4	1.2	1.1
40 HW	3.2	3.0	2.8	2.5	2.3	2.1	1.9	1.7	1.4

With engine bleed for packs off, increase weight by 700 kg.
With engine anti-ice on, decrease weight by 1950 kg.
With engine and wing anti-ice on, decrease weight by 2950 kg (optional system).

Long Range Cruise Maximum Operating Altitude

Max Cruise Thrust

ISA + 10°C and Below

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
85	31000	-8	34200*	34200*	33800	32200	30800
80	32300	-10	35700*	35700*	35100	33500	32100
75	33700	-14	37000*	37000*	36500	34900	33500
70	35200	-17	38300*	38300*	37900	36400	35000
65	36700	-19	39700*	39700*	39400	37900	36500
60	38400	-19	41000	41000	41000	39600	38200
55	40200	-19	41000	41000	41000	41000	40000
50	41000	-19	41000	41000	41000	41000	41000
45	41000	-19	41000	41000	41000	41000	41000
40	41000	-19	41000	41000	41000	41000	41000

ISA + 15°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
85	31000	-2	32900*	32900*	32900*	32200	30800
80	32300	-5	34600*	34600*	34600*	33500	32100
75	33700	-8	36100*	36100*	36100*	34900	33500
70	35200	-11	37500*	37500*	37500*	36400	35000
65	36700	-13	38900*	38900*	38900*	37900	36500
60	38400	-13	40300*	40300*	40300*	39600	38200
55	40200	-13	41000	41000	41000	41000	40000
50	41000	-13	41000	41000	41000	41000	41000
45	41000	-13	41000	41000	41000	41000	41000
40	41000	-13	41000	41000	41000	41000	41000

ISA + 20°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
85	31000	4	30400*	30400*	30400*	30400*	30400*
80	32300	1	32900*	32900*	32900*	32900*	32100
75	33700	-2	34800*	34800*	34800*	34800*	33500
70	35200	-6	36300*	36300*	36300*	36300*	35000
65	36700	-8	37800*	37800*	37800*	37800*	36500
60	38400	-8	39200*	39200*	39200*	39200*	38200
55	40200	-8	40700*	40700*	40700*	40700*	40000
50	41000	-8	41000	41000	41000	41000	41000
45	41000	-8	41000	41000	41000	41000	41000
40	41000	-8	41000	41000	41000	41000	41000

***Denotes altitude thrust limited in level flight, 100 fpm residual rate of climb.**

Long Range Cruise Trip Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
279	259	241	226	212	200	190	181	173	166	159
555	516	481	451	424	400	381	364	348	334	321
830	772	720	675	636	600	572	547	524	503	484
1105	1028	959	900	847	800	764	731	700	672	646
1378	1283	1198	1124	1059	1000	955	914	875	840	808
1651	1538	1436	1348	1270	1200	1146	1097	1051	1009	971
1923	1792	1674	1572	1482	1400	1338	1280	1226	1178	1133
2194	2045	1912	1795	1693	1600	1529	1463	1402	1347	1296
2465	2299	2149	2019	1904	1800	1720	1646	1578	1516	1459
2735	2551	2386	2242	2115	2000	1912	1830	1754	1685	1622
3004	2803	2622	2465	2326	2200	2103	2013	1930	1854	1785
3273	3055	2859	2688	2537	2400	2295	2197	2106	2023	1948
3541	3306	3095	2911	2748	2600	2486	2380	2282	2193	2111
3808	3557	3330	3133	2959	2800	2678	2564	2459	2362	2275
4075	3807	3566	3356	3169	3000	2869	2747	2635	2532	2438
4341	4057	3801	3578	3380	3200	3061	2931	2811	2702	2602
4606	4306	4035	3800	3590	3400	3252	3115	2988	2871	2765
4870	4555	4270	4021	3801	3600	3444	3298	3164	3041	2929
5134	4803	4504	4243	4011	3800	3635	3482	3341	3211	3092
5397	5051	4738	4464	4221	4000	3827	3666	3517	3380	3256
5660	5298	4972	4686	4431	4200	4018	3850	3694	3550	3420
5922	5545	5205	4907	4642	4400	4210	4033	3870	3720	3583
6183	5792	5438	5128	4852	4600	4402	4217	4046	3890	3747
6444	6038	5671	5349	5062	4800	4593	4401	4223	4059	3910
6704	6284	5903	5569	5271	5000	4785	4584	4399	4229	4074

Long Range Cruise Trip Fuel and Time

Reference Fuel and Time Required

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	29		31		33		35		37	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	1.5	0:38	1.5	0:38	1.5	0:37	1.5	0:37	1.5	0:37
400	2.5	1:09	2.4	1:08	2.4	1:07	2.4	1:06	2.4	1:05
600	3.5	1:41	3.4	1:38	3.4	1:36	3.3	1:34	3.3	1:33
800	4.5	2:12	4.4	2:09	4.3	2:05	4.2	2:03	4.1	2:00
1000	5.5	2:42	5.4	2:38	5.3	2:34	5.1	2:31	5.0	2:28
1200	6.5	3:12	6.4	3:07	6.2	3:02	6.1	2:59	6.0	2:56
1400	7.6	3:42	7.4	3:37	7.2	3:31	7.0	3:27	6.9	3:23
1600	8.6	4:12	8.4	4:06	8.2	3:59	8.0	3:54	7.8	3:51
1800	9.7	4:42	9.4	4:35	9.2	4:28	8.9	4:22	8.8	4:18
2000	10.7	5:12	10.5	5:04	10.2	4:56	9.9	4:50	9.7	4:46
2200	11.8	5:41	11.5	5:32	11.2	5:24	10.9	5:18	10.7	5:13
2400	12.9	6:10	12.6	6:00	12.2	5:51	11.9	5:45	11.6	5:40
2600	14.0	6:39	13.7	6:29	13.3	6:19	12.9	6:12	12.6	6:07
2800	15.1	7:08	14.7	6:57	14.3	6:47	13.9	6:40	13.6	6:34
3000	16.2	7:37	15.8	7:25	15.3	7:15	14.9	7:07	14.6	7:01
3200	17.4	8:05	16.9	7:52	16.4	7:42	16.0	7:34	15.6	7:28
3400	18.5	8:33	18.0	8:20	17.5	8:09	17.0	8:01	16.7	7:55
3600	19.7	9:01	19.2	8:47	18.6	8:36	18.1	8:28	17.7	8:21
3800	20.9	9:29	20.3	9:15	19.7	9:03	19.1	8:55	18.8	8:48
4000	22.0	9:57	21.4	9:42	20.8	9:31	20.2	9:23	19.8	9:15
4200	23.2	10:24	22.6	10:09	21.9	9:57	21.3	9:49	21.0	9:42
4400	24.4	10:51	23.7	10:36	23.0	10:24	22.4	10:16	22.1	10:08
4600	25.7	11:18	24.9	11:03	24.2	10:51	23.5	10:43	23.3	10:35
4800	26.9	11:46	26.1	11:30	25.3	11:18	24.7	11:09	24.4	11:02
5000	28.1	12:13	27.3	11:57	26.5	11:45	25.8	11:36	25.5	11:28

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	LANDING WEIGHT (1000 KG)				
	30	40	50	60	70
2	-0.3	-0.2	0.0	0.3	0.5
4	-0.6	-0.3	0.0	0.5	1.1
6	-0.9	-0.5	0.0	0.8	1.9
8	-1.2	-0.7	0.0	1.0	2.7
10	-1.6	-0.8	0.0	1.4	3.6
12	-1.9	-1.0	0.0	1.7	4.6
14	-2.2	-1.2	0.0	2.1	5.6
16	-2.6	-1.4	0.0	2.6	6.8
18	-2.9	-1.6	0.0	3.0	8.0
20	-3.3	-1.7	0.0	3.5	9.3
22	-3.7	-1.9	0.0	4.0	10.7
24	-4.1	-2.1	0.0	4.6	12.2
26	-4.5	-2.3	0.0	5.2	13.8
28	-4.9	-2.5	0.0	5.8	15.4
30	-5.3	-2.7	0.0	6.4	17.1

Based on 280/.78 climb, Long Range Cruise speed and .78/280/250 descent.

Long Range Cruise Step Climb

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
1320	1241	1170	1108	1051	1000	954	912	873	837	805
1836	1729	1633	1547	1470	1400	1336	1278	1225	1176	1131
2352	2216	2095	1986	1889	1800	1719	1646	1578	1515	1458
2867	2703	2557	2426	2307	2200	2102	2013	1930	1855	1785
3382	3190	3019	2865	2726	2600	2485	2380	2283	2194	2112
3897	3677	3481	3304	3145	3000	2868	2747	2636	2534	2439
4411	4164	3942	3743	3563	3400	3251	3114	2989	2873	2766
4925	4650	4404	4182	3982	3800	3634	3482	3342	3213	3093
5439	5136	4865	4621	4401	4200	4017	3849	3695	3553	3421
5953	5622	5326	5060	4819	4600	4400	4217	4048	3892	3748
6466	6108	5787	5499	5238	5000	4783	4584	4401	4232	4076

Trip Fuel and Time Required

AIR DIST (NM)	TRIP FUEL (1000 KG)							TIME (HRS:MIN)
	LANDING WEIGHT (1000 KG)							
	40	45	50	55	60	65	70	
1000	4.3	4.6	4.9	5.4	5.7	6.1	6.4	2:26
1400	5.9	6.3	6.7	7.3	7.8	8.3	8.8	3:20
1800	7.5	8.0	8.6	9.3	9.9	10.6	11.2	4:13
2200	9.1	9.7	10.5	11.3	12.1	13.0	13.8	5:07
2600	10.7	11.5	12.4	13.4	14.4	15.4	16.4	6:01
3000	12.4	13.3	14.4	15.6	16.7	17.9	19.0	6:54
3400	14.1	15.2	16.5	17.8	19.1	20.5	21.8	7:48
3800	15.8	17.2	18.6	20.1	21.6	23.1	24.6	8:41
4200	17.7	19.1	20.7	22.5	24.1	25.8	27.5	9:34
4600	19.5	21.2	23.0	24.9	26.7	28.6	30.5	10:27
5000	21.5	23.3	25.3	27.4	29.4	31.5	33.6	11:20

Based on 280/.78 climb, Long Range Cruise speed and .78/280/250 descent.
Valid for all pressure altitudes with 4000 ft step climb to 2000 ft above optimum altitude.

Short Trip Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
95	81	70	62	55	50	46	42	39	36	34
161	144	130	118	108	100	93	87	81	77	72
227	206	188	174	161	150	140	132	125	118	112
291	267	246	229	213	200	188	178	168	160	152
354	327	304	283	266	250	236	224	212	202	193
417	387	361	338	318	300	284	270	257	245	234
480	447	418	393	370	350	332	316	301	288	275
543	507	475	447	422	400	380	362	345	330	316
608	568	533	502	475	450	428	408	389	373	357
675	631	592	558	527	500	475	453	433	414	397

Trip Fuel and Time Required

AIR DIST (NM)		LANDING WEIGHT (1000 KG)						TIME (HRS:MIN)
		40	45	50	55	60	65	
50	FUEL (1000 KG)	0.5	0.6	0.6	0.6	0.7	0.7	0:14
	ALT (FT)	11000	11000	11000	9000	9000	9000	
100	FUEL (1000 KG)	0.8	0.9	0.9	1.0	1.0	1.1	0:23
	ALT (FT)	17000	17000	17000	15000	15000	15000	
150	FUEL (1000 KG)	1.1	1.2	1.2	1.3	1.3	1.4	0:31
	ALT (FT)	25000	25000	23000	23000	23000	23000	
200	FUEL (1000 KG)	1.3	1.4	1.5	1.6	1.6	1.7	0:38
	ALT (FT)	31000	29000	27000	27000	25000	25000	
250	FUEL (1000 KG)	1.5	1.6	1.7	1.8	1.9	2.0	0:44
	ALT (FT)	41000	37000	35000	33000	31000	31000	
300	FUEL (1000 KG)	1.7	1.8	1.9	2.0	2.2	2.3	0:51
	ALT (FT)	41000	41000	37000	37000	35000	35000	
350	FUEL (1000 KG)	1.9	2.0	2.1	2.3	2.4	2.5	0:57
	ALT (FT)	41000	41000	39000	37000	37000	35000	
400	FUEL (1000 KG)	2.1	2.2	2.4	2.5	2.7	2.8	1:03
	ALT (FT)	41000	41000	41000	39000	37000	35000	
450	FUEL (1000 KG)	2.3	2.4	2.6	2.7	2.9	3.1	1:10
	ALT (FT)	41000	41000	41000	39000	37000	35000	
500	FUEL (1000 KG)	2.5	2.6	2.8	3.0	3.2	3.3	1:18
	ALT (FT)	41000	41000	41000	39000	37000	35000	

Based on 280/.78 climb, Long Range Cruise speed and .78/280/250 descent.

Holding Planning

Flaps Up

WEIGHT (1000 KG)	TOTAL FUEL FLOW (KG/HR)								
	PRESSURE ALTITUDE (FT)								
	1500	5000	10000	15000	20000	25000	30000	35000	41000
80	2810	2770	2740	2730	2670	2670	2710		
75	2650	2610	2580	2560	2500	2490	2530	2610	
70	2500	2450	2420	2390	2350	2310	2350	2400	
65	2340	2290	2260	2230	2190	2140	2180	2210	
60	2180	2130	2100	2070	2030	1970	2000	2020	
55	2030	1980	1940	1910	1870	1820	1830	1850	1960
50	1870	1820	1780	1750	1710	1710	1680	1690	1770
45	1720	1670	1650	1620	1580	1550	1530	1520	1580
40	1610	1550	1500	1460	1430	1400	1380	1360	1400

This table includes 5% additional fuel for holding in a racetrack pattern.

Flight Crew Oxygen Requirements

For Aircraft with Gaseous Passenger Oxygen System

Table 1

NUMBER OF CREW	OXYGEN REQUIRED (LITERS)
2	660
3	990
4	1320

Table 2

NUMBER OF CREW	OXYGEN REQUIRED FOR LEVEL OFF AT 14000 FT (LITERS)	
	TOTAL POST DECOMPRESSION TIME (HR)	
	2	3
2	660	960
3	980	1440
4	1310	1920

Table 3

NUMBER OF CREW	ADDITIONAL LITERS REQUIRED FOR EACH MINUTE HELD AT INTERMEDIATE ALTITUDE OTHER THAN 14000 FT				
	INTERMEDIATE PRESSURE ALTITUDE (FT)				
	UP TO 13999	14000	14001 TO 17999	18000 TO 21999	22000 TO 25000
	REGULATOR ON "NORMAL" OR (100%)				
2	0 (22)	0 (17)	1 (16)	3 (12)	6 (10)
3	0 (33)	0 (25)	2 (24)	5 (18)	8 (15)
4	0 (44)	0 (34)	2 (32)	6 (24)	11 (20)

For more extensive than normal crew usage, add 2.05 liters/person/minute for each crew member at 8000 ft cabin altitude when regulator setting is NORMAL; or 13 liters/person/minute when regulator setting is 100%.

Instructions:

1. **Determine protective breathing requirements from Table 1.**
2. **Determine supplemental requirements for level off at 14000 ft from Table 2 and correct for level off altitudes other than 14000 ft using Table 3.**
3. **Flight crew system oxygen requirements are the larger of protective breathing (Table 1) or supplemental requirements (Table 2).**

Flight Crew Oxygen Requirements

For Aircraft with Gaseous Passenger Oxygen System

Table 4

Cylinder Volume to Pressure Conversion

OXYGEN VOLUME (1000 LITERS)	CYLINDER PRESSURE AT 21°C (PSI)
0.1	200
0.3	300
0.5	400
0.7	500
0.8	600
1.0	700
1.2	800
1.4	900
1.5	1000
1.7	1100
1.9	1200
2.1	1300
2.2	1400
2.4	1500
2.6	1600
2.7	1700
2.9	1800
3.1	1900
3.3	2000

Check maximum pressure in shaded area. Maximum cylinder pressure = 1850 PSI at 21°C. For maximum cylinder pressure at hotter or colder temperatures, add or subtract 32 PSI per 5°C, respectively.

Table 5

Temperature Corrections

CYLINDER PRESSURE AT 21°C (PSI)	PRESSURE CORRECTION FOR EACH 5°C ABOVE/BELOW 21°C (PSI)
400	+7/-7
600	+11/-11
800	+14/-14
1000	+17/-17
1200	+21/-21
1400	+24/-24
1600	+28/-28
1800	+31/-31
2000	+34/-34

Passenger Oxygen Requirements

For Aircraft with Gaseous Passenger Oxygen System

Table 1

NUMBER OF OCCUPANTS IN PASSENGER CABIN	TOTAL POST DECOMPRESSION TIME (HOURS)	PRESSURE ALTITUDE AT DECOMPRESSION (FT)				
		27000	31000	35000	39000	43000
		LITERS REQUIRED				
100	0.17*	1170	1240	1330	1470	1620
	1	1480	1600	1750	1960	2180
	2	2140	2260	2410	2620	2840
	3	2800	2920	3070	3280	3500
200	0.17*	2330	2460	2630	2900	3170
	1	2940	3190	3480	3870	4290
	2	4260	4510	4800	5190	5610
	3	5580	5830	6120	6510	6930

Total post decompression time includes descent, level-off at intermediate altitude (if applicable) and flight at final level-off altitude.
Time to shut down 90% of masks at or below 14000 ft pressure altitude is 11 minutes.
***Minimum post decompression time (10 min) approximates direct descent to 10000 ft pressure altitude.**

Table 2

NUMBER OF OCCUPANTS IN PASSENGER CABIN	ADDITIONAL OXYGEN REQUIRED (LITERS PER MINUTE ABOVE 14000 FT PRESSURE ALTITUDE)			
	INTERMEDIATE PRESSURE ALTITUDE			
	15000**	17000	21000	25000
100	13	79	149	209
200	26	158	298	418

Total oxygen quantity required is:
Emergency descent and level-off at or below 14000 ft pressure altitude (from table 1) plus cruise above 14000 ft pressure altitude (from table 2).
****30% of cabin occupants using oxygen.**

Passenger Oxygen Requirements

For Aircraft with Gaseous Passenger Oxygen System

Table 3

Cylinder Volume to Pressure Conversion

CYLINDER PRESSURE AT 21°C (PSI)	OXYGEN VOLUME (1000 LITERS)								
	NUMBER OF 115 CUBIC FOOT CYLINDERS INSTALLED								
	4	5	6	7	8	9	10	11	12
100	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.3
200	0.7	0.9	1.1	1.3	1.5	1.7	1.9	2.1	2.3
300	1.4	1.8	2.2	2.6	2.9	3.3	3.7	4.0	4.4
400	2.1	2.7	3.2	3.8	4.3	4.9	5.4	6.0	6.5
500	2.8	3.5	4.3	5.0	5.7	6.4	7.1	7.9	8.6
600	3.5	4.4	5.3	6.2	7.1	8.0	8.9	9.8	10.7
700	4.2	5.3	6.3	7.4	8.5	9.5	10.6	11.7	12.7
800	4.9	6.1	7.4	8.6	9.9	11.1	12.3	13.6	14.8
900	5.6	7.0	8.4	9.8	11.3	12.7	14.1	15.5	16.9
1000	6.3	7.9	9.5	11.1	12.6	14.2	15.8	17.4	19.0
1100	7.0	8.7	10.5	12.3	14.0	15.8	17.5	19.3	21.1
1200	7.7	9.6	11.5	13.5	15.4	17.3	19.3	21.2	23.1
1300	8.4	10.5	12.6	14.7	16.8	18.9	21.0	23.1	25.2
1400	9.1	11.3	13.6	15.9	18.2	20.5	22.7	25.0	27.3
1500	9.8	12.2	14.7	17.1	19.6	22.0	24.5	26.9	29.4
1600	10.5	13.1	15.7	18.3	21.0	23.6	26.2	28.8	31.5
1700	11.1	13.9	16.7	19.5	22.3	25.1	27.9	30.7	33.5
1800	11.8	14.8	17.8	20.8	23.7	26.7	29.7	32.6	35.6
1900	12.5	15.7	18.8	22.0	25.1	28.3	31.4	34.6	37.7
2000	13.2	16.5	19.9	23.2	26.5	29.8	33.1	36.5	39.8

Check maximum pressure in shaded area. Maximum cylinder pressure = 1850 PSI at 21°C. For maximum cylinder pressure at hotter or colder temperatures, add or subtract 32 PSI per 5°C, respectively.

Table 4

Temperature Corrections

CYLINDER PRESSURE AT 21°C (PSI)	PRESSURE CORRECTION FOR EACH 5°C ABOVE/BELOW 21°C (PSI)
400	+7/-7
600	+11/-11
800	+14/-14
1000	+17/-17
1200	+21/-21
1400	+24/-24
1600	+28/-28
1800	+31/-31
2000	+34/-34

ENGINE INOP

MAX CONTINUOUS THRUST

Net Level Off Weight

PRESSURE ALTITUDE (1000 FT)	LEVEL OFF WEIGHT (1000 KG)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
30	44.4	43.1	41.6
28	48.1	46.5	44.9
26	51.9	50.1	48.5
24	56.2	54.3	52.5
22	61.2	59.0	56.9
20	66.6	64.1	61.6
18	70.9	68.5	65.9
16	76.1	73.5	70.5
14	80.7	78.0	75.1

Anti-Ice Adjustments

ANTI-ICE CONFIGURATION	LEVEL OFF WEIGHT ADJUSTMENT (1000 KG)							
	PRESSURE ALTITUDE (1000 FT)							
	14	16	18	20	22	24	26	28
ENGINE ONLY	-1.8	-2.3	-2.5	-1.6	-1.5	-1.4	-1.2	-1.1
ENGINE & WING	-7.9	-6.9	-6.6	-6.6	-6.0	-5.4	-5.0	

Intentionally
Blank

Landing Field Limit Weight - Dry Runway

Flaps 40

Based on anti-skid operative and automatic speedbrakes

Wind Corrected Field Length (M)

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1000			900	1000	1070	1140	1200	1270
1200	890	980	1090	1200	1270	1350	1420	1490
1400	1060	1160	1280	1400	1480	1560	1630	1710
1600	1240	1350	1470	1600	1680	1770	1850	1940
1800	1420	1540	1670	1800	1890	1980	2070	2160
2000	1600	1720	1860	2000	2090	2190	2290	2380
2200	1780	1910	2050	2200	2290	2400	2500	2600
2400	1960	2100	2250	2400	2500	2610	2720	2820
2600	2140	2280	2440	2600	2700	2820	2940	3050
2800	2260	2410	2570	2800	2910	3030	3150	
3000	2330	2480	2640	3000	3110			
3200	2400	2550	2710	3200				
3400	2480	2630	2780					
3600	2550	2700	2840					
3800	2620	2770	2910					
4000	2690	2840	2980					
4200	2760	2910	3050					
4400	2830	2980	3120					
4600	2900	3050	3190					
4800	2980	3130						

Field Limit Weight (1000 KG)

WIND CORR'D FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
1200	47.3	44.5	41.8	39.3		
1400	57.5	54.8	51.6	48.5	45.5	42.6
1600	66.3	63.0	60.0	57.0	54.1	50.6
1800	75.7	71.5	67.6	64.0	60.8	57.7
2000		80.0	75.8	71.5	67.5	63.8
2200			83.4	79.1	74.6	70.3
2400					81.5	77.1
2600						83.2

Decrease field limit weight by 4500 kg when using manual speedbrakes.

Landing Field Limit Weight - Dry Runway

Flaps 40

Based on anti-skid inoperative and manual speedbrakes

Wind Corrected Field Length (M)

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1800				1800	1940	2110	2250	2420
2000			1750	2000	2140	2320	2470	2650
2200		1700	1950	2200	2350	2530	2690	2870
2400	1640	1890	2140	2400	2560	2740	2910	3090
2600	1820	2080	2330	2600	2760	2950	3130	3320
2800	2000	2260	2530	2800	2970	3160	3350	3540
3000	2180	2450	2720	3000	3170	3380	3560	3760
3200	2360	2630	2910	3200	3380	3590	3780	3980
3400	2540	2820	3100	3400	3590	3800	4000	4210
3600	2720	3010	3300	3600	3790	4010	4220	4430
3800	2900	3190	3490	3800	4000	4220	4440	4650
4000	3080	3380	3680	4000	4200	4440	4650	4880
4200	3260	3570	3880	4200	4410	4650	4870	5100
4400	3440	3750	4070	4400	4620	4860	5090	5320
4600	3620	3940	4260	4600	4820	5070	5310	5550
4800	3800	4120	4450	4800	5030	5280	5530	5770
5000	3980	4310	4650	5000	5230	5490	5750	
5200	4160	4500	4840	5200	5440	5710		
5400	4340	4680	5030	5400	5650			
5600	4520	4870	5230	5600				

Field Limit Weight (1000 KG)

WIND CORR'D FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
2200	42.4	39.8				
2400	47.5	44.6	41.5	38.8		
2600	52.7	49.5	46.1	43.1	40.2	
2800	57.9	54.4	50.8	47.5	44.3	41.3
3000	63.0	59.3	55.4	51.8	48.5	45.1
3200	68.5	64.1	60.0	56.1	52.5	48.9
3400	74.2	69.2	64.4	60.3	56.4	52.6
3600	79.7	74.5	69.2	64.5	60.3	56.3
3800		79.6	74.1	68.9	64.2	59.9
4000			79.0	73.5	68.4	63.6
4200			83.5	78.2	72.6	67.4
4400				82.4	77.1	71.4
4600					81.1	75.5
4800						79.4
5000						83.1

Landing Field Limit Weight - Dry Runway - High Altitudes

Flaps 40

Based on anti-skid operative and automatic speedbrakes

Wind Corrected Field Length (M)

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1200	1100	1140	1160	1200	1250	1350	1430	1500
1400	1230	1290	1330	1400	1460	1560	1640	1720
1600	1360	1430	1500	1600	1670	1770	1850	1940
1800	1490	1580	1670	1800	1880	1980	2070	2160
2000	1620	1730	1850	2000	2080	2190	2280	2380
2200	1760	1880	2020	2200	2290	2400	2500	2600
2400	1890	2020	2190	2400	2500	2600	2710	2820
2600	2020	2170	2360	2600	2710	2810	2930	3040
2800	2150	2320	2530	2800	2920	3020	3140	3260
3000	2280	2460	2710	3000	3130	3230	3360	3480
3200	2410	2610	2880	3200	3340	3440	3570	3700
3400	2540	2760	3050	3400	3550	3650	3780	3930
3600	2670	2900	3220	3600	3760	3860	4000	
3800	2800	3050	3390	3800	3970			
4000	2940	3200	3570	4000				
4200	3070	3350	3740					
4400	3200	3490	3910					
4600	3330	3640						
4800	3460	3790						
5000	3590	3930						

Field Limit Weight (1000 KG)

WIND CORR'D FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT)					
	10000	11000	12000	13000	14000	14500
1400	42.6	41.2	39.8	38.5		
1600	50.6	48.9	47.3	45.7	44.1	43.3
1800	57.7	56.1	54.6	52.8	51.0	50.1
2000	63.8	62.1	60.4	58.8	57.2	56.4
2200	70.3	68.2	66.2	64.3	62.6	61.7
2400	77.1	74.7	72.4	70.3	68.2	67.1
2600	83.2	80.9	78.7	76.4	74.0	72.8
2800			82.1	80.5	78.9	78.1
3000				82.5	80.9	80.1
3200					82.7	81.9

Decrease field limit weight by 3550 kg when using manual speedbrakes.

Landing Field Limit Weight - Dry Runway - High Altitudes

Flaps 40

Based on anti-skid inoperative and manual speedbrakes

Wind Corrected Field Length (M)

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
2600				2600	2790	2970	3150	3340
2800			2520	2800	2990	3180	3360	3560
3000		2440	2720	3000	3200	3390	3580	3780
3200		2620	2910	3200	3400	3600	3790	4000
3400	2530	2810	3100	3400	3600	3800	4010	4220
3600	2710	3000	3300	3600	3800	4010	4220	4440
3800	2890	3190	3490	3800	4010	4220	4440	4660
4000	3070	3370	3680	4000	4210	4430	4650	4880
4200	3250	3560	3880	4200	4410	4640	4870	5100
4400	3430	3750	4070	4400	4610	4840	5080	5320
4600	3610	3930	4260	4600	4820	5050	5300	5540
4800	3790	4120	4460	4800	5020	5260	5520	5750
5000	3970	4310	4650	5000	5220	5470	5730	5970
5200	4160	4500	4840	5200	5430	5680	5950	6190
5400	4340	4680	5040	5400	5630	5880	6160	6410
5600	4520	4870	5230	5600	5830	6090	6380	6630
5800	4700	5060	5420	5800	6030	6300	6590	
6000	4880	5250	5610	6000	6240	6510		
6200	5060	5430	5810	6200	6440	6720		
6400	5240	5620	6000	6400	6640			

Field Limit Weight (1000 KG)

WIND CORR'D FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT)					
	10000	11000	12000	13000	14000	14500
2800	41.3	40.0	38.7			
3000	45.1	43.6	42.2	40.9	39.5	38.8
3200	48.9	47.3	45.7	44.2	42.7	42.0
3400	52.6	50.9	49.2	47.6	46.0	45.2
3600	56.3	54.5	52.7	50.9	49.2	48.3
3800	59.9	58.0	56.1	54.3	52.4	51.5
4000	63.6	61.5	59.5	57.6	55.6	54.6
4200	67.4	65.0	62.9	60.9	58.8	57.8
4400	71.4	68.9	66.4	64.1	62.0	60.9
4600	75.5	72.8	70.2	67.6	65.2	64.0
4800	79.4	76.8	73.9	71.3	68.6	67.3
5000	83.1	80.4	77.8	74.9	72.1	70.7
5200			81.2	78.6	75.7	74.2
5400				81.8	79.1	77.7
5600					82.3	80.8

Landing Field Limit Weight - Wet Runway

Flaps 40

Based on anti-skid operative and automatic speedbrakes

Wind Corrected Field Length (M)

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1000				1000	1080	1150	1220	1290
1200		960	1080	1200	1280	1360	1430	1520
1400	1040	1140	1270	1400	1480	1570	1650	1740
1600	1210	1330	1460	1600	1690	1780	1870	1960
1800	1390	1520	1660	1800	1890	1990	2090	2180
2000	1570	1700	1850	2000	2100	2200	2300	2400
2200	1750	1890	2040	2200	2300	2410	2520	2630
2400	1930	2070	2240	2400	2510	2620	2740	2850
2600	2110	2260	2430	2600	2710	2830	2950	3070
2800	2290	2450	2620	2800	2910	3040	3170	3290
3000	2470	2630	2810	3000	3120	3250	3390	3510
3200	2590	2770	2950	3200	3320	3460	3600	
3400	2660	2840	3020	3400	3530	3670		
3600	2740	2910	3080	3600				
3800	2810	2980	3150					
4000	2880	3050	3220					
4200	2950	3120	3290					
4400	3020	3190	3360					
4600	3090	3270	3430					
4800	3160	3340	3500					

Field Limit Weight (1000 KG)

WIND CORR'D FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
1200	38.9					
1400	48.3	45.4	42.7	40.1		
1600	57.2	54.4	51.2	48.1	45.1	42.2
1800	64.7	61.6	58.7	55.7	52.6	49.2
2000	72.8	68.8	65.2	61.9	58.8	55.8
2200	80.6	76.5	72.2	68.2	64.5	61.1
2400		83.4	79.2	74.8	70.6	66.6
2600				81.2	76.9	72.3
2800					82.6	78.2
3000						83.4

Decrease field limit weight by 4500 kg when using manual speedbrakes.

Landing Field Limit Weight - Wet Runway

Flaps 40

Based on anti-skid inoperative and manual speedbrakes

Wind Corrected Field Length (M)

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1800					1950	2140	2300	2490
2000				2000	2160	2350	2520	2710
2200			1920	2200	2360	2560	2730	2930
2400			2110	2400	2570	2770	2950	3150
2600		2020	2310	2600	2770	2980	3170	3380
2800	1920	2210	2500	2800	2980	3190	3390	3600
3000	2100	2400	2690	3000	3190	3410	3610	3820
3200	2280	2580	2880	3200	3390	3620	3830	4050
3400	2460	2770	3080	3400	3600	3830	4040	4270
3600	2640	2950	3270	3600	3800	4040	4260	4490
3800	2820	3140	3460	3800	4010	4250	4480	4720
4000	3000	3330	3660	4000	4220	4470	4700	4940
4200	3180	3510	3850	4200	4420	4680	4920	5160
4400	3360	3700	4040	4400	4630	4890	5130	5390
4600	3540	3890	4230	4600	4830	5100	5350	5610
4800	3720	4070	4430	4800	5040	5310	5570	5830
5000	3900	4260	4620	5000	5250	5520	5790	6050
5200	4080	4440	4810	5200	5450	5740	6010	6280
5400	4260	4630	5010	5400	5660	5950	6230	6500
5600	4440	4820	5200	5600	5860	6160	6440	

Field Limit Weight (1000 KG)

WIND CORR'D FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
2400	39.5					
2600	43.9	41.2	38.3			
2800	48.4	45.5	42.3	39.5		
3000	52.9	49.7	46.3	43.3	40.4	
3200	57.4	54.0	50.4	47.1	44.0	40.9
3400	61.9	58.2	54.4	50.9	47.6	44.3
3600	66.5	62.4	58.4	54.6	51.1	47.6
3800	71.5	66.7	62.3	58.3	54.5	50.9
4000	76.5	71.3	66.3	61.9	57.9	54.1
4200	81.0	75.9	70.5	65.6	61.3	57.2
4400		80.3	74.8	69.5	64.7	60.4
4600			79.0	73.5	68.4	63.6
4800			82.9	77.6	72.1	66.9
5000				81.3	75.9	70.4
5200					79.5	73.9
5400					82.9	77.5
5600						80.7

Landing Field Limit Weight - Wet Runway - High Altitudes

Flaps 40

Based on anti-skid operative and automatic speedbrakes

Wind Corrected Field Length (M)

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1200		1180	1180	1200	1240	1370	1450	1530
1400	1280	1330	1350	1400	1450	1580	1660	1750
1600	1410	1470	1520	1600	1660	1780	1880	1970
1800	1540	1620	1690	1800	1870	1990	2090	2190
2000	1670	1770	1870	2000	2080	2200	2300	2410
2200	1800	1910	2040	2200	2290	2410	2520	2630
2400	1930	2060	2210	2400	2500	2620	2730	2850
2600	2060	2210	2380	2600	2710	2830	2950	3070
2800	2200	2350	2550	2800	2920	3040	3160	3290
3000	2330	2500	2730	3000	3130	3250	3380	3510
3200	2460	2650	2900	3200	3340	3450	3590	3730
3400	2590	2800	3070	3400	3550	3660	3810	3950
3600	2720	2940	3240	3600	3760	3870	4020	4170
3800	2850	3090	3410	3800	3970	4080	4230	4390
4000	2980	3240	3590	4000	4180	4290	4450	
4200	3110	3380	3760	4200	4390	4500		
4400	3240	3530	3930	4400	4600			
4600	3380	3680	4100	4600				
4800	3510	3830	4270					
5000	3640	3970	4450					

Field Limit Weight (1000 KG)

WIND CORR'D FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT)					
	10000	11000	12000	13000	14000	14500
1600	42.2	40.8	39.5	38.2		
1800	49.2	47.6	46.0	44.4	42.9	42.1
2000	55.8	54.2	52.4	50.6	48.9	48.0
2200	61.1	59.5	57.9	56.3	54.8	53.9
2400	66.6	64.7	62.9	61.2	59.5	58.7
2600	72.3	70.2	68.1	66.1	64.2	63.3
2800	78.2	75.9	73.5	71.3	69.2	68.1
3000	83.4	81.2	78.9	76.6	74.2	73.0
3200			81.9	80.3	78.7	77.8
3400				82.1	80.5	79.7
3600					82.1	81.2
3800						82.8

Decrease field limit weight by 3550 kg when using manual speedbrakes.

Landing Field Limit Weight - Wet Runway - High Altitudes

Flaps 40

Based on anti-skid inoperative and manual speedbrakes

Wind Corrected Field Length (M)

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
2600					2810	3010	3200	3420
2800				2800	3020	3220	3410	3640
3000				3000	3220	3430	3630	3850
3200			2880	3200	3420	3640	3840	4070
3400			3080	3400	3620	3840	4060	4290
3600		2940	3270	3600	3830	4050	4270	4510
3800	2810	3130	3460	3800	4030	4260	4490	4730
4000	2990	3320	3660	4000	4230	4470	4710	4950
4200	3170	3500	3850	4200	4440	4680	4920	5170
4400	3350	3690	4040	4400	4640	4880	5140	5390
4600	3530	3880	4240	4600	4840	5090	5350	5610
4800	3710	4070	4430	4800	5040	5300	5570	5830
5000	3890	4250	4620	5000	5250	5510	5780	6050
5200	4070	4440	4820	5200	5450	5720	6000	6270
5400	4250	4630	5010	5400	5650	5920	6210	6490
5600	4430	4820	5200	5600	5850	6130	6430	6710
5800	4620	5000	5390	5800	6060	6340	6640	6920
6000	4800	5190	5590	6000	6260	6550	6860	7140
6200	4980	5380	5780	6200	6460	6760	7070	7360
6400	5160	5560	5970	6400	6660	6960	7290	7580

Field Limit Weight (1000 KG)

WIND CORR'D FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT)					
	10000	11000	12000	13000	14000	14500
3200	40.9	39.7	38.4			
3400	44.3	42.8	41.5	40.1	38.8	38.1
3600	47.6	46.0	44.5	43.1	41.6	40.9
3800	50.9	49.2	47.6	46.0	44.4	43.6
4000	54.1	52.3	50.6	48.9	47.2	46.4
4200	57.2	55.4	53.6	51.8	50.0	49.1
4400	60.4	58.5	56.6	54.7	52.8	51.9
4600	63.6	61.5	59.5	57.6	55.6	54.6
4800	66.9	64.6	62.5	60.4	58.4	57.4
5000	70.4	67.9	65.5	63.3	61.2	60.1
5200	73.9	71.2	68.7	66.2	63.9	62.8
5400	77.5	74.7	72.0	69.4	66.8	65.5
5600	80.7	78.1	75.3	72.5	69.8	68.5
5800		81.2	78.6	75.7	72.9	71.5
6000			81.5	78.8	76.0	74.5
6200				81.7	79.0	77.6
6400					81.7	80.3
6600						83.0

Landing Climb Limit Weight

Valid for approach with Flaps 15 and landing with Flaps 40

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

AIRPORT OAT		LANDING CLIMB LIMIT WEIGHT (1000 KG)					
		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	0	2000	4000	6000	8000	10000
54	129	65.7					
52	126	67.4					
50	122	69.2	63.8				
48	118	70.5	65.4				
46	115	71.8	67.1	61.9			
44	111	73.0	68.3	63.3			
42	108	74.3	69.5	64.9	59.4		
40	104	75.7	70.7	66.0	60.8		
38	100	77.0	71.9	67.1	62.1	56.5	
36	97	78.3	73.1	68.3	63.2	57.5	
34	93	79.6	74.5	69.6	64.3	58.4	56.3
32	90	81.0	75.8	70.7	65.2	59.5	57.3
30	86	81.6	76.9	71.5	66.1	60.5	58.2
28	82	81.6	77.8	72.3	67.0	61.4	58.7
26	79	81.6	78.7	72.9	67.5	62.2	59.2
24	75	81.6	78.7	73.5	68.0	62.9	59.6
22	72	81.6	78.8	74.0	68.5	63.4	59.9
20	68	81.6	78.8	74.0	68.9	63.7	60.2
18	64	81.6	78.8	74.1	69.3	64.1	60.5
16	61	81.6	78.9	74.1	69.4	64.5	60.8
14	57	81.6	78.9	74.1	69.4	64.8	61.1
12	54	81.6	79.0	74.2	69.4	64.9	61.4
10	50	81.6	79.0	74.2	69.4	64.9	61.7
-40	-40	81.6	79.5	74.8	69.8	65.3	62.3

With engine bleed for packs off, increase weight by 1050 kg.
With engine anti-ice on, decrease weight by 250 kg.
With engine and wing anti-ice on, decrease weight by 850 kg.
When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 7050 kg.

Landing Climb Limit Weight - High Altitudes

Valid for approach with Flaps 15 and landing with Flaps 40

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

AIRPORT OAT		LANDING CLIMB LIMIT WEIGHT (1000 KG)					
		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	10000	11000	12000	13000	14000	14500
34	93	56.4					
32	90	57.3	55.0				
30	86	58.1	55.9	53.5			
28	82	58.7	56.5	54.1	51.9		
26	79	59.2	56.9	54.7	52.4	50.4	
24	75	59.6	57.3	55.0	52.8	50.6	49.6
22	72	59.9	57.6	55.3	53.1	50.9	49.8
20	68	60.2	57.8	55.6	53.3	51.1	50.1
18	64	60.5	58.1	55.8	53.6	51.4	50.3
16	61	60.7	58.4	56.1	53.9	51.7	50.6
14	57	61.1	58.7	56.4	54.2	51.9	50.8
12	54	61.4	59.0	56.7	54.4	52.2	51.1
10	50	61.7	59.3	57.0	54.7	52.5	51.4
-40	-40	62.3	60.5	58.7	56.6	54.6	53.6

With engine bleed for packs off, increase weight by 1100 kg.
With engine anti-ice on, decrease weight by 1600 kg.
With engine and wing anti-ice on, decrease weight by 2100 kg.
When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 5500 kg.

ENGINE INOP

ADVISORY INFORMATION

Go-Around Climb Gradient

Flaps 15

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

OAT (°C)	REFERENCE GO-AROUND GRADIENT (%)					
	PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
54	4.19	3.05				
50	4.92	3.77	2.69			
46	5.48	4.48	3.35	2.25		
42	6.05	5.00	4.01	2.84	1.79	
38	6.62	5.53	4.50	3.42	2.21	1.78
34	7.20	6.09	5.02	3.90	2.63	2.20
30	7.80	6.59	5.44	4.31	3.08	2.62
26	7.84	6.98	5.75	4.60	3.46	2.84
22	7.87	7.00	5.99	4.81	3.72	2.99
18	7.89	7.02	6.00	5.00	3.89	3.11
14	7.92	7.04	6.02	5.01	4.05	3.24
10	7.94	7.06	6.03	5.02	4.07	3.37

Gradient Adjustment for Weight (%)

WEIGHT (1000 KG)	REFERENCE GO-AROUND GRADIENT (%)									
	0	1	2	3	4	5	6	7	8	9
70	-1.88	-2.19	-2.49	-2.77	-3.04	-3.29	-3.52	-3.74	-3.94	-4.13
65	-1.37	-1.60	-1.82	-2.02	-2.22	-2.40	-2.57	-2.72	-2.87	-3.00
60	-0.74	-0.87	-0.99	-1.10	-1.21	-1.30	-1.39	-1.48	-1.55	-1.62
55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50	0.88	0.99	1.11	1.23	1.34	1.46	1.58	1.69	1.80	1.92
45	2.03	2.30	2.58	2.85	3.12	3.38	3.65	3.91	4.17	4.43
40	3.44	3.92	4.39	4.85	5.31	5.77	6.22	6.66	7.10	7.54

Gradient Adjustment for Speed (%)

SPEED (KIAS)	WEIGHT ADJUSTED GO-AROUND GRADIENT (%)										
	0	1	2	3	4	5	6	7	8	9	10
VREF40	-0.21	-0.22	-0.23	-0.24	-0.24	-0.25	-0.25	-0.26	-0.26	-0.26	-0.27
VREF40+5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VREF40+10	0.15	0.15	0.15	0.16	0.16	0.16	0.16	0.16	0.15	0.15	0.15
VREF40+15	0.24	0.25	0.25	0.25	0.24	0.24	0.23	0.23	0.22	0.21	0.20
VREF40+20	0.29	0.29	0.28	0.27	0.26	0.25	0.23	0.22	0.20	0.18	0.16
VREF40+25	0.29	0.28	0.27	0.25	0.22	0.20	0.17	0.14	0.11	0.07	0.04
VREF40+30	0.25	0.23	0.20	0.17	0.13	0.09	0.04	0.00	-0.05	-0.10	-0.14

**With engine bleed for packs off, increase gradient by 0.3%.
With engine anti-ice on, decrease gradient by 0.1%.
With engine and wing anti-ice on, decrease gradient by 0.4%.
When operating in icing conditions during any part of the flight with forecast landing temperatures below 10°C, decrease gradient by 0.6%.**

ENGINE INOP

ADVISORY INFORMATION

Go-Around Climb Gradient - High Altitudes

Flaps 15

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

OAT (°C)	REFERENCE GO-AROUND GRADIENT (%)					
	PRESSURE ALTITUDE (FT)					
	10000	11000	12000	13000	14000	14500
34	2.20	1.71	1.33	0.96		
30	2.62	2.11	1.61	1.18	0.80	0.62
26	2.84	2.36	1.89	1.40	0.95	0.75
22	2.99	2.50	2.02	1.56	1.11	0.89
18	3.11	2.62	2.14	1.68	1.22	1.00
14	3.24	2.74	2.26	1.79	1.33	1.11
10	3.37	2.87	2.39	1.92	1.45	1.22
6	3.39	3.00	2.51	2.04	1.57	1.34
2	3.40	3.02	2.64	2.16	1.68	1.45
-2	3.41	3.04	2.67	2.25	1.80	1.57
-6	3.43	3.05	2.68	2.26	1.83	1.62
-10	3.44	3.06	2.69	2.26	1.84	1.63

Gradient Adjustment for Weight (%)

WEIGHT (1000 KG)	REFERENCE GO-AROUND GRADIENT (%)									
	0	1	2	3	4	5	6	7	8	9
70	-1.88	-2.19	-2.49	-2.77	-3.04	-3.29	-3.52	-3.74	-3.94	-4.13
65	-1.37	-1.60	-1.82	-2.02	-2.22	-2.40	-2.57	-2.72	-2.87	-3.00
60	-0.74	-0.87	-0.99	-1.10	-1.21	-1.30	-1.39	-1.48	-1.55	-1.62
55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50	0.88	0.99	1.11	1.23	1.34	1.46	1.58	1.69	1.80	1.92
45	2.03	2.30	2.58	2.85	3.12	3.38	3.65	3.91	4.17	4.43
40	3.44	3.92	4.39	4.85	5.31	5.77	6.22	6.66	7.10	7.54

Gradient Adjustment for Speed (%)

SPEED (KIAS)	WEIGHT ADJUSTED GO-AROUND GRADIENT (%)										
	0	1	2	3	4	5	6	7	8	9	10
VREF40	-0.21	-0.22	-0.23	-0.24	-0.254	-0.25	-0.25	-0.26	-0.26	-0.26	-0.27
VREF40+5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VREF40+10	0.15	0.15	0.15	0.16	0.16	0.16	0.16	0.16	0.15	0.15	0.15
VREF40+15	0.24	0.25	0.25	0.25	0.24	0.24	0.23	0.23	0.22	0.21	0.20
VREF40+20	0.29	0.29	0.28	0.27	0.26	0.25	0.23	0.22	0.20	0.18	0.16
VREF40+25	0.29	0.28	0.27	0.25	0.22	0.20	0.17	0.14	0.11	0.07	0.04
VREF40+30	0.25	0.23	0.20	0.17	0.13	0.09	0.04	0.00	-0.05	-0.10	-0.14

With engine bleed for packs off, increase gradient by 0.3%.
With engine anti-ice on, decrease gradient by 0.4%.
With engine and wing anti-ice on, decrease gradient by 0.6%.
When operating in icing conditions during any part of the flight with forecast landing temperatures below 10°C, decrease gradient by 0.6%.

Quick Turnaround Limit Weight - Category F Steel Brakes

(Note: A placard showing carbon brakes configuration will be put at the Center Forward Panel upon modification.)

Flaps 40

OAT (°C)	LIMIT WEIGHT (1000 KG)					
	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
54	81.3					
50	81.6	78.6				
45	81.6	79.3	76.1			
40	81.6	79.9	76.8	73.5		
35	81.6	80.6	77.5	74.2	71.0	
30	81.6	81.3	78.1	74.8	71.6	68.6
25	81.6	81.6	78.8	75.5	72.3	69.2
20	81.6	81.6	79.4	76.2	72.9	69.8
15	81.6	81.6	80.1	76.9	73.6	70.4
10	81.6	81.6	80.8	77.6	74.3	71.1
5	81.6	81.6	81.5	78.3	75.0	71.7
0	81.6	81.6	81.6	79.0	75.7	72.4
-5	81.6	81.6	81.6	79.8	76.5	73.1
-10	81.6	81.6	81.6	80.5	77.3	73.9
-15	81.6	81.6	81.6	81.3	78.0	74.6
-20	81.6	81.6	81.6	81.6	78.8	75.4
-30	81.6	81.6	81.6	81.6	80.4	77.1
-40	81.6	81.6	81.6	81.6	81.6	78.7
-50	81.6	81.6	81.6	81.6	81.6	80.4
-54	81.6	81.6	81.6	81.6	81.6	81.2

Increase weight by 800 kg per 1% uphill slope. Decrease weight by 1050 kg per 1% downhill slope.
Increase weight by 1850 kg per 10 knots headwind. Decrease weight by 6850 kg per 10 knots tailwind.
After landing at weights exceeding those shown above, adjusted for slope and wind, wait at least 67 minutes and check that wheel thermal plugs have not melted before executing a subsequent takeoff.

As an alternate procedure, ensure that each brake pressure plate temperature, without artificial cooling, is less than 425°F as follows:
No sooner than 10 and no later than 15 minutes after parking, measure each brake pressure plate surface temperature at a minimum of two points per brake by an accurate method (using a Doric Microtemp 450 hand held thermometer or equivalent, hold temperature probe in place for 20 seconds or until reading stabilizes). If each measured temperature is less than 425°F, immediate dispatch is allowed; otherwise the required minimum ground wait period of 67 minutes applies.

If a Brake Temperature Monitoring System (BTMS) is installed:

No sooner than 10 and no later than 15 minutes after parking, check the BRAKE TEMP light. If the BRAKE TEMP light is not on, no ground waiting period is required. If the BRAKE TEMP light is on, do not dispatch until at least 67 minutes after landing, or until all the BTMS readings on the Systems Display are below 3.5 and the BRAKE TEMP light is off. Check that wheel thermal plugs have not melted before making a subsequent takeoff.
Note: If any brake temperature display digit is blank or indicates 0.0 or 0.1, then this method cannot be used.

Quick Turnaround Limit Weight - Category M Carbon Brakes

Flaps 40

OAT		LIMIT WEIGHT (1000 KG)					
		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	0	2000	4000	6000	8000	10000
54	129	75.2					
50	122	75.7	72.6				
45	113	76.3	73.2	70.3			
40	104	77.0	73.9	70.9	67.9		
35	95	77.7	74.5	71.5	68.5	65.6	
30	86	78.3	75.2	72.1	69.1	66.2	63.4
25	77	79.0	75.9	72.7	69.7	66.8	64.0
20	68	79.7	76.6	73.4	70.3	67.4	64.5
15	59	80.3	77.3	74.1	71.0	68.0	65.1
10	50	81.0	78.0	74.8	71.6	68.6	65.7
5	41	81.8	78.7	75.5	72.3	69.3	66.3
0	32	82.5	79.4	76.2	73.0	69.9	66.9
-5	23	83.3	80.1	77.0	73.7	70.6	67.6
-10	14	84.0	80.8	77.7	74.5	71.3	68.3
-15	5	84.8	81.6	78.5	75.2	72.1	69.0
-20	-4	85.7	82.4	79.2	76.0	72.8	69.7
-30	-22	86.1	84.0	80.8	77.7	74.4	71.2
-40	-40	86.1	85.8	82.5	79.3	76.0	72.7
-50	-58	86.1	86.1	84.3	81.0	77.8	74.4
-54	-65	86.1	86.1	85.0	81.7	78.5	75.1

**Increase weight by 650 kg per 1% uphill slope. Decrease weight by 1150 kg per 1% downhill slope.
Increase weight by 1650 kg per 10 knots headwind. Decrease weight by 7900 kg per 10 knots tailwind.
After landing at weights exceeding those shown above, adjusted for slope and wind, wait at least 48 minutes and check that wheel thermal plugs have not melted before executing a takeoff.**

If a Brake Temperature Monitoring System (BTMS) is installed:

**No sooner than 10 and no later than 15 minutes after parking, check the BRAKE TEMP light. If the BRAKE TEMP light is not on, no ground waiting period is required. If the BRAKE TEMP light is on, do not dispatch until at least 48 minutes after landing, or until all the BTMS readings on the systems Display are below 3.0 and the BRAKE TEMP light is off. Check that wheel thermal plugs have not melted before making a subsequent takeoff.
Note: If any brake temperature display digit is blank or indicates 0.0 or 0.1, then this method cannot be used.**

Quick Turnaround Limit Weight - Category F Steel Brakes - High Altitudes

(Note: A placard showing carbon brakes configuration will be put at the Center Forward Panel upon modification.)

Flaps 40

OAT (°C)	LIMIT WEIGHT (1000 KG)					
	AIRPORT PRESSURE ALTITUDE (FT)					
	10000	11000	12000	13000	14000	14500
30	68.6	67.0	65.5			
25	69.2	67.6	66.1	64.7		
20	69.8	68.2	66.7	65.2	63.8	63.1
15	70.4	68.9	67.3	65.8	64.4	63.6
10	71.1	69.5	67.9	66.4	64.9	64.2
5	71.7	70.2	68.6	67.0	65.5	64.8
0	72.4	70.8	69.3	67.7	66.2	65.4
-5	73.1	71.5	69.9	68.4	66.8	66.0
-10	73.9	72.2	70.6	69.0	67.5	66.7
-15	74.6	72.9	71.3	69.7	68.1	67.4
-20	75.4	73.7	72.1	70.4	68.8	68.0
-25	76.2	74.5	72.8	71.2	69.6	68.7
-30	77.1	75.3	73.6	71.9	70.3	69.5
-35	77.9	76.2	74.4	72.7	71.1	70.2
-40	78.7	77.0	75.3	73.5	71.8	71.0
-45	79.6	77.9	76.2	74.4	72.7	71.8
-50	80.4	78.8	77.1	75.3	73.5	72.6
-54	81.1	79.4	77.8	76.0	74.2	73.3

**Increase weight by 650 kg per 1% uphill slope. Decrease weight by 1050 kg per 1% downhill slope.
Increase weight by 1500 kg per 10 knots headwind. Decrease weight by 6650 kg per 10 knots tailwind.
After landing at weights exceeding those shown above, adjusted for slope and wind, wait at least 67 minutes and check that wheel thermal plugs have not melted before executing a subsequent takeoff.**

**As an alternate procedure, ensure that each brake pressure plate temperature, without artificial cooling, is less than 425°F as follows:
No sooner than 10 and no later than 15 minutes after parking, measure each brake pressure plate surface temperature at a minimum of two points per brake by an accurate method (using a Doric Microtemp 450 hand held thermometer or equivalent, hold temperature probe in place for 20 seconds or until reading stabilizes). If each measured temperature is less than 425°F, immediate dispatch is allowed; otherwise the required minimum ground wait period of 67 minutes applies.**

If a Brake Temperature Monitoring System (BTMS) is installed:

**No sooner than 10 and no later than 15 minutes after parking, check the BRAKE TEMP light. If the BRAKE TEMP light is not on, no ground waiting period is required. If the BRAKE TEMP light is on, do not dispatch until at least 67 minutes after landing, or until all the BTMS readings on the Systems Display are below 3.5 and the BRAKE TEMP light is off. Check that wheel thermal plugs have not melted before making a subsequent takeoff.
Note: If any brake temperature display digit is blank or indicates 0.0 or 0.1, then this method cannot be used.**

Quick Turnaround Limit Weight - Category M Carbon Brakes - High Altitudes

Flaps 40

OAT (°C)	LIMIT WEIGHT (1000 KG)					
	AIRPORT PRESSURE ALTITUDE (FT)					
	10000	11000	12000	13000	14000	14500
30	63.4	62.1	60.8			
25	64.0	62.6	61.3	60.0		
20	64.5	63.2	61.8	60.5	59.2	58.5
15	65.1	63.7	62.4	61.0	59.7	59.0
10	65.7	64.3	62.9	61.6	60.2	59.6
5	66.3	64.9	63.5	62.1	60.8	60.1
0	66.9	65.5	64.1	62.7	61.3	60.7
-5	67.6	66.1	64.7	63.3	61.9	61.2
-10	68.3	66.8	65.3	63.9	62.5	61.8
-15	69.0	67.4	65.9	64.5	63.1	62.4
-20	69.7	68.1	66.6	65.1	63.7	63.0
-25	70.4	68.8	67.3	65.8	64.3	63.6
-30	71.2	69.6	68.0	66.5	65.0	64.3
-35	71.9	70.3	68.8	67.2	65.7	64.9
-40	72.7	71.1	69.5	68.0	66.4	65.6
-45	73.6	71.9	70.3	68.7	67.2	66.4
-50	74.4	72.8	71.1	69.5	67.9	67.2
-54	75.1	73.4	71.8	70.2	68.6	67.8

**Increase weight by 600 kg per 1% uphill slope. Decrease weight by 1000 kg per 1% downhill slope.
Increase weight by 1450 kg per 10 knots headwind. Decrease weight by 6550 kg per 10 knots tailwind.
After landing at weights exceeding those shown above, adjusted for slope and wind, wait at least 48 minutes and check that wheel thermal plugs have not melted before executing a takeoff.**

If a Brake Temperature Monitoring System (BTMS) is installed:

**No sooner than 10 and no later than 15 minutes after parking, check the BRAKE TEMP light. If the BRAKE TEMP light is not on, no ground waiting period is required. If the BRAKE TEMP light is on, do not dispatch until at least 48 minutes after landing, or until all the BTMS readings on the systems Display are below 3.0 and the BRAKE TEMP light is off. Check that wheel thermal plugs have not melted before making a subsequent takeoff.
Note: If any brake temperature display digit is blank or indicates 0.0 or 0.1, then this method cannot be used.**

Performance Dispatch — Chapter PD
Gear Down Planning — Section 33

GEAR DOWN

Takeoff Climb Limit Weight

Flaps 5

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

AIRPORT OAT		TAKEOFF CLIMB WEIGHT (1000 KG)					
		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	0	2000	4000	6000	8000	10000
54	129	55.5	51.5	47.9	44.6	41.1	
52	126	56.5	52.4	48.8	45.3	41.8	
50	122	57.6	53.4	49.6	46.1	42.5	
48	118	58.8	54.5	50.5	46.9	43.3	
46	115	60.0	55.6	51.4	47.7	44.0	
44	111	61.1	56.7	52.5	48.5	44.8	41.0
42	108	62.3	57.8	53.5	49.4	45.6	41.8
40	104	63.5	58.9	54.5	50.3	46.5	42.7
38	100	64.7	60.0	55.6	51.3	47.3	43.5
36	97	65.9	61.1	56.6	52.3	48.2	44.3
34	93	67.1	62.3	57.7	53.3	49.1	45.2
32	90	68.3	63.5	58.8	54.3	50.0	46.1
30	86	69.7	64.7	59.9	55.3	51.0	47.0
28	82	69.7	65.9	61.0	56.4	52.0	47.9
26	79	69.8	67.1	62.2	57.5	53.0	48.8
24	75	69.9	67.1	63.3	58.4	53.9	49.7
22	72	69.9	67.2	64.5	59.6	55.0	50.7
20	68	70.0	67.2	64.5	60.8	56.1	51.7
18	65	70.0	67.3	64.6	61.9	57.1	52.7
16	61	70.1	67.3	64.6	61.9	58.2	53.6
14	58	70.1	67.4	64.7	62.0	59.1	54.5
12	54	70.2	67.4	64.7	62.0	59.1	55.3
10	50	70.2	67.4	64.7	62.0	59.2	56.1
0	32	70.5	67.7	64.9	62.2	59.3	56.2
-10	14	70.6	67.8	65.1	62.3	59.4	56.3
-20	-4	70.7	67.9	65.1	62.3	59.4	56.4
-30	-22	70.7	68.0	65.2	62.4	59.5	56.4
-40	-40	70.8	68.0	65.2	62.4	59.5	56.4
-50	-58	70.8	68.1	65.2	62.4	59.5	56.4
-54	-65	70.9	68.1	65.2	62.4	59.6	56.4

With engine bleeds for packs off, increase weight by 1300 kg.
With engine anti-ice on, decrease weight by 250 kg.
With engine and wing anti-ice on, decrease weight by 3850 kg (optional system).

GEAR DOWN

Landing Climb Limit Weight

Valid for approach with Flaps 15 and landing with Flaps 30 or 40

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

AIRPORT OAT		LANDING CLIMB LIMIT WEIGHT (1000 KG)						
		AIRPORT PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
54	129	60.9	57.4					
52	126	62.0	58.9					
50	122	63.1	60.4	55.8				
48	118	64.3	61.5	57.2				
46	115	65.5	62.6	58.6	54.1			
44	111	66.7	63.7	59.6	55.4			
42	108	67.9	64.8	60.7	56.7	52.0		
40	104	69.1	65.9	61.7	57.7	53.1		
38	100	70.3	67.1	62.8	58.7	54.3	49.4	
36	97	71.5	68.3	63.8	59.8	55.3	50.3	
34	93	72.6	69.5	65.0	60.8	56.3	51.1	49.4
32	90	72.7	70.9	66.2	61.8	57.1	52.1	50.3
30	86	72.7	72.1	67.1	62.5	57.9	53.0	51.1
28	82	72.8	72.2	68.0	63.2	58.7	53.8	51.6
26	79	72.9	72.2	68.9	63.8	59.2	54.6	52.1
24	75	73.0	72.3	68.9	64.3	59.6	55.3	52.4
22	72	73.0	72.4	68.9	64.8	60.0	55.6	52.7
20	68	73.1	72.4	69.0	64.8	60.5	56.0	52.9
18	64	73.1	72.5	69.0	64.8	60.8	56.3	53.2
16	61	73.2	72.5	69.1	64.9	60.9	56.7	53.4
14	57	73.3	72.6	69.1	64.9	60.9	57.0	53.7
12	54	73.3	72.6	69.2	64.9	60.9	57.0	54.0
10	50	73.4	72.7	69.2	65.0	61.0	57.1	54.2
-40	-40	74.0	73.2	69.7	65.5	61.3	57.4	54.9

With engine bleed for packs off, increase weight by 1150 kg.
With engine anti-ice on, decrease weight by 250 kg.
With engine and wing anti-ice on, decrease weight by 1350 kg.
When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 7950 kg.

GEAR DOWN

Takeoff Obstacle Limit Weight

Flaps 5

Sea Level, 30°C & Below, Zero Wind

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

Reference Obstacle Limit Weight (1000 KG)

OBSTACLE HEIGHT (M)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 KG)										
	DISTANCE FROM BRAKE RELEASE (100 M)										
	25	30	35	40	45	50	55	60	65	70	75
5	69.8	72.9									
20	63.6	67.4	70.0	71.8							
40	58.5	62.2	65.1	67.4	69.1	70.5	71.5	72.4	73.1	73.6	73.8
60	54.7	58.5	61.4	63.8	65.7	67.3	68.7	69.7	70.6	71.4	72.0
80	51.6	55.4	58.4	60.9	62.9	64.6	66.1	67.3	68.4	69.3	70.0
100	49.0	52.8	55.9	58.4	60.5	62.3	63.8	65.1	66.3	67.3	68.1
120	46.7	50.5	53.6	56.2	58.4	60.2	61.8	63.2	64.4	65.5	66.4
140	44.7	48.5	51.6	54.2	56.5	58.4	60.0	61.4	62.7	63.8	64.8
160	42.8	46.6	49.8	52.4	54.7	56.6	58.3	59.8	61.1	62.3	63.3
180	41.2	45.0	48.1	50.8	53.1	55.0	56.8	58.3	59.6	60.8	61.9
200		43.4	46.6	49.2	51.6	53.6	55.3	56.9	58.3	59.5	60.6
220		42.0	45.1	47.8	50.2	52.2	54.0	55.5	57.0	58.2	59.4
240			43.8	46.5	48.8	50.9	52.7	54.3	55.7	57.0	58.2
260			42.5	45.3	47.6	49.7	51.5	53.1	54.6	55.9	57.1
280			41.4	44.1	46.4	48.5	50.3	52.0	53.5	54.8	56.0
300				43.0	45.3	47.4	49.3	50.9	52.4	53.8	55.0

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

OAT Adjustments

OAT (°C)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 KG)								
	42	46	50	54	58	62	66	70	74
30 & BELOW	0	0	0	0	0	0	0	0	0
32	-0.7	-0.8	-0.8	-0.9	-1.0	-1.1	-1.2	-1.2	-1.3
34	-1.4	-1.5	-1.7	-1.9	-2.0	-2.2	-2.3	-2.5	-2.6
36	-2.1	-2.3	-2.5	-2.8	-3.0	-3.2	-3.5	-3.7	-3.9
38	-2.8	-3.1	-3.4	-3.7	-4.0	-4.3	-4.6	-5.0	-5.3
40	-3.5	-3.8	-4.2	-4.6	-5.0	-5.4	-5.8	-6.2	-6.6
42	-4.1	-4.6	-5.0	-5.5	-6.0	-6.4	-6.9	-7.4	-7.8
44	-4.8	-5.3	-5.8	-6.4	-6.9	-7.5	-8.0	-8.6	-9.1
46	-5.4	-6.0	-6.6	-7.3	-7.9	-8.5	-9.1	-9.8	-10.4
48	-6.1	-6.7	-7.4	-8.1	-8.8	-9.5	-10.2	-10.9	-11.6
50	-6.7	-7.5	-8.2	-9.0	-9.8	-10.6	-11.3	-12.1	-12.9

GEAR DOWN

Takeoff Obstacle Limit Weight

Flaps 5

Pressure Altitude Adjustments

ALT (FT)	OAT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)								
	42	46	50	54	48	62	66	70	74
S.L. & BELOW	0	0	0	0	0	0	0	0	0
1000	-1.6	-1.7	-1.9	-2.0	-2.1	-2.3	-2.4	-2.6	-2.7
2000	-3.1	-3.4	-3.7	-4.0	-4.3	-4.6	-4.9	-5.2	-5.5
3000	-4.6	-5.0	-5.5	-5.9	-6.4	-6.8	-7.2	-7.7	-8.1
4000	-6.1	-6.7	-7.3	-7.8	-8.4	-9.0	-9.6	-10.2	-10.7
5000	-7.3	-8.1	-8.8	-9.5	-10.2	-11.0	-11.7	-12.4	-13.1
6000	-8.6	-9.5	-10.3	-11.2	-12.1	-12.9	-13.8	-14.6	-15.5
7000	-9.8	-10.8	-11.8	-12.8	-13.8	-14.8	-15.8	-16.8	-17.8
8000	-11.0	-12.1	-13.3	-14.4	-15.6	-16.7	-17.8	-19.0	-20.1
9000	-12.2	-13.5	-14.8	-16.0	-17.2	-18.5	-19.8	-21.0	-22.2
10000	-13.5	-14.9	-16.2	-17.6	-18.9	-20.3	-21.7	-23.0	-24.4

Wind Adjustments

WIND (KTS)	OAT & ALT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)								
	42	46	50	54	58	62	66	70	74
15 TW	-4.8	-5.0	-5.2	-5.3	-5.5	-5.7	-5.9	-6.0	-6.2
10 TW	-3.2	-3.3	-3.4	-3.6	-3.7	-3.8	-3.9	-4.0	-4.1
5 TW	-1.6	-1.7	-1.7	-1.8	-1.8	-1.9	-2.0	-2.0	-2.1
0	0	0	0	0	0	0	0	0	0
10 HW	0.9	0.9	0.8	0.7	0.6	0.5	0.4	0.4	0.3
20 HW	1.9	1.7	1.6	1.4	1.2	1.1	0.9	0.7	0.6
30 HW	2.8	2.5	2.3	2.1	1.9	1.6	1.4	1.2	1.0
40 HW	3.6	3.3	3.0	2.8	2.0				

With engine bleed for packs off, increase weight by 300 kg.
With engine anti-ice on, decrease weight by 2000 kg.
With engine and wing anti-ice on, decrease weight by 7250 kg (optional system).

GEAR DOWN

Long Range Cruise Altitude Capability

Max Cruise Thrust, 100 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
85	15600	12500	9400
80	18500	15600	12700
75	21200	18500	15700
70	23700	21500	18600
65	26200	24500	21900
60	28700	27200	25400
55	30900	29700	28200
50	33000	32000	30800
45	35200	34200	33100
40	37600	36600	35500

GEAR DOWN

Long Range Cruise 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
340	300	266	239	218	200	187	174	164	155	147
676	598	531	479	437	400	374	350	329	311	295
1007	892	794	717	654	600	561	526	495	467	443
1333	1183	1055	954	872	800	749	702	661	624	593
1656	1472	1315	1190	1089	1000	936	878	827	782	743
1974	1758	1573	1426	1305	1200	1124	1056	995	941	894
2289	2042	1830	1661	1522	1400	1312	1233	1162	1100	1045
2600	2324	2086	1895	1737	1600	1501	1411	1330	1259	1197
2908	2603	2340	2128	1953	1800	1689	1588	1498	1419	1349
3213	2880	2592	2360	2168	2000	1877	1766	1667	1579	1502

Reference Fuel and Time Required

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)							
	10		14		20		24	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	2.6	0:53	2.4	0:52	2.3	0:49	2.2	0:48
400	5.0	1:42	4.7	1:37	4.3	1:31	4.1	1:27
600	7.5	2:29	7.1	2:22	6.4	2:12	6.1	2:06
800	10.1	3:16	9.5	3:06	8.6	2:53	8.1	2:45
1000	12.7	4:02	11.9	3:50	10.8	3:33	10.1	3:23
1200	15.4	4:46	14.4	4:32	13.0	4:12	12.2	4:00
1400	18.1	5:30	17.0	5:14	15.3	4:51	14.4	4:37
1600	21.0	6:14	19.6	5:55	17.6	5:29	16.6	5:13
1800	23.8	6:56	22.3	6:36	20.0	6:07	18.8	5:49
2000	26.7	7:38	24.9	7:16	22.4	6:44	21.0	6:25

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	LANDING WEIGHT (1000 KG)					
	40	45	50	55	60	65
2	-0.2	-0.1	0.0	0.1	0.3	0.4
4	-0.4	-0.2	0.0	0.2	0.5	0.7
6	-0.6	-0.3	0.0	0.4	0.7	1.1
8	-0.8	-0.4	0.0	0.5	0.9	1.4
10	-1.0	-0.5	0.0	0.6	1.2	1.7
12	-1.2	-0.6	0.0	0.7	1.4	2.1
14	-1.4	-0.7	0.0	0.8	1.6	2.4
16	-1.6	-0.8	0.0	0.9	1.8	2.7
18	-1.8	-0.9	0.0	1.0	2.0	3.0
20	-1.9	-1.0	0.0	1.1	2.2	3.4
22	-2.1	-1.1	0.0	1.2	2.5	3.7
24	-2.3	-1.2	0.0	1.3	2.7	4.0
26	-2.5	-1.3	0.0	1.5	2.9	4.3
28	-2.7	-1.3	0.0	1.6	3.1	4.6

Based on VREF40 + 70 climb, Long Range Cruise and VREF40 + 70 descent.

GEAR DOWN

Holding Planning

Flaps Up

WEIGHT (1000 KG)	TOTAL FUEL FLOW (KG/HR)							
	PRESSURE ALTITUDE (FT)							
	1500	5000	10000	15000	20000	25000	30000	35000
80	4190	4160	4140	4160	4170			
75	3950	3920	3900	3900	3900	4040		
70	3720	3680	3660	3650	3640	3710		
65	3490	3450	3420	3400	3390	3410		
60	3260	3210	3180	3150	3130	3140	3300	
55	3030	2990	2940	2910	2880	2880	2960	
50	2800	2760	2710	2680	2630	2630	2670	
45	2580	2540	2500	2460	2410	2380	2420	2510
40	2360	2320	2280	2240	2190	2150	2180	2200

This table includes 5% additional fuel for holding in a racetrack pattern.

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Net Level Off Weight

PRESSURE ALTITUDE (1000 FT)	LEVEL OFF WEIGHT (1000 KG)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
22	41.3		
20	44.6	43.4	42.1
18	46.7	46.1	44.9
16	51.0	49.4	47.7
14	53.2	52.0	50.7
12	56.7	55.4	53.7
10	60.3	58.7	56.6
8	63.5	61.8	59.7
6	66.1	64.5	62.7
4	67.8	66.6	65.4
2	69.2	68.7	68.2
0	69.9	69.9	69.9

Anti-Ice Adjustments

ANTI-ICE CONFIGURATION	LEVEL OFF WEIGHT ADJUSTMENT (1000 KG)										
	PRESSURE ALTITUDE (1000 FT)										
	0	2	4	6	8	10	12	14	16	18	20
ENGINE ONLY	-1.2	-1.2	-1.4	-1.4	-1.4	-1.3	-1.2	-1.2	-1.2	-1.1	-0.9
ENGINE & WING	-5.7	-5.6	-5.8	-5.8	-5.6	-5.2	-4.9	-4.9	-4.9		

Performance Dispatch

Text

Introduction

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

Takeoff

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

Brake Energy or Tire Speed Limit Weight tables are only provided if they are limiting for the range of conditions covered in the FCOM Section PD.

Minimum Takeoff Weight

Takeoff at the 26B2 Bump thrust rating requires observance of a minimum takeoff weight in order to maintain airplane controllability during takeoff. For takeoff at weights below the minimum takeoff weight, use of a lower thrust rating (certified derate) is required. Note that the assumed temperature method of reducing thrust may not be used as a means to comply with this restriction. Conservative minimum takeoff weight is 56699 kg at the 26B2 Bump takeoff thrust. Alternatively, lower minimum takeoff weights may be obtained, for the actual pressure altitude and outside air temperature, by using the Minimum Takeoff Weight tables provided.

Field Limit Weight - Slope and Wind Corrections

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

Field and Climb Limit Weight

Tables are presented for selected airport pressure altitudes and runway conditions and show both Field and Climb Limit Weights. Enter the appropriate table for pressure altitude and runway condition with "Slope and Wind Corrected Field Length" determined above and airport OAT to obtain Field Limit Weight. Also read Climb Limit Weight for the same OAT. Intermediate altitudes may be interpolated or use next higher altitude. When finding a maximum weight for a wet runway, the dry runway limit weight must also be determined and the lower of the two weights used.

Obstacle Limit Weight

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

Tire Speed Limit

Tire Speed Limit Weight tables are only provided if they are limiting for the range of conditions covered in the FCOM Section PD.

Maximum tire speed limited weights are presented for 225 MPH tires. To determine the tire speed limit weight, enter the table with OAT and airport pressure altitude. Adjust the tire speed limit weight according to the notes below the table to account for wind.

Brake Energy Limit VMBE

Brake Energy Limit Weight tables are only provided if they are limiting for the range of conditions covered in the FCOM Section PD.

The Maximum Brake Energy Speed table provides the Reference VMBE for a variety of airport pressure altitudes and temperatures. Enter the Weight Adjusted VMBE table to adjust the Reference VMBE for the actual brake release gross weight. Correct VMBE for slope and wind. If V1 exceeds VMBE, decrease brake release weight as indicated for each knot that V1 exceeds VMBE and determine V1, VR, and V2 for the lower brake release weight.

Enroute

Long Range Cruise Maximum Operating Altitude

These tables provide the maximum operating altitude in the same manner as the FMC. Maximum altitudes are shown for a given cruise weight and maneuver capability. Note that this table considers both thrust and buffet limits, providing the more limiting of the two. Any data that is thrust limited is denoted by an asterisk and represents only a thrust limited condition in level flight with 100 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 15° may cause the airplane to lose speed and/or altitude. The altitudes shown in the table are limited to the maximum certified altitude of 41000 ft.

Long Range Cruise Trip Fuel and Time

Long Range Cruise Trip Fuel and Time tables are provided to determine trip time and fuel required to destination.

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

Long Range Cruise Step Climb Trip Fuel and Time

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

Short Trip Fuel and Time

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

Holding Planning

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

Flight Crew Oxygen Requirements

This airplane is equipped with a gaseous passenger oxygen system.

Regulations require that sufficient oxygen be provided to the flight crew to account for the greater of supplemental breathing oxygen in the event of a cabin depressurization or protective breathing in the event of smoke or harmful fumes in the flight deck.

Tables are provided to determine the flight crew oxygen dispatch requirements. Table 1 shows minimum oxygen quantity necessary to ensure that protective breathing requirements are satisfied. Table 2 shows the supplemental oxygen requirement for loss of pressurization, emergency descent and total post decompression flight time above 10000 ft. Table 3 gives adjustments that must be applied to Table 2 crew member supplemental requirements in situations where the enroute altitude after decompression will exceed 14000 ft. The increments shown in Table 3 reflect only the increase in oxygen flow rate associated with periods of post decompression flight at altitudes other than 14000 ft. Hence, this time must also be included in the Table 2 time value used.

Table 1, Table 2 and Table 3 values are based on "NORMAL" regulator settings. Table 3 also shows “100%” regulator setting adjustments that can be used if the operator chooses to schedule oxygen dispatch requirements based on pure oxygen availability.

Additional adjustments for more extensive than normal crew usage can be made by adding 2.05 liters/person/minute (1.2 psi/person/minute for the single cylinder system) or 13 liters/person/minute (8 psi/person/minute) if 100% oxygen is selected during normal usage.

After determining the total volume (liters) required for the flight crew by using the larger value from Table 1 or Table 2, obtain the dispatch pressure required from the Cylinder Volume to Pressure Conversion table (Table 4). Adjust this reading for cylinder temperature as required, using the adjustments given (Table 5).

Passenger Oxygen Requirements

Data is provided to determine minimum oxygen cylinder pressure dispatch requirements. Table 1 shows oxygen quantity required to complete an emergency descent to 14000 ft, level off and continue for the duration of the post decompression time period to 10000 ft. The minimum oxygen quantity required for a particular flight is obtained by entering Table 1 with the total number of passenger cabin outlets intended to be used and planned cruise altitude, and reading oxygen volume required for the projected post decompression time above 10000 ft.

Table 2 shows adjustments which must be applied to the Table 1 values in situations where the minimum enroute altitude after decompression exceeds 14000 ft. The Table 2 adjustments reflect only the incremental increase in oxygen quantity associated with periods of post decompression flight at altitudes above 14000 ft. Consequently, time spent holding at higher than 14000 ft must also be included in the total post decompression time used in Table 1.

After determining the total volume (in liters) required from Tables 1 and 2, the Cylinder Volume to Pressure Conversion Table 3 is used to establish the minimum dispatch pressure for the particular cylinder configuration installed in the airplane. Temperature corrections for non-reference conditions are given in Table 4 and must be used to adjust the required dispatch pressure at 21°C to the final flight dispatch value.

Net Level Off Weight

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

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

Landing

Tables are provided for determining the maximum landing weight as limited by field length or climb requirements for a single landing flap.

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

Landing Field Limit Weight

For the expected runway condition and anti-skid system configuration, obtain wind corrected field length by entering the Wind Corrected Field Length table with field length available and wind component along the runway. Now enter the Field Limit Weight table with wind corrected field length and pressure altitude to read field limit weight.

Landing Climb Limit Weight

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

Go-Around Climb Gradient

Enter the Reference Go-Around Gradient table with airport OAT and pressure altitude to determine the reference go-around gradient. Then adjust the reference gradient for airplane weight and speed using the tables provided to determine the weight and speed adjusted go-around gradient. Apply the necessary corrections for engine bleed configuration and icing conditions as noted.

Quick Turnaround Limit Weight

Enter the appropriate table (Steel or Carbon Brakes) with airport pressure altitude and OAT to read maximum quick turnaround weight. Apply the noted adjustments as required.

If the landing weight exceeds the maximum quick turnaround weight, wait the specified time and then check that the wheel thermal plugs have not melted before executing a subsequent takeoff. For Steel Brakes, the alternate procedures on the charts can be used to ensure the brake temperature is within limits. These procedures cannot be used for carbon brakes.

Gear Down

This section provides flight planning data for revenue operation with gear down. Unless otherwise noted, the gear down tables in this section are identical in format and usage to the corresponding gear up tables previously described.

To eliminate erroneous displays the flight crew should enter only gross weight data on the PERF INIT page of the Control Display Unit (CDU). Omission of the cost index and cruise altitude entries on the PERF INIT page will render the VNAV function unavailable during flight. As a result, the following information will not be provided: VNAV guidance and speed schedules, trip fuel and ETA predictions, optimum and maximum altitude data, step climb and top of descent predictions, and the VNAV descent guidance path.

The gross weight entry allows the FMCS takeoff and approach speed schedules to be generated. In addition, the flap maneuver speed and VREF speed bugs will be available for display on the primary flight display speed tape. Except for VNAV, normal autopilot and autothrottle modes will remain available for use during the flight, as will the LNAV mode.

Takeoff/Landing Climb Limit Weight

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

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Performance Dispatch Chapter PD

Table of Contents Section 40

737-800W CFM56-7B24 KG M FAA CATC/N

General

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

Serial and tabulation number are supplied by Boeing.

Registry Number	Serial Number	Tabulation Number
B-5511	37576	YF921
B-5512	37577	YF922
B-5528	37578	YF923
B-5529	37150	YF924
B-5532	37151	YF925
B-5533	37152	YF926
B-5535	37579	YF927
B-5566	37153	YF928
B-5159	35044	YK961

Registry Number	Serial Number	Tabulation Number
B-5160	35045	YK962
B-5161	35046	YK963
B-5162	35047	YK964
B-5301	35048	YK965
B-5302	35049	YK966
B-5303	35050	YK968
B-5305	35051	YK969
B-5306	35052	YK970
B-5307	35053	YK971
B-5459	35057	YK973
B-5458	35055	YK974
B-5476	35056	YK975
B-5488	37148	YK976
B-5489	37149	YK977
B-5487	35058	YK978
B-5498	37574	YK979
B-5499	37575	YK980
B-5630	38386	YS151
B-5631	38387	YS152
B-5632	38388	YS153
B-5633	38389	YS154
B-5635	38390	YS155
B-5653	38391	YS156
B-5655	38392	YS157
B-5656	38393	YS158
B-5657	38394	YS159
B-5659	38396	YS160

Registry Number	Serial Number	Tabulation Number
B-5658	38395	YS166
B-5706	38398	YS168
B-5708	38403	YS169
B-5707	38399	YS170
B-5751	38400	YS171
B-5752	38404	YS172
B-5750	38380	YS173
B-5788	38382	YS174
B-5789	38401	YS175
B-5790	38402	YS176
B-1911	39907	YS179
B-1912	39908	YS180
B-1913	39900	YS181
B-1915	39901	YS182
B-1970	39903	YS183
B-1969	39902	YS184
B-1971	39904	YS185
B-1706	39905	YS186
B-1708	39911	YS187
B-1707	39906	YS188
B-1709	39912	YS189
B-1749	39909	YS190
B-1966	39910	YT501
B-6485	39913	YT502
B-6483	39918	YT503
B-6482	41391	YT504
B-6487	39919	YT505

Registry Number	Serial Number	Tabulation Number
B-6486	41395	YT506
B-1964	39914	YT507
B-6489	39915	YT508
B-6490	41392	YT509
B-6488	41396	YT510
B-6818	39916	YT511
B-6819	39917	YT512
B-6849	40959	YT513
B-6842	40957	YT514
B-7176	41393	YT515
B-7177	41394	YT516
B-7179	40960	YT517
B-7178	40958	YT518
B-7197	42925	YV741
B-7557	42926	YV742
B-7558	42927	YV743
B-7559	42928	YV744
B-7847	42930	YV745
B-7846	42929	YV746
B-7848	42931	YV747
B-7849	42932	YV748
B-1557	42933	YV749
B-1550	42934	YV750
B-1558	42935	YV751
B-1579	42936	YV752
B-1580	42937	YV753
B-7816	42938	YV754

Registry Number	Serial Number	Tabulation Number
B-7826	42939	YV755
YV756	42945	YV756
YV757	42946	YV757
YV758	42947	YV758
YV759	42949	YV759
YV760	42941	YV760
YV761	42948	YV761
YV762	42950	YV762
YV763	63682	YV763
YV764	42951	YV764
YV765	63683	YV765
YV766	42944	YV766
YV767	42940	YV767

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Takeoff Field Corrections - Dry Runway

Slope Corrections

FIELD LENGTH AVAILABLE (M)	SLOPE CORRECTED FIELD LENGTH (M)								
	RUNWAY SLOPE (%)								
	-2.0	-1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	2.0
1200	1240	1230	1220	1210	1200	1190	1170	1160	1140
1400	1470	1450	1430	1420	1400	1370	1350	1320	1290
1600	1690	1670	1650	1620	1600	1560	1520	1480	1440
1800	1920	1890	1860	1830	1800	1750	1700	1650	1590
2000	2140	2110	2070	2040	2000	1940	1870	1810	1740
2200	2370	2330	2290	2240	2200	2120	2050	1970	1890
2400	2600	2550	2500	2450	2400	2310	2220	2130	2040
2600	2820	2770	2710	2660	2600	2500	2400	2300	2190
2800	3050	2990	2920	2860	2800	2690	2570	2460	2340
3000	3280	3210	3140	3070	3000	2870	2750	2620	2490
3200	3500	3430	3350	3280	3200	3060	2920	2780	2640
3400	3730	3650	3560	3480	3400	3250	3100	2950	2790
3600	3950	3870	3780	3690	3600	3440	3270	3110	2940
3800	4180	4080	3990	3890	3800	3620	3450	3270	3090
4000	4410	4300	4200	4100	4000	3810	3620	3430	3240
4200	4630	4520	4420	4310	4200	4000	3800	3600	3390
4400	4860	4740	4630	4510	4400	4190	3970	3760	3540
4600	5080	4960	4840	4720	4600	4370	4150	3920	3690
4800	5310	5180	5060	4930	4800	4560	4320	4080	3840
5000	5540	5400	5270	5130	5000	4750	4500	4250	3990

Wind Corrections

SLOPE CORR'D FIELD LENGTH (M)	SLOPE & WIND CORRECTED FIELD LENGTH (M)							
	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1200	880	990	1090	1200	1270	1340	1410	1490
1400	1050	1170	1280	1400	1480	1550	1630	1710
1600	1220	1350	1470	1600	1680	1760	1850	1930
1800	1390	1520	1660	1800	1890	1980	2070	2160
2000	1560	1700	1850	2000	2090	2190	2280	2380
2200	1730	1880	2040	2200	2300	2400	2500	2610
2400	1890	2060	2230	2400	2500	2610	2720	2830
2600	2060	2240	2420	2600	2710	2820	2940	3050
2800	2230	2420	2610	2800	2910	3030	3150	3280
3000	2400	2600	2800	3000	3120	3240	3370	3500
3200	2570	2780	2990	3200	3330	3450	3590	3720
3400	2740	2960	3180	3400	3530	3670	3810	3950
3600	2910	3140	3370	3600	3740	3880	4020	4170
3800	3080	3320	3560	3800	3940	4090	4240	4400
4000	3250	3500	3750	4000	4150	4300	4460	4620
4200	3420	3680	3940	4200	4350	4510	4680	4840
4400	3590	3860	4130	4400	4560	4720	4890	5070
4600	3760	4040	4320	4600	4760	4930	5110	5290
4800	3930	4220	4510	4800	4970	5150	5330	5510
5000	4090	4400	4700	5000	5180	5360	5540	5740

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 5

Sea Level Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1220	56.4	51.7	51.3	51.0	50.6	50.3	50.0	47.2	45.9	44.6	43.3
1400	61.1	56.1	55.7	55.3	55.0	54.6	54.2	51.3	49.9	48.5	47.1
1600	66.1	60.6	60.2	59.8	59.4	59.0	58.6	55.5	54.0	52.5	51.0
1800	70.6	64.8	64.4	63.9	63.5	63.1	62.7	59.3	57.7	56.1	54.5
2000	74.7	68.5	68.0	67.6	67.2	66.7	66.3	62.7	61.0	59.3	57.6
2200	78.5	72.0	71.5	71.0	70.6	70.1	69.6	65.9	64.1	62.3	60.5
2400	82.0	75.2	74.7	74.2	73.7	73.2	72.7	68.8	66.9	65.0	63.1
2600	85.0	77.9	77.4	76.8	76.3	75.8	75.3	71.2	69.2	67.3	65.4
2800	86.1	80.5	79.9	79.4	78.8	78.3	77.8	73.5	71.5	69.4	67.4
3000	86.1	82.8	82.3	81.7	81.2	80.6	80.1	75.6	73.5	71.4	69.3
3200	86.1	85.3	84.7	84.1	83.5	83.0	82.4	77.8	75.6	73.4	71.3
3400	86.1	86.1	86.1	86.1	85.9	85.3	84.7	80.0	77.7	75.4	73.2
3600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	82.0	79.7	77.3	75.1
3800	86.1	86.1	86.1	86.1	86.1	86.1	86.1	84.0	81.6	79.2	76.8
4000	86.1	86.1	86.1	86.1	86.1	86.1	86.1	85.9	83.4	80.9	78.5
4200	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	85.2	82.7	80.2
4400	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	84.4	81.9
4600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.0	83.5
CLIMB LIMIT WT (1000 KG)	79.2	78.6	78.5	78.4	78.3	78.1	78.0	72.6	69.9	67.3	64.7

2000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1220	53.3	48.8	48.5	48.2	47.9	47.5	46.3	43.7	42.6	41.4	40.2
1400	57.8	53.0	52.7	52.3	52.0	51.6	50.3	47.6	46.3	45.0	43.8
1600	62.5	57.3	56.9	56.6	56.2	55.9	54.4	51.5	50.1	48.7	47.4
1800	66.8	61.3	60.9	60.5	60.1	59.7	58.1	55.0	53.6	52.1	50.6
2000	70.6	64.8	64.3	63.9	63.5	63.1	61.4	58.2	56.6	55.0	53.5
2200	74.2	68.0	67.6	67.2	66.7	66.3	64.5	61.1	59.4	57.8	56.2
2400	77.5	71.0	70.6	70.1	69.6	69.2	67.4	63.7	62.0	60.3	58.6
2600	80.3	73.6	73.1	72.6	72.1	71.7	69.8	66.0	64.2	62.4	60.6
2800	83.0	76.0	75.5	75.0	74.5	74.0	72.0	68.1	66.2	64.3	62.5
3000	85.5	78.2	77.7	77.1	76.6	76.1	74.1	70.0	68.0	66.1	64.2
3200	86.1	80.5	79.9	79.4	78.9	78.3	76.2	72.0	70.0	68.0	66.0
3400	86.1	82.7	82.1	81.6	81.0	80.5	78.3	73.9	71.9	69.8	67.8
3600	86.1	84.8	84.3	83.7	83.1	82.6	80.3	75.8	73.7	71.6	69.5
3800	86.1	86.1	86.1	85.7	85.1	84.5	82.2	77.6	75.4	73.2	71.1
4000	86.1	86.1	86.1	86.1	86.1	86.1	84.0	79.3	77.1	74.9	72.7
4200	86.1	86.1	86.1	86.1	86.1	86.1	85.8	81.0	78.7	76.5	74.2
4400	86.1	86.1	86.1	86.1	86.1	86.1	86.1	82.7	80.4	78.0	75.8
4600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	84.3	81.9	79.6	77.3
CLIMB LIMIT WT (1000 KG)	76.1	75.5	75.4	75.3	75.2	75.1	72.4	67.3	64.9	62.4	60.0

With engine bleed for packs off, increase field limit weight by 400 kg and climb limit weight by 1500 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 900 kg and climb limit weight by 1400 kg.

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 5

4000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1220	50.3	46.1	45.8	45.5	45.2	44.0	42.8	40.5	39.4	38.3	37.3
1400	54.6	50.1	49.8	49.5	49.1	47.8	46.6	44.1	43.0	41.8	40.7
1600	59.0	54.2	53.9	53.5	53.2	51.8	50.4	47.8	46.5	45.2	44.1
1800	63.1	57.9	57.6	57.2	56.8	55.3	53.9	51.1	49.7	48.3	47.1
2000	66.7	61.2	60.8	60.4	60.1	58.5	56.9	54.0	52.5	51.1	49.8
2200	70.1	64.3	63.9	63.5	63.1	61.4	59.8	56.7	55.1	53.6	52.2
2400	73.1	67.1	66.7	66.3	65.8	64.1	62.4	59.1	57.5	55.9	54.5
2600	75.8	69.5	69.1	68.6	68.2	66.4	64.6	61.1	59.5	57.8	56.3
2800	78.3	71.8	71.3	70.8	70.3	68.5	66.6	63.0	61.3	59.6	58.0
3000	80.6	73.8	73.3	72.8	72.3	70.4	68.5	64.8	63.0	61.2	59.5
3200	82.9	75.9	75.4	74.9	74.4	72.4	70.4	66.6	64.7	62.9	61.2
3400	85.2	78.0	77.5	77.0	76.4	74.4	72.3	68.3	66.5	64.5	62.8
3600	86.1	80.0	79.5	78.9	78.4	76.3	74.2	70.1	68.1	66.1	64.3
3800	86.1	81.9	81.4	80.8	80.3	78.0	75.9	71.7	69.7	67.7	65.8
4000	86.1	83.7	83.2	82.6	82.0	79.8	77.6	73.3	71.2	69.2	67.3
4200	86.1	85.5	85.0	84.4	83.8	81.5	79.2	74.9	72.8	70.6	68.7
4400	86.1	86.1	86.1	86.1	85.5	83.2	80.9	76.4	74.3	72.1	70.1
4600	86.1	86.1	86.1	86.1	86.1	84.8	82.5	77.9	75.7	73.5	71.5
CLIMB LIMIT WT (1000 KG)	72.9	72.4	72.3	72.2	72.1	69.6	67.1	62.3	60.1	57.8	55.8

6000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1220	47.4	43.5	43.2	42.9	41.8	40.7	39.6	37.4	36.4	35.5	34.6
1400	51.4	47.3	47.0	46.7	45.5	44.3	43.1	40.8	39.7	38.7	37.8
1600	55.6	51.2	50.9	50.6	49.3	48.0	46.7	44.2	43.1	42.0	41.0
1800	59.5	54.7	54.4	54.0	52.7	51.3	49.9	47.3	46.0	44.9	43.8
2000	62.9	57.8	57.5	57.1	55.7	54.2	52.7	49.9	48.6	47.4	46.2
2200	66.0	60.7	60.4	60.0	58.4	56.9	55.4	52.4	51.0	49.7	48.5
2400	68.9	63.4	63.0	62.6	61.0	59.3	57.8	54.7	53.2	51.9	50.6
2600	71.4	65.6	65.2	64.8	63.1	61.4	59.7	56.5	55.0	53.6	52.2
2800	73.7	67.7	67.2	66.8	65.1	63.3	61.6	58.2	56.6	55.2	53.8
3000	75.8	69.6	69.1	68.7	66.9	65.0	63.2	59.8	58.1	56.6	55.1
3200	78.0	71.5	71.1	70.6	68.8	66.8	65.0	61.4	59.7	58.1	56.6
3400	80.2	73.5	73.0	72.5	70.6	68.6	66.7	63.0	61.2	59.6	58.1
3600	82.2	75.3	74.9	74.4	72.4	70.4	68.4	64.6	62.8	61.1	59.5
3800	84.2	77.1	76.6	76.1	74.1	72.0	70.0	66.1	64.2	62.5	60.9
4000	86.1	78.8	78.3	77.8	75.7	73.6	71.5	67.5	65.6	63.9	62.2
4200	86.1	80.5	80.0	79.5	77.4	75.2	73.1	69.0	67.0	65.2	63.5
4400	86.1	82.2	81.7	81.1	78.9	76.7	74.6	70.4	68.4	66.6	64.8
4600	86.1	83.8	83.3	82.7	80.5	78.2	76.1	71.8	69.8	67.9	66.1
CLIMB LIMIT WT (1000 KG)	69.8	69.4	69.3	69.2	66.7	64.3	62.0	57.5	55.4	53.5	51.8

With engine bleed for packs off, increase field limit weight by 400 kg and climb limit weight by 1500 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 900 kg and climb limit weight by 1400 kg.

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 5

8000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1220	44.5	40.9	40.7	39.7	38.6	37.6	36.5	34.6	33.7	32.8	31.9
1400	48.4	44.6	44.3	43.2	42.1	41.0	39.9	37.8	36.8	35.9	35.0
1600	52.3	48.3	48.0	46.8	45.6	44.4	43.2	40.9	39.9	38.9	37.9
1800	55.9	51.6	51.3	50.0	48.7	47.4	46.2	43.7	42.6	41.6	40.5
2000	59.1	54.5	54.2	52.9	51.5	50.1	48.8	46.2	45.0	43.9	42.8
2200	62.1	57.2	56.9	55.5	54.1	52.6	51.2	48.5	47.2	46.0	44.9
2400	64.8	59.7	59.3	57.9	56.4	54.8	53.4	50.5	49.2	48.0	46.8
2600	67.1	61.8	61.4	59.9	58.3	56.7	55.2	52.2	50.8	49.5	48.3
2800	69.2	63.7	63.3	61.7	60.1	58.4	56.8	53.7	52.3	51.0	49.6
3000	71.2	65.4	65.0	63.4	61.7	60.0	58.3	55.1	53.6	52.2	50.9
3200	73.2	67.3	66.8	65.2	63.4	61.6	59.9	56.6	55.1	53.6	52.2
3400	75.2	69.1	68.6	66.9	65.1	63.2	61.5	58.0	56.5	55.0	53.5
3600	77.1	70.8	70.4	68.6	66.7	64.8	63.0	59.5	57.9	56.3	54.8
3800	78.9	72.5	72.0	70.2	68.3	66.3	64.4	60.8	59.2	57.6	56.1
4000	80.7	74.1	73.6	71.7	69.8	67.8	65.9	62.2	60.5	58.8	57.3
4200	82.4	75.7	75.2	73.3	71.3	69.2	67.3	63.5	61.8	60.1	58.5
4400	84.1	77.2	76.7	74.8	72.7	70.6	68.6	64.8	63.0	61.3	59.7
4600	85.8	78.8	78.2	76.3	74.2	72.0	70.0	66.1	64.3	62.6	60.9
CLIMB LIMIT WT (1000 KG)	66.5	66.2	66.1	63.9	61.6	59.3	57.2	53.1	51.2	49.5	47.8

10000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1220	41.8	38.4	37.6	36.6	35.6	34.6	33.7	31.8	30.9	30.0	29.2
1400	45.5	41.9	41.0	40.0	38.9	37.8	36.8	34.8	33.9	32.9	32.0
1600	49.2	45.4	44.4	43.3	42.2	41.0	39.9	37.8	36.7	35.7	34.8
1800	52.6	48.5	47.5	46.3	45.1	43.8	42.7	40.4	39.3	38.2	37.1
2000	55.6	51.2	50.1	48.9	47.6	46.3	45.0	42.6	41.4	40.3	39.2
2200	58.4	53.8	52.6	51.3	49.9	48.6	47.3	44.7	43.5	42.3	41.1
2400	60.9	56.1	54.9	53.5	52.1	50.6	49.3	46.6	45.3	44.0	42.8
2600	63.0	58.0	56.7	55.3	53.8	52.3	50.9	48.1	46.7	45.4	44.1
2800	65.0	59.8	58.4	57.0	55.4	53.8	52.4	49.4	48.0	46.7	45.3
3000	66.8	61.4	60.0	58.5	56.8	55.2	53.7	50.7	49.2	47.8	46.4
3200	68.7	63.1	61.6	60.1	58.4	56.7	55.1	52.0	50.5	49.0	47.6
3400	70.5	64.7	63.3	61.6	59.9	58.2	56.5	53.3	51.7	50.2	48.8
3600	72.3	66.4	64.8	63.2	61.4	59.6	57.9	54.6	53.0	51.4	49.9
3800	74.0	67.9	66.3	64.6	62.8	61.0	59.2	55.8	54.2	52.6	51.0
4000	75.6	69.4	67.8	66.0	64.2	62.3	60.5	57.0	55.3	53.7	52.1
4200	77.2	70.9	69.3	67.4	65.5	63.6	61.8	58.2	56.5	54.8	53.2
4400	78.8	72.3	70.7	68.8	66.9	64.9	63.1	59.4	57.7	56.0	54.3
4600	80.4	73.8	72.1	70.2	68.2	66.2	64.3	60.6	58.8	57.1	55.4
CLIMB LIMIT WT (1000 KG)	63.2	62.8	61.1	59.0	56.8	54.6	52.6	48.9	47.0	45.2	43.5

With engine bleed for packs off, increase field limit weight by 400 kg and climb limit weight by 1500 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 900 kg and climb limit weight by 1400 kg.

Takeoff Field Corrections - Wet Runway

Slope Corrections

FIELD LENGTH AVAILABLE (M)	SLOPE CORRECTED FIELD LENGTH (M)								
	RUNWAY SLOPE (%)								
	-2.0	-1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	2.0
1200	1230	1220	1210	1210	1200	1190	1190	1180	1170
1400	1450	1440	1430	1410	1400	1380	1370	1350	1340
1600	1680	1660	1640	1620	1600	1580	1550	1530	1500
1800	1900	1880	1850	1830	1800	1770	1730	1700	1670
2000	2130	2100	2060	2030	2000	1960	1920	1870	1830
2200	2350	2310	2280	2240	2200	2150	2100	2050	2000
2400	2580	2530	2490	2440	2400	2340	2280	2220	2160
2600	2820	2760	2710	2650	2600	2530	2470	2400	2330
2800	3060	2990	2930	2860	2800	2730	2650	2580	2500
3000	3300	3220	3150	3070	3000	2920	2840	2750	2670
3200	3540	3450	3370	3280	3200	3110	3020	2930	2840
3400	3780	3680	3590	3490	3400	3300	3210	3110	3010
3600	4020	3910	3810	3700	3600	3500	3390	3290	3180
3800	4250	4140	4030	3910	3800	3680	3570	3450	3330
4000	4490	4360	4240	4120	4000	3870	3740	3600	3470
4200	4720	4590	4460	4330	4200	4050	3910	3760	3610
4400	4960	4820	4680	4540	4400	4240	4080	3910	3750
4600	5190	5040	4900	4750	4600	4420	4250	4070	3890
4800	5430	5270	5110	4960	4800	4610	4420	4220	4030
5000	5660	5500	5330	5170	5000	4790	4590	4380	4170

Wind Corrections

SLOPE CORR'D FIELD LENGTH (M)	SLOPE & WIND CORRECTED FIELD LENGTH (M)							
	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1200	850	970	1080	1200	1280	1360	1440	1530
1400	1020	1150	1270	1400	1490	1570	1670	1760
1600	1190	1330	1460	1600	1690	1790	1890	1990
1800	1360	1510	1650	1800	1900	2000	2110	2220
2000	1530	1690	1840	2000	2110	2220	2330	2450
2200	1700	1870	2030	2200	2310	2430	2550	2680
2400	1870	2050	2220	2400	2520	2650	2770	2910
2600	2040	2230	2410	2600	2730	2860	3000	3140
2800	2210	2400	2600	2800	2940	3080	3220	3360
3000	2380	2580	2790	3000	3140	3290	3440	3590
3200	2550	2760	2980	3200	3350	3500	3660	3820
3400	2710	2940	3170	3400	3560	3720	3880	4050
3600	2880	3120	3360	3600	3760	3930	4110	4280
3800	3050	3300	3550	3800	3970	4150	4330	4510
4000	3220	3480	3740	4000	4180	4360	4550	4740
4200	3390	3660	3930	4200	4390	4580	4770	4970
4400	3560	3840	4120	4400	4590	4790	4990	5200
4600	3730	4020	4310	4600	4800	5010	5220	5430
4800	3900	4200	4500	4800	5010	5220	5440	5660
5000	4070	4380	4690	5000	5210	5430	5660	5890

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 5

Sea Level Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1220	56.4	51.2	50.8	50.5	50.1	49.7	49.3	46.8	45.6	44.3	43.2
1400	61.0	55.5	55.0	54.6	54.2	53.8	53.4	50.7	49.4	48.1	46.8
1600	65.8	59.8	59.4	58.9	58.5	58.1	57.7	54.7	53.3	51.9	50.5
1800	70.2	63.8	63.3	62.9	62.4	62.0	61.5	58.4	56.8	55.3	53.9
2000	74.2	67.5	67.0	66.5	66.0	65.5	65.1	61.7	60.1	58.5	57.0
2200	78.0	71.0	70.4	69.9	69.4	68.9	68.4	64.9	63.2	61.5	59.9
2400	81.6	74.2	73.6	73.1	72.5	72.0	71.5	67.8	66.0	64.3	62.6
2600	84.5	76.8	76.2	75.7	75.1	74.6	74.0	70.2	68.3	66.5	64.7
2800	86.1	79.4	78.8	78.3	77.7	77.1	76.5	72.6	70.6	68.7	66.9
3000	86.1	82.0	81.4	80.8	80.2	79.6	79.0	74.9	72.8	70.9	69.0
3200	86.1	84.5	83.8	83.2	82.6	82.0	81.3	77.1	75.0	73.0	71.0
3400	86.1	86.1	86.1	85.6	84.9	84.3	83.7	79.3	77.1	75.0	73.0
3600	86.1	86.1	86.1	86.1	86.1	86.1	85.9	81.4	79.2	77.0	74.9
3800	86.1	86.1	86.1	86.1	86.1	86.1	86.1	83.4	81.1	78.9	76.7
4000	86.1	86.1	86.1	86.1	86.1	86.1	86.1	85.3	83.0	80.7	78.5
4200	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	84.9	82.5	80.2
4400	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	84.3	81.9
4600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.0	83.6
CLIMB LIMIT WT (1000 KG)	79.2	78.6	78.5	78.4	78.3	78.1	78.0	72.6	69.9	67.3	64.7

2000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1220	53.2	48.3	47.9	47.6	47.2	46.9	45.7	43.4	42.3	41.1	40.0
1400	57.6	52.3	51.9	51.5	51.2	50.8	49.5	47.0	45.8	44.6	43.4
1600	62.1	56.4	56.0	55.6	55.2	54.8	53.4	50.7	49.4	48.1	46.9
1800	66.3	60.2	59.8	59.3	58.9	58.5	57.0	54.1	52.8	51.4	50.0
2000	70.1	63.7	63.2	62.7	62.3	61.8	60.3	57.3	55.8	54.3	52.9
2200	73.7	66.9	66.5	66.0	65.5	65.0	63.4	60.2	58.7	57.1	55.6
2400	77.0	70.0	69.4	68.9	68.4	67.9	66.2	62.9	61.3	59.7	58.1
2600	79.8	72.4	71.9	71.4	70.9	70.3	68.6	65.1	63.4	61.7	60.1
2800	82.5	74.9	74.3	73.8	73.2	72.7	70.8	67.2	65.5	63.7	62.0
3000	85.2	77.3	76.7	76.1	75.5	75.0	73.1	69.3	67.5	65.7	63.9
3200	86.1	79.6	79.0	78.4	77.8	77.2	75.2	71.4	69.5	67.6	65.8
3400	86.1	81.8	81.2	80.6	80.0	79.4	77.4	73.4	71.4	69.5	67.6
3600	86.1	84.0	83.4	82.8	82.1	81.5	79.4	75.3	73.3	71.3	69.4
3800	86.1	86.1	85.5	84.8	84.2	83.6	81.4	77.1	75.1	73.1	71.0
4000	86.1	86.1	86.1	86.1	86.1	85.5	83.3	78.9	76.8	74.7	72.7
4200	86.1	86.1	86.1	86.1	86.1	86.1	85.1	80.7	78.5	76.4	74.3
4400	86.1	86.1	86.1	86.1	86.1	86.1	86.1	82.4	80.2	78.0	75.8
4600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	84.1	81.8	79.6	77.4
CLIMB LIMIT WT (1000 KG)	76.1	75.5	75.4	75.3	75.2	75.1	72.4	67.3	64.9	62.4	60.0

With engine bleed for packs off, increase field limit weight by 350 kg and climb limit weight by 1500 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 800 kg and climb limit weight by 1400 kg.

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 5

4000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1220	50.1	45.5	45.2	44.9	44.5	43.4	42.3	40.2	39.2	38.1	37.2
1400	54.3	49.3	49.0	48.6	48.3	47.1	45.9	43.6	42.5	41.3	40.3
1600	58.6	53.2	52.8	52.5	52.1	50.8	49.5	47.1	45.9	44.7	43.6
1800	62.5	56.8	56.4	56.0	55.6	54.2	52.9	50.2	49.0	47.7	46.5
2000	66.1	60.1	59.6	59.2	58.8	57.3	55.9	53.1	51.8	50.4	49.2
2200	69.5	63.1	62.7	62.2	61.8	60.3	58.8	55.8	54.4	53.0	51.7
2400	72.6	66.0	65.5	65.0	64.6	63.0	61.4	58.3	56.8	55.3	54.0
2600	75.2	68.3	67.8	67.3	66.8	65.2	63.5	60.3	58.8	57.2	55.8
2800	77.7	70.6	70.0	69.5	69.0	67.3	65.6	62.3	60.7	59.0	57.6
3000	80.2	72.8	72.2	71.7	71.2	69.4	67.6	64.2	62.5	60.8	59.3
3200	82.6	75.0	74.4	73.9	73.3	71.5	69.6	66.1	64.3	62.6	61.0
3400	85.0	77.1	76.5	75.9	75.4	73.5	71.6	67.9	66.1	64.3	62.7
3600	86.1	79.1	78.5	77.9	77.4	75.4	73.4	69.6	67.8	66.0	64.3
3800	86.1	81.1	80.4	79.8	79.3	77.2	75.2	71.3	69.5	67.5	65.8
4000	86.1	83.0	82.3	81.7	81.1	79.0	77.0	73.0	71.1	69.1	67.3
4200	86.1	84.8	84.2	83.5	82.9	80.8	78.7	74.6	72.6	70.6	68.8
4400	86.1	86.1	85.9	85.3	84.7	82.5	80.3	76.1	74.1	72.1	70.2
4600	86.1	86.1	86.1	86.1	86.1	84.2	82.0	77.7	75.6	73.5	71.6
CLIMB LIMIT WT (1000 KG)	72.9	72.4	72.3	72.2	72.1	69.6	67.1	62.3	60.1	57.8	55.8

6000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1220	47.1	42.9	42.6	42.3	41.2	40.2	39.2	37.2	36.2	35.3	34.5
1400	51.1	46.5	46.2	45.8	44.7	43.6	42.5	40.3	39.3	38.3	37.4
1600	55.1	50.2	49.8	49.5	48.3	47.0	45.9	43.5	42.4	41.4	40.4
1800	58.8	53.5	53.2	52.8	51.5	50.2	49.0	46.5	45.3	44.2	43.2
2000	62.2	56.6	56.2	55.8	54.5	53.1	51.8	49.1	47.9	46.7	45.6
2200	65.4	59.5	59.1	58.7	57.3	55.8	54.4	51.7	50.3	49.1	48.0
2400	68.3	62.2	61.7	61.3	59.8	58.3	56.8	54.0	52.6	51.3	50.1
2600	70.7	64.3	63.9	63.4	61.9	60.3	58.8	55.8	54.3	53.0	51.8
2800	73.1	66.5	66.0	65.5	63.9	62.3	60.7	57.5	56.0	54.7	53.4
3000	75.4	68.5	68.0	67.5	65.9	64.2	62.5	59.3	57.7	56.3	55.0
3200	77.7	70.6	70.0	69.5	67.8	66.0	64.3	61.0	59.4	57.9	56.5
3400	79.9	72.5	72.0	71.5	69.7	67.9	66.1	62.6	61.0	59.5	58.0
3600	82.0	74.4	73.9	73.3	71.5	69.6	67.8	64.3	62.6	61.0	59.5
3800	84.0	76.2	75.7	75.1	73.2	71.3	69.4	65.8	64.0	62.4	60.9
4000	86.0	78.0	77.4	76.9	74.9	73.0	71.0	67.3	65.5	63.9	62.3
4200	86.1	79.7	79.2	78.6	76.6	74.6	72.6	68.8	66.9	65.2	63.6
4400	86.1	81.4	80.8	80.2	78.2	76.1	74.1	70.2	68.3	66.6	64.9
4600	86.1	83.1	82.5	81.9	79.8	77.7	75.6	71.6	69.7	67.9	66.2
CLIMB LIMIT WT (1000 KG)	69.8	69.4	69.3	69.2	66.7	64.3	62.0	57.5	55.4	53.5	51.8

With engine bleed for packs off, increase field limit weight by 350 kg and climb limit weight by 1500 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 800 kg and climb limit weight by 1400 kg.

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 5

8000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1220	44.3	40.3	40.0	39.1	38.1	37.1	36.2	34.3	33.5	32.7	31.9
1400	48.0	43.7	43.4	42.4	41.3	40.3	39.3	37.3	36.4	35.5	34.6
1600	51.8	47.2	46.8	45.8	44.7	43.5	42.4	40.3	39.3	38.3	37.4
1800	55.2	50.4	50.0	48.9	47.7	46.4	45.3	43.0	41.9	40.9	40.0
2000	58.4	53.2	52.9	51.7	50.4	49.1	47.9	45.4	44.3	43.3	42.2
2200	61.4	56.0	55.6	54.3	53.0	51.6	50.3	47.8	46.6	45.5	44.4
2400	64.2	58.5	58.1	56.7	55.3	53.9	52.5	49.9	48.7	47.5	46.4
2600	66.4	60.5	60.0	58.7	57.2	55.7	54.3	51.5	50.3	49.0	47.8
2800	68.6	62.4	62.0	60.6	59.0	57.5	56.0	53.1	51.8	50.5	49.3
3000	70.7	64.4	63.9	62.4	60.8	59.2	57.7	54.7	53.3	52.0	50.7
3200	72.8	66.2	65.8	64.2	62.6	60.9	59.3	56.3	54.8	53.5	52.1
3400	74.9	68.1	67.6	66.0	64.3	62.6	61.0	57.8	56.3	54.9	53.5
3600	76.9	69.8	69.3	67.7	66.0	64.2	62.5	59.2	57.7	56.3	54.9
3800	78.7	71.5	71.0	69.3	67.5	65.7	64.0	60.6	59.1	57.6	56.1
4000	80.6	73.2	72.6	70.9	69.1	67.2	65.4	62.0	60.4	58.9	57.4
4200	82.4	74.8	74.2	72.5	70.6	68.7	66.9	63.3	61.7	60.1	58.6
4400	84.1	76.4	75.8	74.0	72.1	70.1	68.3	64.6	63.0	61.4	59.8
4600	85.8	77.9	77.3	75.5	73.5	71.5	69.6	65.9	64.2	62.6	61.0
CLIMB LIMIT WT (1000 KG)	66.5	66.2	66.1	63.9	61.6	59.3	57.2	53.1	51.2	49.5	47.8

10000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1220	41.5	37.8	37.0	36.1	35.2	34.3	33.4	31.6	30.8	30.0	29.2
1400	45.0	41.0	40.1	39.2	38.2	37.2	36.2	34.4	33.4	32.6	31.7
1600	48.6	44.3	43.3	42.3	41.3	40.2	39.2	37.1	36.2	35.2	34.3
1800	51.8	47.2	46.3	45.2	44.0	42.9	41.8	39.7	38.6	37.6	36.6
2000	54.8	49.9	48.9	47.8	46.6	45.3	44.2	41.9	40.8	39.7	38.7
2200	57.6	52.5	51.4	50.2	48.9	47.7	46.5	44.1	42.9	41.8	40.7
2400	60.2	54.8	53.7	52.4	51.1	49.8	48.5	46.0	44.8	43.6	42.5
2600	62.3	56.7	55.5	54.2	52.8	51.4	50.1	47.5	46.2	45.0	43.8
2800	64.3	58.5	57.3	55.9	54.5	53.0	51.6	48.9	47.6	46.3	45.1
3000	66.3	60.3	59.0	57.6	56.1	54.6	53.2	50.3	49.0	47.6	46.4
3200	68.2	62.0	60.7	59.2	57.7	56.1	54.7	51.7	50.3	49.0	47.6
3400	70.1	63.7	62.3	60.8	59.2	57.6	56.1	53.1	51.7	50.2	48.9
3600	72.0	65.3	63.9	62.4	60.8	59.1	57.5	54.4	52.9	51.5	50.1
3800	73.7	66.9	65.5	63.9	62.2	60.5	58.9	55.7	54.2	52.7	51.2
4000	75.4	68.4	67.0	65.3	63.6	61.9	60.2	56.9	55.4	53.8	52.3
4200	77.1	69.9	68.4	66.7	65.0	63.2	61.5	58.1	56.5	54.9	53.4
4400	78.7	71.4	69.8	68.1	66.3	64.5	62.8	59.3	57.7	56.1	54.5
4600	80.3	72.8	71.2	69.5	67.6	65.8	64.0	60.5	58.8	57.2	55.6
CLIMB LIMIT WT (1000 KG)	63.2	62.8	61.1	59.0	56.8	54.6	52.6	48.9	47.0	45.2	43.5

With engine bleed for packs off, increase field limit weight by 350 kg and climb limit weight by 1500 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 800 kg and climb limit weight by 1400 kg.

Takeoff Obstacle Limit Weight

Flaps 5

Sea Level, 30°C & Below, Zero Wind

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

Reference Obstacle Limit Weight (1000 KG)

OBSTACLE HEIGHT (M)	DISTANCE FROM BRAKE RELEASE (100 M)										
	25	30	35	40	45	50	55	60	65	70	75
5	70.0	75.5	79.3	81.7							
20	64.2	69.5	73.6	76.8	79.1	80.6	82.0	83.1			
40	59.4	64.4	68.4	71.6	74.2	76.3	78.0	79.2	80.3	81.2	82.0
60	55.7	60.5	64.4	67.7	70.4	72.7	74.5	76.1	77.4	78.4	79.3
80	52.5	57.3	61.2	64.5	67.2	69.5	71.5	73.2	74.6	75.9	76.9
100	49.8	54.6	58.5	61.7	64.5	66.8	68.9	70.7	72.2	73.5	74.7
120	47.5	52.1	56.0	59.3	62.1	64.5	66.5	68.4	70.0	71.4	72.6
140	45.4	50.0	53.8	57.1	59.9	62.3	64.4	66.3	68.0	69.4	70.7
160	43.4	48.0	51.8	55.1	57.9	60.4	62.5	64.4	66.1	67.6	69.0
180	41.7	46.2	50.0	53.3	56.1	58.6	60.8	62.7	64.4	65.9	67.3
200		44.6	48.4	51.6	54.4	56.9	59.1	61.1	62.8	64.4	65.8
220		43.1	46.8	50.1	52.9	55.4	57.6	59.5	61.3	62.9	64.3
240		41.6	45.4	48.6	51.4	53.9	56.1	58.1	59.9	61.5	63.0
260			44.0	47.3	50.1	52.6	54.8	56.8	58.6	60.2	61.7
280			42.8	46.0	48.8	51.3	53.5	55.5	57.3	58.9	60.4
300			41.6	44.8	47.6	50.1	52.3	54.3	56.1	57.8	59.3

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

OAT Adjustments

OAT (°C)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 KG)					
	40	50	60	70	80	90
30 & BELOW	0	0	0	0	0	0
32	-0.7	-0.8	-1.0	-1.2	-1.4	-1.6
34	-1.3	-1.7	-2.1	-2.4	-2.8	-3.2
36	-2.0	-2.5	-3.1	-3.7	-4.2	-4.8
38	-2.7	-3.4	-4.1	-4.9	-5.6	-6.3
40	-3.3	-4.2	-5.2	-6.1	-7.0	-7.9
42	-4.0	-5.1	-6.2	-7.3	-8.4	-9.5
44	-4.6	-5.9	-7.2	-8.5	-9.8	-11.0
46	-5.3	-6.8	-8.2	-9.7	-11.1	-12.6
48	-6.0	-7.6	-9.3	-10.9	-12.5	-14.2
50	-6.6	-8.5	-10.3	-12.1	-13.9	-15.7

Pressure Altitude Adjustments

ALT (FT)	OAT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)					
	40	50	60	70	80	90
S.L. & BELOW	0	0	0	0	0	0
1000	-1.6	-2.0	-2.3	-2.7	-3.0	-3.4
2000	-3.2	-3.9	-4.6	-5.3	-6.0	-6.8
3000	-4.7	-5.7	-6.8	-7.9	-8.9	-10.0
4000	-6.1	-7.6	-9.0	-10.4	-11.8	-13.2
5000	-7.5	-9.3	-11.0	-12.8	-14.6	-16.3
6000	-8.9	-11.0	-13.1	-15.2	-17.3	-19.4
7000	-10.2	-12.6	-15.0	-17.5	-19.9	-22.3
8000	-11.4	-14.2	-16.9	-19.7	-22.5	-25.3
9000	-12.5	-15.6	-18.7	-21.8	-24.9	-28.0
10000	-13.6	-17.0	-20.4	-23.9	-27.3	-30.7

Takeoff Obstacle Limit Weight

Flaps 5

Sea Level, 30°C & Below, Zero Wind

Wind Adjustments

WIND (KTS)	OAT & ALT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)					
	40	50	60	70	80	90
15 TW	-9.3	-8.8	-8.2	-7.6	-7.1	-6.5
10 TW	-6.2	-5.8	-5.5	-5.1	-4.7	-4.3
5 TW	-3.1	-2.9	-2.7	-2.5	-2.4	-2.2
0	0	0	0	0	0	0
10 HW	1.1	1.0	0.8	0.7	0.6	0.4
20 HW	2.3	2.0	1.7	1.4	1.1	0.8
30 HW	3.5	3.0	2.6	2.1	1.7	1.2
40 HW	4.6	4.0	3.4	2.8	2.2	1.6

With engine bleed for packs off, increase weight by 650 kg.
With engine anti-ice on, decrease weight by 250 kg.
With engine and wing anti-ice on, decrease weight by 1200 kg (optional system).

Tire Speed Limit Weight

Flaps 5 Limit Weight (1000 KG)

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
54	86.2	86.2	82.6	76.1	70.1	
52	86.2	86.2	83.1	76.7	70.6	
50	86.2	86.2	83.7	77.2	71.1	65.5
48	86.2	86.2	84.3	77.7	71.6	65.9
46	86.2	86.2	84.9	78.3	72.1	66.4
44	86.2	86.2	85.6	78.9	72.7	66.9
42	86.2	86.2	86.2	79.4	73.2	67.4
40	86.2	86.2	86.2	80.0	73.7	67.9
38	86.2	86.2	86.2	80.6	74.3	68.3
36	86.2	86.2	86.2	81.2	74.8	68.8
34	86.2	86.2	86.2	81.8	75.3	69.3
32	86.2	86.2	86.2	82.4	75.9	69.9
30	86.2	86.2	86.2	83.0	76.5	70.4
28	86.2	86.2	86.2	83.7	77.0	70.9
26	86.2	86.2	86.2	84.3	77.6	71.4
24	86.2	86.2	86.2	85.0	78.2	72.0
22	86.2	86.2	86.2	85.6	78.8	72.5
20	86.2	86.2	86.2	86.2	79.5	73.1
18	86.2	86.2	86.2	86.2	80.1	73.7
16	86.2	86.2	86.2	86.2	80.7	74.3
14	86.2	86.2	86.2	86.2	81.4	74.9
12	86.2	86.2	86.2	86.2	82.0	75.4
10	86.2	86.2	86.2	86.2	82.6	76.0
-40	86.2	86.2	86.2	86.2	86.2	86.2

Increase tire speed limit weight by 600 kg per knot headwind.
Decrease tire speed limit weight by 1100 kg per knot tailwind.

Intentionally
Blank

Performance Dispatch — Chapter PD

Enroute — Section 41

Long Range Cruise Maximum Operating Altitude

Max Cruise Thrust

ISA + 10°C and Below

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
85	32300	-10	34300*	34300*	33800	32200	30800
80	33600	-13	35800*	35800*	35100	33500	32100
75	35000	-16	37100*	37100*	36400	34900	33500
70	36400	-18	38400*	38400*	37900	36300	35000
65	38000	-18	39800*	39800*	39400	37800	36500
60	39600	-18	41000	41000	41000	39500	38200
55	41000	-18	41000	41000	41000	41000	40000
50	41000	-18	41000	41000	41000	41000	41000
45	41000	-18	41000	41000	41000	41000	41000
40	41000	-18	41000	41000	41000	41000	41000

ISA + 15°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
85	32300	-4	33000*	33000*	33000*	32200	30800
80	33600	-7	34700*	34700*	34700*	33500	32100
75	35000	-10	36200*	36200*	36200*	34900	33500
70	36400	-12	37600*	37600*	37600*	36300	35000
65	38000	-12	38900*	38900*	38900*	37800	36500
60	39600	-12	40400*	40400*	40400*	39500	38200
55	41000	-12	41000	41000	41000	41000	40000
50	41000	-12	41000	41000	41000	41000	41000
45	41000	-12	41000	41000	41000	41000	41000
40	41000	-12	41000	41000	41000	41000	41000

ISA + 20°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
85	32300	2	29400*	29400*	29400*	29400*	29400*
80	33600	-1	32200*	32200*	32200*	32200*	32100
75	35000	-4	34700*	34700*	34700*	34700*	33500
70	36400	-7	36200*	36200*	36200*	36200*	35000
65	38000	-7	37700*	37700*	37700*	37700*	36500
60	39600	-7	39100*	39100*	39100*	39100*	38200
55	41000	-7	40500*	40500*	40500*	40500*	40000
50	41000	-7	41000	41000	41000	41000	41000
45	41000	-7	41000	41000	41000	41000	41000
40	41000	-7	41000	41000	41000	41000	41000

***Denotes altitude thrust limited in level flight, 100 fpm residual rate of climb.**

Long Range Cruise Trip Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
279	259	241	226	212	200	190	181	173	166	159
556	516	481	451	424	400	382	364	349	334	321
832	774	721	676	636	600	573	547	524	503	484
1108	1030	960	900	848	800	764	730	700	672	646
1383	1286	1200	1125	1059	1000	955	914	875	840	809
1657	1542	1439	1349	1271	1200	1146	1097	1051	1009	971
1931	1797	1677	1574	1483	1400	1338	1280	1227	1178	1134
2204	2052	1916	1798	1694	1600	1529	1464	1403	1347	1297
2477	2307	2154	2022	1905	1800	1721	1647	1579	1517	1460
2749	2561	2392	2246	2117	2000	1912	1830	1755	1686	1623
3021	2815	2630	2470	2328	2200	2104	2014	1932	1856	1787
3292	3069	2868	2694	2540	2400	2295	2198	2108	2025	1950
3563	3322	3105	2917	2751	2600	2487	2382	2284	2195	2114
3832	3574	3342	3140	2962	2800	2678	2565	2461	2365	2277
4101	3826	3579	3363	3173	3000	2870	2749	2637	2535	2441
4369	4077	3814	3586	3384	3200	3061	2933	2814	2704	2605
4636	4328	4050	3808	3594	3400	3253	3116	2990	2874	2769
4902	4578	4285	4030	3805	3600	3445	3300	3166	3044	2932
5168	4827	4520	4252	4015	3800	3636	3484	3343	3214	3096
5433	5076	4755	4474	4226	4000	3828	3668	3520	3384	3260
5697	5325	4989	4696	4436	4200	4019	3851	3696	3554	3424
5961	5573	5223	4917	4647	4400	4211	4035	3873	3724	3588
6224	5820	5457	5139	4857	4600	4403	4219	4050	3894	3751
6486	6068	5690	5360	5067	4800	4594	4403	4226	4064	3915
6747	6314	5923	5581	5277	5000	4786	4587	4403	4233	4079

Long Range Cruise Trip Fuel and Time

Reference Fuel and Time Required

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	29		31		33		35		37	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	1.5	0:38	1.5	0:37	1.5	0:37	1.5	0:36	1.5	0:36
400	2.5	1:10	2.4	1:09	2.4	1:07	2.4	1:06	2.4	1:04
600	3.5	1:42	3.4	1:40	3.4	1:37	3.3	1:34	3.3	1:32
800	4.5	2:14	4.4	2:11	4.3	2:07	4.3	2:03	4.2	2:00
1000	5.5	2:45	5.4	2:41	5.3	2:36	5.2	2:32	5.1	2:28
1200	6.6	3:16	6.5	3:11	6.3	3:05	6.2	2:59	6.1	2:55
1400	7.7	3:47	7.5	3:41	7.3	3:34	7.2	3:27	7.0	3:22
1600	8.7	4:18	8.5	4:11	8.3	4:02	8.1	3:55	8.0	3:50
1800	9.8	4:49	9.6	4:40	9.3	4:31	9.1	4:23	8.9	4:17
2000	10.9	5:19	10.6	5:10	10.3	5:00	10.1	4:51	9.8	4:44
2200	12.0	5:49	11.7	5:38	11.4	5:27	11.1	5:18	10.9	5:11
2400	13.1	6:18	12.8	6:07	12.5	5:55	12.1	5:45	11.9	5:38
2600	14.3	6:48	13.9	6:35	13.5	6:23	13.1	6:13	12.9	6:05
2800	15.4	7:17	15.0	7:04	14.6	6:51	14.2	6:40	13.9	6:32
3000	16.5	7:47	16.1	7:32	15.6	7:18	15.2	7:07	14.9	6:58
3200	17.7	8:15	17.2	8:00	16.7	7:45	16.3	7:34	15.9	7:25
3400	18.9	8:43	18.4	8:27	17.8	8:12	17.3	8:01	17.0	7:52
3600	20.0	9:11	19.5	8:55	18.9	8:39	18.4	8:27	18.0	8:18
3800	21.2	9:39	20.6	9:22	20.0	9:06	19.5	8:54	19.1	8:45
4000	22.4	10:08	21.8	9:50	21.2	9:33	20.6	9:21	20.2	9:11
4200	23.6	10:35	23.0	10:16	22.3	10:00	21.7	9:47	21.3	9:38
4400	24.9	11:02	24.2	10:43	23.5	10:26	22.8	10:14	22.4	10:04
4600	26.1	11:29	25.4	11:10	24.6	10:53	24.0	10:40	23.6	10:31
4800	27.4	11:56	26.6	11:37	25.8	11:20	25.1	11:07	24.7	10:57
5000	28.6	12:24	27.8	12:04	27.0	11:46	26.3	11:33	25.9	11:24

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	LANDING WEIGHT (1000 KG)						
	40	45	50	55	60	65	70
2	-0.2	-0.1	0.0	0.1	0.3	0.4	0.5
4	-0.3	-0.2	0.0	0.2	0.5	0.7	1.0
6	-0.5	-0.2	0.0	0.3	0.7	1.1	1.7
8	-0.6	-0.3	0.0	0.5	1.0	1.6	2.4
10	-0.8	-0.4	0.0	0.6	1.3	2.1	3.2
12	-1.0	-0.5	0.0	0.7	1.6	2.6	4.0
14	-1.1	-0.6	0.0	0.9	1.9	3.1	4.9
16	-1.3	-0.7	0.0	1.0	2.2	3.8	5.9
18	-1.5	-0.8	0.0	1.2	2.6	4.4	7.0
20	-1.7	-0.9	0.0	1.4	3.0	5.1	8.1
22	-1.8	-1.0	0.0	1.6	3.4	5.8	9.3
24	-2.0	-1.0	0.0	1.8	3.8	6.6	10.6
26	-2.2	-1.1	0.0	2.0	4.3	7.4	11.9
28	-2.4	-1.2	0.0	2.2	4.8	8.3	13.3
30	-2.6	-1.3	0.0	2.4	5.3	9.2	14.8
32	-2.8	-1.4	0.0	2.7	5.8	10.1	16.4

Based on 280/.78 climb, Long Range Cruise and .78/280/250 descent.

Long Range Cruise Step Climb

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
1321	1241	1171	1108	1051	1000	954	911	873	837	804
1839	1730	1634	1548	1470	1400	1336	1278	1225	1176	1130
2354	2218	2096	1987	1889	1800	1719	1645	1577	1515	1457
2869	2704	2558	2426	2308	2200	2102	2012	1930	1854	1784
3383	3190	3019	2865	2726	2600	2485	2380	2283	2194	2112
3895	3676	3480	3304	3145	3000	2868	2747	2636	2534	2439
4407	4161	3940	3742	3563	3400	3251	3115	2990	2874	2768
4919	4645	4401	4180	3981	3800	3635	3483	3344	3215	3096
5430	5130	4861	4619	4399	4200	4018	3851	3697	3556	3424
5942	5614	5321	5057	4818	4600	4401	4219	4051	3896	3753
6453	6099	5781	5495	5236	5000	4785	4587	4405	4237	4081

Trip Fuel and Time Required

AIR DIST (NM)	TRIP FUEL (1000 KG)							TIME (HRS:MIN)
	LANDING WEIGHT (1000 KG)							
	40	45	50	55	60	65	70	
1000	4.5	4.8	5.1	5.4	5.7	6.2	6.5	2:26
1400	6.1	6.5	6.9	7.3	7.9	8.4	8.9	3:20
1800	7.8	8.3	8.8	9.4	10.1	10.8	11.3	4:14
2200	9.5	10.0	10.7	11.4	12.3	13.1	13.9	5:08
2600	11.2	11.9	12.6	13.6	14.6	15.6	16.5	6:01
3000	12.9	13.7	14.7	15.8	16.9	18.1	19.2	6:54
3400	14.7	15.7	16.8	18.0	19.4	20.7	22.0	7:46
3800	16.5	17.6	19.0	20.4	21.9	23.4	24.8	8:39
4200	18.4	19.7	21.2	22.7	24.4	26.2	27.8	9:31
4600	20.3	21.7	23.4	25.2	27.1	29.0	30.8	10:23
5000	22.2	23.9	25.7	27.7	29.8	31.9	33.9	11:16

Based on 280/.78 climb, Long Range Cruise and .78/280/250 descent.
Valid for all pressure altitudes with 4000 ft step climb to 2000 ft above optimum altitude.

Short Trip Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
93	80	69	61	55	50	46	42	39	36	34
161	143	129	118	108	100	93	87	81	77	73
227	206	188	174	161	150	140	132	125	118	112
291	267	246	229	213	200	188	178	168	160	152
355	327	304	283	266	250	236	224	212	202	193
417	387	361	338	318	300	284	270	257	245	234
480	447	418	392	370	350	332	316	301	288	276
543	507	475	447	422	400	380	362	345	330	317
607	567	533	502	475	450	428	408	390	373	358
673	629	591	557	527	500	476	453	433	415	398

Trip Fuel and Time Required

AIR DIST (NM)		LANDING WEIGHT (1000 KG)							TIME (HRS:MIN)
		40	45	50	55	60	65	70	
50	FUEL (1000 KG)	0.5	0.6	0.6	0.6	0.7	0.7	0.7	0:14
	ALT (FT)	12000	12000	11000	8000	8000	10000	8000	
100	FUEL (1000 KG)	0.8	0.9	0.9	1.0	1.0	1.1	1.1	0:23
	ALT (FT)	18000	17000	16000	15000	15000	15000	16000	
150	FUEL (1000 KG)	1.1	1.2	1.2	1.3	1.3	1.4	1.5	0:31
	ALT (FT)	25000	24000	24000	23000	23000	22000	21000	
200	FUEL (1000 KG)	1.3	1.4	1.5	1.6	1.6	1.7	1.8	0:38
	ALT (FT)	31000	29000	27000	26000	26000	25000	24000	
250	FUEL (1000 KG)	1.5	1.6	1.7	1.8	1.9	2.0	2.1	0:44
	ALT (FT)	39000	37000	35000	31000	31000	31000	29000	
300	FUEL (1000 KG)	1.7	1.8	2.0	2.1	2.2	2.3	2.4	0:51
	ALT (FT)	41000	41000	39000	37000	35000	35000	33000	
350	FUEL (1000 KG)	1.9	2.0	2.2	2.3	2.4	2.6	2.7	0:57
	ALT (FT)	41000	41000	39000	39000	37000	35000	35000	
400	FUEL (1000 KG)	2.1	2.2	2.4	2.5	2.7	2.8	3.0	1:03
	ALT (FT)	41000	41000	41000	39000	39000	37000	35000	
450	FUEL (1000 KG)	2.3	2.5	2.6	2.8	2.9	3.1	3.3	1:10
	ALT (FT)	41000	41000	41000	41000	39000	37000	35000	
500	FUEL (1000 KG)	2.5	2.7	2.8	3.0	3.2	3.4	3.5	1:17
	ALT (FT)	41000	41000	41000	41000	39000	37000	35000	

Based on 280/.78 climb, Long Range Cruise and .78/280/250 descent.

Holding Planning

Flaps Up

WEIGHT (1000 KG)	TOTAL FUEL FLOW (KG/HR)								
	PRESSURE ALTITUDE (FT)								
	1500	5000	10000	15000	20000	25000	30000	35000	41000
85	3000	2950	2920	2900	2850	2860	2910		
80	2840	2790	2760	2740	2680	2680	2720		
75	2680	2630	2600	2570	2520	2500	2540	2600	
70	2520	2470	2440	2410	2360	2320	2360	2400	
65	2370	2320	2280	2240	2210	2150	2190	2220	
60	2210	2160	2120	2080	2050	1990	2010	2030	
55	2060	2000	1960	1920	1890	1840	1840	1860	1970
50	1910	1850	1800	1770	1730	1720	1700	1710	1790
45	1750	1700	1680	1640	1600	1570	1540	1540	1600
40	1640	1580	1530	1480	1450	1420	1400	1370	1420

This table includes 5% additional fuel for holding in a racetrack pattern.

Flight Crew Oxygen Requirements

Required Pressure (PSI) for 76 Cu. Ft. Cylinder (YA701-YA706)

BOTTLE TEMPERATURE		NUMBER OF CREW USING OXYGEN		
°C	°F	2	3	4
50	122	735	1055	1360
45	113	725	1040	1340
40	104	715	1020	1320
35	95	700	1005	1300
30	86	690	990	1280
25	77	680	975	1255
20	68	670	960	1240
15	59	655	940	1215
10	50	645	925	1195
5	41	635	910	1175
0	32	620	890	1150
-5	23	610	875	1130
-10	14	600	860	1110

Required Pressure (PSI) for 114/115 Cubic Ft. Cylinder (YA707-YV754)

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

ENGINE INOP

MAX CONTINUOUS THRUST

Net Level Off Weight

PRESSURE ALTITUDE (1000 FT)	LEVEL OFF WEIGHT (1000 KG)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
30	44.3	42.9	41.4
28	47.9	46.3	44.8
26	51.7	49.9	48.3
24	55.4	53.6	51.8
22	59.0	57.1	55.0
20	62.9	60.6	58.1
18	66.8	64.2	61.4
16	70.6	67.9	64.7
14	74.7	71.6	68.0
12	78.1	74.5	70.8
10	81.3	77.3	73.5
8	84.5	80.5	76.7

Anti-Ice Adjustments

ANTI-ICE CONFIGURATION	LEVEL OFF WEIGHT ADJUSTMENT (1000 KG)										
	PRESSURE ALTITUDE (1000 FT)										
	8	10	12	14	16	18	20	22	24	26	28
ENGINE ONLY	-2.4	-2.6	-2.3	-2.1	-2.0	-1.9	-1.7	-1.5	-1.4	-1.2	-1.1
ENGINE & WING	-8.7	-9.1	-8.7	-7.9	-7.4	-7.3	-7.0	-6.1	-5.4	-5.0	

Performance Dispatch — Chapter PD
Landing — Section 42

Landing Field Limit Weight - Dry Runway

Flaps 40

Based on anti-skid operative and automatic speedbrakes

Wind Corrected Field Length (M)

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1200			1090	1200	1270	1350	1420	1500
1400	1060	1160	1270	1400	1480	1560	1640	1720
1600	1240	1340	1460	1600	1680	1770	1850	1940
1800	1420	1520	1650	1800	1890	1980	2070	2170
2000	1600	1710	1840	2000	2090	2190	2290	2390
2200	1770	1890	2030	2200	2300	2400	2500	2610
2400	1950	2070	2220	2400	2500	2610	2720	2830
2600	2110	2250	2380	2600	2710	2820	2930	3050
2800	2210	2350	2530	2800	2910	3030	3150	3280
3000	2300	2450	2680	3000	3120	3240	3360	3500
3200	2390	2540	2840	3200	3320	3450	3580	
3400	2480	2630	2990	3400	3530			
3600	2570	2730	3140	3600				
3800	2660	2820	3290					
4000	2750	2910	3450					
4200	2850	3000	3600					
4400	2940	3100						
4600	3030	3190						
4800	3120	3280						
5000	3210	3380						

Field Limit Weight (1000 KG)

WIND CORR'D FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
1200	46.2	43.6	41.1	38.7		
1400	56.0	53.2	50.2	47.3	44.5	41.8
1600	64.0	61.1	58.3	55.6	52.7	49.5
1800	72.7	69.0	65.5	62.5	59.5	56.7
2000	81.8	77.5	73.5	69.7	66.0	62.8
2200		85.6	81.6	77.3	73.2	69.2
2400			88.1	84.8	80.4	75.9
2600					85.9	81.9
2800						85.3

Decrease field limit weight by 4350 kg when using manual speedbrakes.

Landing Field Limit Weight - Dry Runway

Flaps 40

Based on anti-skid inoperative and manual speedbrakes

Wind Corrected Field Length (M)

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1200				1200	1350	1470	1650	1770
1400			1170	1400	1560	1680	1860	1990
1600		1130	1370	1600	1760	1890	2070	2210
1800	1080	1320	1560	1800	1960	2100	2290	2430
2000	1260	1500	1750	2000	2170	2310	2500	2650
2200	1440	1690	1950	2200	2370	2520	2710	2870
2400	1620	1880	2140	2400	2570	2730	2920	3090
2600	1800	2060	2330	2600	2780	2940	3130	3310
2800	1980	2250	2520	2800	2980	3150	3340	3530
3000	2160	2440	2720	3000	3180	3360	3550	3750
3200	2340	2620	2910	3200	3390	3580	3760	3970
3400	2520	2810	3100	3400	3590	3790	3970	4190
3600	2700	3000	3300	3600	3790	4000	4180	4410
3800	2890	3180	3490	3800	4000	4210	4400	4630
4000	3070	3370	3680	4000	4200	4420	4610	4850
4200	3250	3560	3870	4200	4400	4630	4820	5070
4400	3430	3750	4070	4400	4610	4840	5030	5290
4600	3610	3930	4260	4600	4810	5050	5240	5510
4800	3790	4120	4450	4800	5020	5260	5450	5730
5000	3970	4310	4650	5000	5220	5470	5660	5950

Field Limit Weight (1000 KG)

WIND CORR'D FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
2200	41.8	39.1				
2400	46.6	43.7	40.3			
2600	51.4	48.2	44.7	41.8	39.1	
2800	56.2	52.8	49.0	45.9	43.0	40.0
3000	60.9	57.3	53.3	50.0	46.8	43.7
3200	65.8	61.8	57.6	54.1	50.7	47.4
3400	71.2	66.5	61.9	58.2	54.6	51.1
3600	76.6	71.6	66.3	62.3	58.4	54.7
3800	82.2	76.8	71.2	66.5	62.3	58.4
4000	87.8	82.1	76.1	71.1	66.2	62.0
4200		87.4	81.1	75.7	70.6	65.7
4400			86.1	80.4	74.9	69.8
4600				85.1	79.4	73.9
4800					83.8	77.9
5000						82.0
5200						86.0

Landing Field Limit Weight - Wet Runway

Flaps 40

Based on anti-skid operative and automatic speedbrakes

Wind Corrected Field Length (M)

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1200				1200	1280	1360	1440	1530
1400			1270	1400	1480	1570	1660	1750
1600	1220	1330	1460	1600	1690	1780	1870	1970
1800	1390	1510	1640	1800	1890	1990	2090	2190
2000	1570	1690	1830	2000	2100	2200	2300	2410
2200	1750	1870	2020	2200	2300	2410	2520	2630
2400	1920	2050	2210	2400	2510	2620	2740	2860
2600	2100	2230	2400	2600	2710	2830	2950	3080
2800	2280	2420	2590	2800	2920	3040	3170	3300
3000	2440	2600	2740	3000	3120	3250	3380	3520
3200	2530	2700	2900	3200	3330	3460	3600	3740
3400	2620	2790	3050	3400	3530	3670	3820	3970
3600	2710	2880	3200	3600	3740	3880	4030	
3800	2800	2980	3350	3800	3940	4090		
4000	2890	3070	3510	4000				
4200	2980	3160	3660					
4400	3080	3250	3810					
4600	3170	3350	3960					
4800	3260	3440	4120					
5000	3350	3530						

Field Limit Weight (1000 KG)

WIND CORR'D FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
1200	38.4					
1400	47.1	44.5	41.9	39.5		
1600	55.6	52.8	49.8	46.9	44.1	41.5
1800	62.6	59.8	57.1	54.4	51.2	48.2
2000	70.0	66.5	63.3	60.4	57.6	54.8
2200	77.8	73.8	70.0	66.4	63.2	60.1
2400	85.3	81.3	77.0	73.0	69.1	65.4
2600		87.5	84.0	79.6	75.4	71.3
2800				85.7	81.6	77.1
3000					86.0	82.1
3200						85.0
3400						88.0

Decrease field limit weight by 4350 kg when using manual speedbrakes.

Landing Field Limit Weight - Wet Runway

Flaps 40

Based on anti-skid inoperative and manual speedbrakes

Wind Corrected Field Length (M)

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1200				1200	1370	1500	1710	1840
1400				1400	1580	1710	1920	2060
1600			1340	1600	1780	1920	2130	2280
1800		1260	1530	1800	1980	2130	2340	2500
2000	1180	1450	1730	2000	2190	2340	2550	2720
2200	1360	1640	1920	2200	2390	2550	2760	2940
2400	1540	1820	2110	2400	2590	2760	2980	3160
2600	1720	2010	2310	2600	2800	2970	3190	3380
2800	1900	2200	2500	2800	3000	3180	3400	3600
3000	2080	2380	2690	3000	3200	3390	3610	3820
3200	2260	2570	2880	3200	3410	3610	3820	4040
3400	2440	2760	3080	3400	3610	3820	4030	4260
3600	2620	2940	3270	3600	3810	4030	4240	4480
3800	2800	3130	3460	3800	4020	4240	4450	4700
4000	2980	3320	3660	4000	4220	4450	4660	4920
4200	3160	3500	3850	4200	4420	4660	4880	5140
4400	3350	3690	4040	4400	4630	4870	5090	5360
4600	3530	3880	4230	4600	4830	5080	5300	5580
4800	3710	4060	4430	4800	5040	5290	5510	5800
5000	3890	4250	4620	5000	5240	5500	5720	6020

Field Limit Weight (1000 KG)

WIND CORR'D FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
2400	39.0					
2600	43.2	40.5				
2800	47.4	44.5	41.1	38.4		
3000	51.6	48.4	44.9	42.0	39.2	
3200	55.7	52.4	48.6	45.6	42.6	39.7
3400	59.9	56.3	52.4	49.2	46.0	42.9
3600	64.1	60.3	56.2	52.7	49.4	46.1
3800	68.6	64.2	59.9	56.3	52.7	49.3
4000	73.3	68.5	63.6	59.8	56.1	52.5
4200	78.1	73.0	67.6	63.3	59.4	55.7
4400	82.9	77.5	71.9	67.0	62.8	58.8
4600	87.8	82.1	76.1	71.1	66.2	62.0
4800		86.7	80.5	75.1	70.0	65.2
5000			84.8	79.2	73.8	68.7
5200				83.3	77.6	72.3
5400				87.4	81.5	75.8
5600					85.4	79.3
5800						82.8
6000						86.4

Landing Climb Limit Weight

Valid for approach with flaps 15 and landing with flaps 40

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

AIRPORT OAT		LANDING CLIMB LIMIT WEIGHT (1000 KG)												
		AIRPORT PRESSURE ALTITUDE (FT)												
°C	°F	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
54	129	61.8	60.4	58.9										
52	126	63.0	61.6	60.0	57.8									
50	122	64.3	62.8	61.1	58.9	56.7								
48	118	65.5	64.0	62.3	60.0	57.8	55.6							
46	115	66.8	65.3	63.6	61.3	59.0	56.8	54.6						
44	111	68.1	66.5	64.8	62.4	60.1	57.8	55.7	53.5					
42	108	69.3	67.8	66.0	63.6	61.3	58.9	56.7	54.5	52.4				
40	104	70.6	69.1	67.3	64.8	62.4	60.1	57.8	55.6	53.4	51.2			
38	100	71.9	70.4	68.6	66.0	63.6	61.2	58.9	56.7	54.4	52.2	50.2		
36	97	73.4	71.7	69.9	67.3	64.8	62.4	60.0	57.7	55.5	53.2	51.1	49.1	
34	93	74.7	73.1	71.1	68.6	66.0	63.5	61.1	58.8	56.5	54.2	52.0	50.0	47.9
32	90	74.8	74.5	72.5	69.8	67.3	64.7	62.3	59.9	57.5	55.2	53.0	50.9	48.8
30	86	74.9	74.5	73.9	71.2	68.5	65.9	63.4	61.0	58.7	56.3	54.0	51.9	49.8
28	82	74.9	74.6	73.9	72.5	69.8	67.2	64.6	62.2	59.8	57.4	55.1	52.8	50.7
26	79	75.0	74.7	74.0	72.6	71.1	68.5	65.9	63.3	60.9	58.5	56.2	53.9	51.6
24	75	75.1	74.7	74.1	72.6	71.2	69.7	67.1	64.5	62.0	59.6	57.3	54.9	52.7
22	72	75.1	74.8	74.1	72.7	71.2	69.8	68.3	65.8	63.2	60.7	58.4	56.0	53.7
20	68	75.2	74.9	74.2	72.7	71.3	69.8	68.4	67.0	64.4	61.9	59.4	57.2	54.8
18	64	75.3	74.9	74.2	72.8	71.3	69.9	68.4	67.0	65.5	63.1	60.5	58.2	55.9
16	61	75.3	75.0	74.3	72.8	71.4	69.9	68.4	67.1	65.6	64.1	61.7	59.2	56.9
14	57	75.4	75.0	74.3	72.9	71.4	70.0	68.5	67.1	65.6	64.2	62.6	60.3	57.8
12	54	75.4	75.1	74.4	73.0	71.5	70.0	68.5	67.2	65.6	64.2	62.7	61.1	58.8
10	50	75.5	75.1	74.5	73.0	71.5	70.1	68.6	67.2	65.7	64.2	62.7	61.1	59.5
-40	-40	76.0	75.7	75.1	73.6	72.2	70.7	69.1	67.7	66.1	64.6	63.1	61.5	59.9

With engine bleeds for packs off, increase weight by 1400 kg.
With engine anti-ice on, decrease weight by 250 kg.
With engine and wing anti-ice on, decrease weight by 1350 kg.
When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 6600 kg.

ENGINE INOP

ADVISORY INFORMATION

Go-Around Climb Gradient

Flaps 15

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

OAT (°C)	REFERENCE GO-AROUND GRADIENT (%)					
	PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
54	1.76					
50	2.22	1.33				
46	2.71	1.78	0.91			
42	3.21	2.25	1.34	0.47		
38	3.72	2.71	1.77	0.87	0.03	
34	4.22	3.19	2.22	1.28	0.40	
30	4.76	3.69	2.68	1.72	0.80	
26	4.79	4.19	3.15	2.15	1.22	0.33
22	4.81	4.21	3.63	2.60	1.65	0.74
18	4.84	4.23	3.65	3.07	2.06	1.15
14	4.86	4.25	3.67	3.09	2.48	1.53
10	4.88	4.27	3.69	3.10	2.49	1.85
6	4.90	4.29	3.70	3.11	2.50	1.86
2	4.92	4.31	3.72	3.12	2.51	1.87

Gradient Adjustment for Weight (%)

WEIGHT (1000 KG)	REFERENCE GO-AROUND GRADIENT (%)					
	0	1	2	3	4	5
80	-2.40	-2.70	-2.98	-3.25	-3.51	-3.78
75	-1.93	-2.17	-2.39	-2.61	-2.82	-3.03
70	-1.39	-1.55	-1.71	-1.87	-2.02	-2.17
65	-0.75	-0.84	-0.93	-1.01	-1.09	-1.18
60	0	0	0	0	0	0
55	0.88	0.97	1.07	1.18	1.28	1.39
50	1.96	2.16	2.37	2.60	2.83	3.08

Gradient Adjustment for Speed (%)

SPEED (KIAS)	WEIGHT ADJUSTED GO-AROUND GRADIENT (%)										
	0	1	2	3	4	5	6	7	8	9	10
VREF40	-0.19	-0.21	-0.22	-0.23	-0.23	-0.22	-0.22	-0.21	-0.22	-0.21	-0.20
VREF40+5	0	0	0	0	0	0	0	0	0	0	0
VREF40+10	0.10	0.09	0.09	0.09	0.09	0.09	0.09	0.08	0.07	0.07	0.07
VREF40+15	0.14	0.12	0.11	0.11	0.11	0.10	0.09	0.08	0.07	0.05	0.05
VREF40+20	0.12	0.10	0.08	0.07	0.05	0.04	0.03	0.01	-0.02	-0.04	-0.04
VREF40+25	0.06	0.02	-0.03	-0.06	-0.09	-0.11	-0.12	-0.15	-0.18	-0.20	-0.21
VREF40+30	-0.05	-0.11	-0.17	-0.23	-0.28	-0.30	-0.32	-0.35	-0.38	-0.41	-0.42

With engine bleed for packs off, increase gradient by 0.2%.
With engine anti-ice on, decrease gradient by 0.1%.
With engine and wing anti-ice on, decrease gradient by 0.3%.
When operating in icing conditions during any part of the flight with forecast landing temperatures below 10°C decrease gradient by 1.0%.

Quick Turnaround Limit Weight - Category C Steel Brakes

(Note: A placard showing carbon brakes configuration will be put at the Center Forward Panel upon modification.)

Flaps 40

AIRPORT OAT (°C)	LIMIT WEIGHT (1000 KG)					
	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
54	79.6					
50	80.2	77.2				
45	80.9	77.8	74.8			
40	81.6	78.5	75.4	72.4		
35	82.3	79.2	76.1	73.1	70.1	
30	83.0	79.9	76.7	73.7	70.8	67.9
25	83.8	80.6	77.4	74.4	71.4	68.5
20	84.6	81.3	78.1	75.1	72.1	69.1
15	85.4	82.1	78.9	75.8	72.7	69.8
10	86.1	82.9	79.6	76.5	73.4	70.4
5	86.1	83.7	80.4	77.2	74.1	71.1
0	86.1	84.5	81.2	78.0	74.9	71.8
-5	86.1	85.4	82.0	78.8	75.6	72.5
-10	86.1	86.1	82.8	79.6	76.4	73.3
-15	86.1	86.1	83.7	80.4	77.2	74.0
-20	86.1	86.1	84.6	81.2	78.0	74.8
-30	86.1	86.1	86.1	83.0	79.7	76.4
-40	86.1	86.1	86.1	84.9	81.5	78.1
-50	86.1	86.1	86.1	86.1	83.4	79.9
-54	86.1	86.1	86.1	86.1	84.1	80.7

**Increase weight by 700 kg per 1% uphill slope. Decrease weight by 1200 kg per 1% downhill slope.
Increase weight by 1850 kg per 10 knots headwind. Decrease weight by 7750 kg per 10 knots tailwind.
After landing at weights exceeding those shown above, adjusted for slope and wind, wait at least 67 minutes and check that wheel thermal plugs have not melted before executing a subsequent takeoff.**

As an alternate procedure, ensure that each brake pressure plate surface temperature, without artificial cooling, is less than 218°C as follows: No sooner than 10 and no later than 15 minutes after parking, measure each brake pressure plate surface temperature at a minimum of two points per brake by an accurate method (using a Doric Microtemp 450 hand held thermometer or equivalent, hold temperature probe in place for 20 seconds or until reading stabilizes). If each measured temperature is less than 218°C, immediate dispatch is allowed; otherwise the required minimum ground wait period of 67 minutes applies.

If a Brake Temperature Monitoring System (BTMS) is installed:

**No sooner than 10 and no later than 15 minutes after parking, check the BRAKE TEMP light. If the BRAKE TEMP light is not on, no ground waiting period is required. If the BRAKE TEMP light is on, do not dispatch until at least 67 minutes after landing, or until all the BTMS readings on the systems Display are below 3.5 and the BRAKE TEMP light is off. Check that wheel thermal plugs have not melted before making a subsequent takeoff.
Note: If any brake temperature display digit is blank or indicates 0.0 or 0.1, then this method cannot be used.**

Quick Turnaround Limit Weight - Category N Carbon Brakes

Flaps 40

OAT		LIMIT WEIGHT (1000 KG)					
		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	0	2000	4000	6000	8000	10000
54	129	73.5					
50	122	74.0	71.2				
45	113	74.6	71.8	69.0			
40	104	75.2	72.4	69.6	66.9		
35	95	75.9	73.0	70.2	67.4	64.8	
30	86	76.6	73.7	70.8	68.0	65.3	62.8
25	77	77.3	74.3	71.4	68.6	65.9	63.3
20	68	78.0	75.0	72.1	69.3	66.5	63.9
15	59	78.7	75.7	72.8	69.9	67.1	64.4
10	50	79.4	76.4	73.5	70.6	67.8	65.0
5	41	80.2	77.2	74.2	71.3	68.4	65.6
0	32	81.0	77.9	74.9	72.0	69.1	66.3
-5	23	81.8	78.7	75.6	72.7	69.8	66.9
-10	14	82.6	79.5	76.4	73.4	70.5	67.6
-15	5	83.4	80.3	77.2	74.2	71.2	68.3
-20	-4	84.3	81.1	78.0	74.9	71.9	69.0
-30	-22	86.1	82.9	79.7	76.6	73.5	70.5
-40	-40	86.1	84.7	81.5	78.3	75.2	72.1
-50	-58	86.1	86.1	83.4	80.1	77.0	73.8
-54	-65	86.1	86.1	84.1	80.9	77.7	74.5

**Increase weight by 650 kg per 1% uphill slope. Decrease weight by 1200 kg per 1% downhill slope.
Increase weight by 1550 kg per 10 knots headwind. Decrease weight by 8350 kg per 10 knots tailwind.
After landing at weights exceeding those shown above, adjusted for slope and wind, wait at least 48 minutes and check that wheel thermal plugs have not melted before executing a takeoff.**

If a Brake Temperature Monitoring System (BTMS) is installed:

**No sooner than 10 and no later than 15 minutes after parking, check the BRAKE TEMP light. If the BRAKE TEMP light is not on, no ground waiting period is required. If the BRAKE TEMP light is on, do not dispatch until at least 48 minutes after landing, or until all the BTMS readings on the systems Display are below 3.0 and the BRAKE TEMP light is off. Check that wheel thermal plugs have not melted before making a subsequent takeoff.
Note: If any brake temperature display digit is blank or indicates 0.0 or 0.1, then this method cannot be used.**

GEAR DOWN

Takeoff Climb Limit Weight

Flaps 5

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

AIRPORT OAT		TAKEOFF CLIMB WEIGHT (1000 KG)					
		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	0	2000	4000	6000	8000	10000
54	129	53.2	51.3	48.2	44.8	41.3	
52	126	54.4	51.3	49.0	45.6	42.0	
50	122	55.7	51.6	49.0	46.3	42.8	
48	118	57.1	52.8	48.9	46.8	43.5	
46	115	58.3	54.0	49.2	46.8	44.3	
44	111	59.6	55.3	50.3	46.8	45.1	41.2
42	108	60.8	56.5	51.5	47.1	45.1	42.0
40	104	62.1	57.7	52.6	48.1	45.1	42.9
38	100	63.4	58.9	53.7	49.1	45.4	43.1
36	97	64.6	60.0	54.8	50.2	46.4	43.1
34	93	66.0	61.2	55.9	51.2	47.4	43.4
33	91	66.6	61.8	56.5	51.7	47.9	43.9
32	90	67.2	62.4	57.0	52.2	48.4	44.4
31	88	67.9	62.9	57.5	52.7	48.9	44.8
30	86	68.5	63.5	58.1	53.3	49.4	45.3
28	82	69.8	64.6	59.1	54.3	50.3	46.3
26	79	70.0	65.7	60.2	55.3	51.3	47.2
24	75	70.1	66.9	61.3	56.3	52.2	48.1
22	72	70.1	67.3	62.4	57.4	53.2	49.0
20	68	70.2	67.3	63.6	58.5	54.2	50.0
18	65	70.2	67.4	64.6	59.6	55.3	50.9
16	61	70.3	67.4	64.7	60.8	56.4	51.9
14	58	70.3	67.5	64.7	61.9	57.5	52.9
12	54	70.4	67.5	64.7	62.0	58.6	54.0
10	50	70.4	67.6	64.8	62.0	59.1	55.0

With engine bleeds for packs off, increase weight by 250 kg.
With engine anti-ice on, decrease weight by 1650 kg.
With engine and wing anti-ice on, decrease weight by 6350 kg (optional system).

GEAR DOWN

Landing Climb Limit Weight

Valid for approach with Flaps 15 and Landing with Flaps 40

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

AIRPORT OAT		LANDING CLIMB LIMIT WEIGHT (1000 KG)					
		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	0	2000	4000	6000	8000	10000
54	129	51.5					
52	126	52.4					
50	122	53.4	49.6				
48	118	54.5	50.6				
46	115	55.6	51.6	47.7			
44	111	56.7	52.6	48.7			
42	108	57.7	53.6	49.6	45.8		
40	104	58.8	54.6	50.6	46.7		
38	100	59.9	55.6	51.5	47.6	43.9	
36	97	61.0	56.6	52.5	48.5	44.7	
34	93	62.1	57.7	53.5	49.4	45.5	41.9
32	90	63.2	58.8	54.4	50.3	46.4	42.7
30	86	64.4	59.9	55.5	51.3	47.2	43.5
28	82	64.5	61.0	56.5	52.2	48.2	44.3
26	79	64.5	62.1	57.5	53.2	49.1	45.1
24	75	64.6	62.1	58.6	54.1	50.0	46.0
22	72	64.6	62.1	59.6	55.2	51.0	46.9
20	68	64.7	62.2	59.7	56.2	51.9	47.8
18	64	64.7	62.2	59.7	57.2	52.9	48.8
16	61	64.8	62.3	59.8	57.2	53.8	49.6
14	57	64.8	62.3	59.8	57.3	54.6	50.5
12	54	64.9	62.4	59.8	57.3	54.7	51.2
10	50	64.9	62.4	59.9	57.3	54.7	51.9
-40	-40	65.4	62.9	60.3	57.7	55.0	52.2

With engine bleeds for packs off, increase weight by 1200 kg.
With engine anti-ice on, decrease weight by 200 kg.
With engine and wing anti-ice on, decrease weight by 1150 kg.
When operating in icing conditions during any part of the flight when forecast landing temperature is below 10°C, decrease weight by 6750 kg.

GEAR DOWN

Takeoff Obstacle Limit Weight

Flaps 5

Sea Level, 30°C & Below, Zero Wind

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

Reference Obstacle Limit Weight (1000 KG)

OBSTACLE HEIGHT (M	DISTANCE FROM BRAKE RELEASE (100 M)										
	25	30	35	40	45	50	55	60	65	70	75
20	62.6	66.7									
40	57.6	61.6	64.7	67.1							
60	53.8	57.8	61.0	63.5	65.6	67.2					
80	50.7	54.8	58.0	60.6	62.8	64.5	66.0	67.3			
100	48.1	52.2	55.4	58.1	60.3	62.2	63.8	65.1	66.3	67.3	68.1
120	45.9	49.9	53.2	55.9	58.2	60.1	61.7	63.2	64.4	65.5	66.4
140	43.8	47.8	51.1	53.9	56.2	58.2	59.9	61.4	62.7	63.8	64.8
160	42.0	46.0	49.3	52.1	54.4	56.5	58.2	59.8	61.1	62.3	63.3
180		44.3	47.6	50.4	52.8	54.9	56.7	58.2	59.6	60.8	61.9
200		42.8	46.1	48.9	51.3	53.4	55.2	56.8	58.2	59.5	60.6
220			44.6	47.5	49.9	52.0	53.8	55.5	56.9	58.2	59.4
240			43.3	46.1	48.5	50.7	52.5	54.2	55.7	57.0	58.2
260			42.0	44.9	47.3	49.4	51.3	53.0	54.5	55.9	57.1
280				43.7	46.1	48.3	50.2	51.9	53.4	54.8	56.0
300				42.6	45.0	47.2	49.1	50.8	52.3	53.7	55.0

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

OAT Adjustments

OAT °C	REFERENCE OBSTACLE LIMIT WEIGHT (1000 KG)							
	40	45	50	55	60	65	70	75
30 & BELOW	0	0	0	0	0	0	0	0
32	-0.7	-0.8	-0.9	-1.0	-1.1	-1.2	-1.3	-1.4
34	-1.4	-1.6	-1.8	-2.0	-2.2	-2.4	-2.6	-2.8
36	-2.0	-2.3	-2.6	-2.9	-3.2	-3.5	-3.8	-4.1
38	-2.7	-3.1	-3.5	-3.9	-4.3	-4.7	-5.1	-5.5
40	-3.4	-3.9	-4.4	-4.9	-5.4	-5.9	-6.4	-6.9
42	-3.9	-4.5	-5.1	-5.7	-6.3	-6.9	-7.5	-8.1
44	-4.5	-5.2	-5.8	-6.5	-7.2	-7.9	-8.5	-9.2
46	-5.0	-5.8	-6.6	-7.3	-8.1	-8.8	-9.6	-10.4
48	-5.6	-6.4	-7.3	-8.1	-9.0	-9.8	-10.7	-11.5
50	-6.1	-7.1	-8.0	-8.9	-9.9	-10.8	-11.8	-12.7

Pressure Altitude Adjustments

ALT (FT)	OAT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)							
	40	45	50	55	60	65	70	75
S.L. & BELOW	0	0	0	0	0	0	0	0
1000	-1.6	-1.7	-1.9	-2.1	-2.2	-2.4	-2.6	-2.7
2000	-3.1	-3.5	-3.8	-4.1	-4.5	-4.8	-5.1	-5.5
3000	-4.5	-5.0	-5.5	-6.0	-6.5	-7.0	-7.5	-8.0
4000	-5.8	-6.5	-7.2	-7.9	-8.6	-9.2	-9.9	-10.6
5000	-7.2	-8.1	-8.9	-9.8	-10.7	-11.5	-12.4	-13.3
6000	-8.6	-9.6	-10.7	-11.7	-12.8	-13.8	-14.9	-15.9
7000	-9.7	-10.9	-12.1	-13.3	-14.5	-15.7	-16.9	-18.1
8000	-10.8	-12.2	-13.5	-14.9	-16.2	-17.6	-19.0	-20.3
9000	-11.8	-13.3	-14.9	-16.4	-17.9	-19.4	-21.0	-22.5
10000	-12.8	-14.5	-16.2	-17.9	-19.6	-21.3	-23.0	-24.7

GEAR DOWN

Takeoff Obstacle Limit Weight

Flaps 5

Sea Level, 30°C & Below, Zero Wind

Wind Adjustments

WIND (KTS)	OAT & ALT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)							
	40	45	50	55	60	65	70	75
15 TW	-8.0	-7.6	-7.3	-7.0	-6.7	-6.3	-6.0	-5.7
10 TW	-5.3	-5.1	-4.9	-4.7	-4.4	-4.2	-4.0	-3.8
5 TW	-2.7	-2.5	-2.4	-2.3	-2.2	-2.1	-2.0	-1.9
0	0	0	0	0	0	0	0	0
10 HW	1.0	0.9	0.8	0.7	0.6	0.5	0.4	0.3
20 HW	2.1	1.9	1.7	1.5	1.2	1.0	0.8	0.6
30 HW	3.1	2.8	2.6	2.3	2.0	1.7	1.5	1.2
40 HW	4.1	3.8	3.5	3.1	2.8	2.4	2.1	1.8

With engine bleed for packs off, increase weight by 250 kg.
With engine anti-ice on, decrease weight by 1850 kg.
With engine and wing anti-ice on, decrease weight by 6600 kg (optional system).

GEAR DOWN

Long Range Cruise Altitude Capability

Max Cruise Thrust, 100 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
85	15500	12500	9300
80	18400	15500	12600
75	21100	18500	15700
70	23700	21500	18600
65	26100	24400	21800
60	28600	27100	25300
55	30800	29600	28100
50	32900	31900	30700
45	35100	34100	33000
40	37500	36500	35400

GEAR DOWN

Long Range Cruise Trip Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
340	300	266	239	218	200	187	174	164	155	147
508	449	399	359	328	300	280	262	246	233	221
675	597	531	479	437	400	374	350	329	311	295
841	745	662	598	545	500	467	438	412	389	369
1006	892	794	717	654	600	561	526	495	468	444
1170	1038	925	835	763	700	655	614	578	546	518
1332	1183	1055	954	872	800	749	703	661	625	593
1494	1328	1185	1072	980	900	843	791	745	704	668
1655	1472	1315	1190	1089	1000	937	879	828	783	743
1814	1615	1444	1308	1197	1100	1031	968	911	862	818
1973	1758	1573	1426	1305	1200	1125	1056	995	941	894
2131	1900	1701	1543	1413	1300	1218	1145	1079	1020	969
2288	2041	1829	1660	1521	1400	1313	1233	1162	1100	1045
2444	2182	1957	1777	1629	1500	1407	1322	1246	1179	1121
2599	2323	2084	1894	1737	1600	1501	1411	1330	1259	1197
2754	2463	2212	2011	1845	1700	1595	1500	1414	1339	1273
2907	2602	2338	2127	1953	1800	1689	1589	1499	1419	1350
3060	2741	2465	2243	2060	1900	1784	1678	1583	1499	1426
3212	2879	2591	2359	2168	2000	1878	1767	1668	1580	1503

Reference Fuel and Time Required

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		20		24		28	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	2.6	0:53	2.5	0:51	2.3	0:49	2.2	0:48	2.2	0:47
300	3.8	1:18	3.6	1:14	3.3	1:10	3.2	1:08	3.1	1:05
400	5.0	1:42	4.7	1:37	4.4	1:31	4.2	1:27	4.0	1:24
500	6.3	2:06	5.9	2:00	5.4	1:52	5.1	1:47	5.0	1:43
600	7.6	2:30	7.1	2:22	6.5	2:13	6.1	2:06	5.9	2:01
700	8.9	2:53	8.3	2:44	7.5	2:33	7.1	2:25	6.9	2:19
800	10.2	3:16	9.5	3:06	8.6	2:53	8.1	2:44	7.8	2:37
900	11.5	3:39	10.7	3:28	9.7	3:13	9.2	3:03	8.8	2:56
1000	12.8	4:02	11.9	3:50	10.8	3:33	10.2	3:23	9.7	3:14
1100	14.2	4:24	13.2	4:11	11.9	3:53	11.2	3:41	10.8	3:31
1200	15.5	4:46	14.5	4:32	13.1	4:12	12.3	3:59	11.8	3:49
1300	16.9	5:08	15.8	4:53	14.2	4:31	13.4	4:18	12.8	4:07
1400	18.3	5:30	17.0	5:14	15.4	4:51	14.4	4:36	13.8	4:25
1500	19.6	5:52	18.3	5:35	16.5	5:10	15.5	4:55	14.9	4:42
1600	21.1	6:13	19.7	5:55	17.7	5:29	16.6	5:13		
1700	22.5	6:34	21.0	6:15	18.9	5:48	17.8	5:31		
1800	24.0	6:55	22.4	6:35	20.1	6:06	18.9	5:48		
1900	25.4	7:16	23.7	6:55	21.3	6:25	20.0	6:06		
2000	26.9	7:37	25.1	7:16	22.5	6:44	21.1	6:24		

GEAR DOWN

Long Range Cruise Trip Fuel and Time

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	LANDING WEIGHT (1000 KG)						
	40	45	50	55	60	65	70
2	-0.2	-0.1	0.0	0.1	0.3	0.4	0.5
4	-0.4	-0.2	0.0	0.2	0.5	0.7	1.0
6	-0.6	-0.3	0.0	0.4	0.7	1.1	1.4
8	-0.8	-0.4	0.0	0.5	0.9	1.4	1.8
10	-1.0	-0.5	0.0	0.6	1.1	1.7	2.3
12	-1.1	-0.6	0.0	0.7	1.4	2.0	2.7
14	-1.3	-0.7	0.0	0.8	1.6	2.4	3.2
16	-1.5	-0.8	0.0	0.9	1.8	2.7	3.6
18	-1.7	-0.9	0.0	1.0	2.0	3.0	4.0
20	-1.9	-0.9	0.0	1.1	2.2	3.3	4.5
22	-2.1	-1.0	0.0	1.2	2.4	3.7	4.9
24	-2.3	-1.1	0.0	1.3	2.6	4.0	5.3
26	-2.4	-1.2	0.0	1.4	2.9	4.3	5.8
28	-2.6	-1.3	0.0	1.5	3.1	4.6	6.2

Based on VREF40 + 70 climb, Long Range Cruise and VREF40 + 70 descent.

GEAR DOWN

Holding Planning

Flaps Up

WEIGHT (1000 KG)	TOTAL FUEL FLOW (KG/HR)						
	PRESSURE ALTITUDE (FT)						
	1500	5000	10000	15000	20000	25000	30000
80	4240	4210	4190	4210	4220		
75	4000	3970	3940	3940	3950	4100	
70	3770	3730	3700	3690	3680	3750	
65	3550	3500	3470	3440	3430	3460	
60	3310	3260	3220	3190	3170	3180	3340
55	3090	3030	2990	2950	2920	2920	3000
50	2860	2810	2760	2720	2670	2660	2710
45	2630	2590	2540	2490	2440	2420	2450
40	2400	2360	2320	2270	2220	2180	2200

This table includes 5% additional fuel for holding in a racetrack pattern.

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Net Level Off Weight

PRESSURE ALTITUDE (1000 FT)	LEVEL OFF WEIGHT (1000 KG)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
20	43.1	41.7	
18	46.0	44.4	42.8
16	48.9	47.3	45.7
14	52.0	50.7	49.1
12	55.0	53.0	50.7
10	57.5	55.3	52.8
8	59.8	57.2	54.6
6	62.1	59.4	56.8
4	64.9	62.3	59.8
2	67.8	65.3	62.8
0	69.2	65.8	62.6

Anti-Ice Adjustments

ANTI-ICE CONFIGURATION	LEVEL OFF WEIGHT ADJUSTMENT (1000 KG)									
	PRESSURE ALTITUDE (1000 FT)									
	0	2	4	6	8	10	12	14	16	18
ENGINE ONLY	-1.2	-1.2	-1.3	-1.5	-1.6	-1.4	-1.3	-1.2	-1.3	-1.1
ENGINE AND WING	-5.7	-5.4	-5.4	-5.7	-5.8	-5.5	-4.9	-4.6	-4.7	

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Performance Dispatch

Chapter PD

Text

Section 44

Introduction

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

Takeoff

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

Brake Energy or Tire Speed Limit Weight tables are only provided if they are limiting for the range of conditions covered in the FCOM Section PD.

Field Limit Weight - Slope and Wind Corrections

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

Field and Climb Limit Weight

Tables are presented for selected airport pressure altitudes and runway conditions and show both Field and Climb Limit Weights. Enter the appropriate table for pressure altitude and runway condition with “Slope and Wind Corrected Field Length” determined above and airport OAT to obtain Field Limit Weight. Also read Climb Limit Weight for the same OAT. Intermediate altitudes may be interpolated or use next higher altitude. When finding a maximum weight for a wet runway, the dry runway limit weight must also be determined and the lower of the two weights used.

Obstacle Limit Weight

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

Tire Speed Limit

Tire Speed Limit Weight tables are only provided if they are limiting for the range of conditions covered in the FCOM Section PD.

Maximum tire speed limited weights are presented for 225 MPH tires. To determine the tire speed limit weight, enter the table with OAT and airport pressure altitude. Adjust the tire speed limit weight according to the notes below the table to account for wind.

Brake Energy Limit VMBE

Brake Energy Limit Weight tables are only provided if they are limiting for the range of conditions covered in the FCOM Section PD.

The Maximum Brake Energy Speed table provides the Reference VMBE for a variety of airport pressure altitudes and temperatures. Enter the Weight Adjusted VMBE table to adjust the Reference VMBE for the actual brake release gross weight. Correct VMBE for slope and wind. If V1 exceeds VMBE, decrease brake release weight as indicated for each knot that V1 exceeds VMBE and determine V1, VR, and V2 for the lower brake release weight.

Enroute

Long Range Cruise Maximum Operating Altitude

These tables provide the maximum operating altitude in the same manner as the FMC. Maximum altitudes are shown for a given cruise weight and maneuver capability. Note that this table considers both thrust and buffet limits, providing the more limiting of the two. Any data that is thrust limited is denoted by an asterisk and represents only a thrust limited condition in level flight with 100 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 15° may cause the airplane to lose speed and/or altitude. The altitudes shown in the table are limited to the maximum certified altitude of 41000 ft.

Long Range Cruise Trip Fuel and Time

Long Range Cruise Trip Fuel and Time tables are provided to determine trip time and fuel required to destination.

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

Long Range Cruise Step Climb Trip Fuel and Time

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

Short Trip Fuel and Time

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

Holding Planning

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

Flight Crew Oxygen Requirements

This airplane is equipped with a chemical passenger oxygen system. Regulations require that sufficient oxygen be provided to the flight crew to account for the greater of supplemental breathing oxygen in the event of a cabin depressurization or protective breathing in the event of smoke or harmful fumes in the flight deck. The oxygen quantity associated with the above requirements is achieved with the minimum dispatch oxygen cylinder pressure.

To determine the minimum dispatch oxygen cylinder pressure enter the appropriate flight crew oxygen table with the number of crew plus observers using oxygen and read the minimum cylinder pressure required for the appropriate cylinder temperature.

Net Level Off Weight

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

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

Landing

Tables are provided for determining the maximum landing weight as limited by field length or climb requirements for a single landing flap.

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

Landing Field Limit Weight

For the expected runway condition and anti-skid system configuration, obtain wind corrected field length by entering the Wind Corrected Field Length table with field length available and wind component along the runway. Now enter the Field Limit Weight table with wind corrected field length and pressure altitude to read field limit weight.

Landing Climb Limit Weight

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

Go-Around Climb Gradient

Enter the Reference Go-Around Gradient table with airport OAT and pressure altitude to determine the reference go-around gradient. Then adjust the reference gradient for airplane weight and speed using the tables provided to determine the weight and speed adjusted go-around gradient. Apply the necessary corrections for engine bleed configuration and icing conditions as noted.

Quick Turnaround Limit Weight

Enter the appropriate table (Steel or Carbon Brakes) with airport pressure altitude and OAT to read maximum quick turnaround weight. Apply the noted adjustments as required.

If the landing weight exceeds the maximum quick turnaround weight, wait the specified time and then check that the wheel thermal plugs have not melted before executing a subsequent takeoff. For Steel Brakes, the alternate procedures on the charts can be used to ensure the brake temperature is within limits. These procedures cannot be used for carbon brakes.

Gear Down

This section provides flight planning data for revenue operation with gear down. Unless otherwise noted, the gear down tables in this section are identical in format and usage to the corresponding gear up tables previously described.

To eliminate erroneous displays the flight crew should enter only gross weight data on the PERF INIT page of the Control Display Unit (CDU). Omission of the cost index and cruise altitude entries on the PERF INIT page will render the VNAV function unavailable during flight. As a result, the following information will not be provided: VNAV guidance and speed schedules, trip fuel and ETA predictions, optimum and maximum altitude data, step climb and top of descent predictions, and the VNAV descent guidance path.

The gross weight entry allows the FMCS takeoff and approach speed schedules to be generated. In addition, the flap maneuver speed and VREF speed bugs will be available for display on the primary flight display speed tape. Except for VNAV, normal autopilot and autothrottle modes will remain available for use during the flight, as will the LNAV mode.

Takeoff/Landing Climb Limit Weight

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

Performance Dispatch Chapter PD

Table of Contents Section 50

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

General

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

Serial and tabulation number are supplied by Boeing.

Registry Number	Serial Number	Tabulation Number
B-5552	37425	YF048
B-5551	36697	YF049
B-5151	34255	YK622
B-5152	34256	YK623
B-5308	32687	YK624
B-5309	32689	YK625
B-5382	36540	YK626
B-5383	35631	YK627
B-5386	35634	YK628

Registry Number	Serial Number	Tabulation Number
B-5385	35633	YK629
B-5388	35635	YK630
B-5318	30723	YK967
B-5319	35102	YL076
B-5355	35104	YL077
B-5389	35636	YL541
B-5432	35641	YL542
B-5433	35642	YL543
B-5435	35644	YL544
B-5563	38012	YL545
B-5565	38015	YL546
B-5595	38017	YL547
B-5603	38020	YL548
B-5605	38022	YL549
B-5602	36824	YL550
B-5601	36823	YL551
B-5791	39930	YS177
B-5845	39931	YS178
B-5792	41790	YS191
B-5846	41791	YS192
B-5688	41792	YS193
B-5847	41793	YS194
B-7195	43885	YT519
B-7196	43886	YT520
B-7560	43887	YT521

Takeoff Field Corrections - Dry Runway

Slope Corrections

FIELD LENGTH AVAILABLE (M)	SLOPE CORRECTED FIELD LENGTH (M)								
	RUNWAY SLOPE (%)								
	-2.0	-1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	2.0
1200	1240	1230	1220	1210	1200	1190	1180	1170	1150
1400	1460	1450	1430	1420	1400	1380	1350	1330	1310
1600	1680	1660	1640	1620	1600	1570	1530	1500	1460
1800	1900	1870	1850	1820	1800	1750	1710	1660	1610
2000	2110	2090	2060	2030	2000	1940	1880	1820	1770
2200	2330	2300	2270	2230	2200	2130	2060	1990	1920
2400	2550	2510	2470	2440	2400	2320	2240	2150	2070
2600	2770	2730	2690	2640	2600	2510	2410	2320	2220
2800	3000	2950	2900	2850	2800	2690	2590	2480	2380
3000	3220	3170	3110	3060	3000	2880	2770	2650	2530
3200	3450	3390	3320	3260	3200	3070	2940	2810	2680
3400	3670	3600	3540	3470	3400	3260	3120	2980	2840
3600	3900	3820	3750	3670	3600	3450	3290	3140	2990
3800	4130	4050	3970	3880	3800	3640	3470	3310	3140
4000	4370	4280	4190	4090	4000	3820	3650	3470	3290
4200	4610	4510	4410	4300	4200	4010	3820	3640	3450
4400	4850	4740	4630	4510	4400	4200	4000	3800	3600
4600	5090	4970	4850	4720	4600	4390	4180	3960	3750
4800	5330	5200	5070	4930	4800	4580	4350	4130	3910
5000	5570	5430	5290	5140	5000	4760	4530	4290	4060

Wind Corrections

SLOPE CORR'D FIELD LENGTH (M)	SLOPE & WIND CORRECTED FIELD LENGTH (M)							
	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1200	880	990	1090	1200	1270	1340	1410	1490
1400	1050	1170	1280	1400	1480	1550	1630	1710
1600	1220	1350	1470	1600	1680	1760	1850	1930
1800	1390	1530	1660	1800	1890	1980	2070	2160
2000	1560	1700	1850	2000	2090	2190	2280	2380
2200	1720	1880	2040	2200	2300	2400	2500	2600
2400	1890	2060	2230	2400	2500	2610	2720	2830
2600	2060	2240	2420	2600	2710	2820	2930	3050
2800	2230	2420	2610	2800	2910	3030	3150	3270
3000	2400	2600	2800	3000	3120	3240	3370	3500
3200	2570	2780	2990	3200	3330	3450	3590	3720
3400	2730	2960	3180	3400	3530	3660	3800	3940
3600	2900	3140	3370	3600	3740	3880	4020	4170
3800	3070	3310	3560	3800	3940	4090	4240	4390
4000	3240	3490	3750	4000	4150	4300	4450	4610
4200	3410	3670	3940	4200	4350	4510	4670	4840
4400	3580	3850	4130	4400	4560	4720	4890	5060
4600	3740	4030	4310	4600	4760	4930	5110	5280
4800	3910	4210	4500	4800	4970	5140	5320	5510
5000	4080	4390	4690	5000	5170	5350	5540	5730

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 5

Sea Level Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1220	58.6	53.8	53.4	53.1	52.7	52.4	52.0	49.6	48.3	47.1	45.8
1400	63.7	58.5	58.1	57.7	57.3	57.0	56.6	53.9	52.5	51.2	49.8
1600	68.9	63.3	62.8	62.4	62.0	61.6	61.2	58.3	56.8	55.4	53.9
1800	73.7	67.6	67.2	66.7	66.3	65.9	65.4	62.4	60.7	59.2	57.6
2000	78.2	71.8	71.3	70.8	70.3	69.9	69.4	66.1	64.4	62.7	61.0
2200	82.5	75.6	75.1	74.6	74.1	73.6	73.1	69.7	67.8	66.0	64.3
2400	86.1	79.2	78.7	78.2	77.6	77.1	76.6	73.0	71.0	69.2	67.3
2600	86.1	82.4	81.8	81.3	80.7	80.2	79.6	75.8	73.8	71.9	69.9
2800	86.1	85.4	84.8	84.2	83.6	83.1	82.5	78.6	76.5	74.4	72.4
3000	86.1	86.1	86.1	86.1	86.1	85.9	85.3	81.2	79.0	76.9	74.8
3200	86.1	86.1	86.1	86.1	86.1	86.1	86.1	83.4	81.2	79.0	76.9
3400	86.1	86.1	86.1	86.1	86.1	86.1	86.1	85.6	83.3	81.1	78.8
3600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	85.3	83.1	80.8
3800	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	84.9	82.6
4000	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	84.4
4200	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
4400	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
4600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
CLIMB LIMIT WT (1000 KG)	86.1	86.0	85.9	85.8	85.7	85.6	85.4	79.8	77.2	74.6	71.9

2000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1220	55.2	50.8	50.5	50.1	49.8	49.5	48.6	46.2	45.0	43.9	42.8
1400	60.1	55.2	54.9	54.5	54.2	53.8	52.8	50.3	49.0	47.7	46.5
1600	65.0	59.7	59.3	59.0	58.6	58.2	57.2	54.4	53.0	51.6	50.3
1800	69.5	63.9	63.5	63.1	62.7	62.3	61.1	58.1	56.6	55.2	53.8
2000	73.7	67.7	67.3	66.8	66.4	66.0	64.8	61.6	60.0	58.4	56.9
2200	77.7	71.3	70.9	70.4	70.0	69.5	68.2	64.8	63.2	61.5	59.9
2400	81.4	74.7	74.2	73.8	73.3	72.8	71.4	67.9	66.1	64.4	62.7
2600	84.6	77.7	77.2	76.7	76.2	75.7	74.3	70.5	68.7	66.9	65.2
2800	86.1	80.5	80.0	79.4	78.9	78.4	76.9	73.1	71.1	69.3	67.5
3000	86.1	83.1	82.6	82.1	81.5	81.0	79.5	75.5	73.5	71.5	69.6
3200	86.1	85.5	84.9	84.4	83.8	83.3	81.7	77.6	75.5	73.5	71.6
3400	86.1	86.1	86.1	86.1	86.0	85.5	83.8	79.6	77.5	75.4	73.4
3600	86.1	86.1	86.1	86.1	86.1	86.1	85.8	81.5	79.4	77.3	75.2
3800	86.1	86.1	86.1	86.1	86.1	86.1	86.1	83.4	81.2	79.0	76.9
4000	86.1	86.1	86.1	86.1	86.1	86.1	86.1	85.2	82.9	80.7	78.6
4200	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	84.6	82.4	80.2
4400	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	84.0	81.8
4600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	85.7	83.4
CLIMB LIMIT WT (1000 KG)	82.5	82.0	81.9	81.8	81.7	81.6	79.7	74.7	72.2	69.7	67.3

With engine bleed for packs off, increase field limit weight by 350 kg and climb limit weight by 1350 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 950 kg and climb limit weight by 1500 kg.

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 5

4000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1220	51.6	47.4	47.1	46.8	46.5	45.9	45.1	43.1	42.0	40.9	40.0
1400	56.1	51.6	51.3	50.9	50.6	49.9	49.1	46.8	45.7	44.5	43.5
1600	60.7	55.8	55.4	55.1	54.8	54.0	53.1	50.6	49.4	48.2	47.0
1800	64.9	59.6	59.3	58.9	58.5	57.7	56.7	54.1	52.8	51.4	50.2
2000	68.8	63.2	62.8	62.4	62.0	61.1	60.1	57.3	55.9	54.4	53.2
2200	72.5	66.6	66.1	65.7	65.3	64.4	63.3	60.3	58.8	57.3	56.0
2400	75.9	69.7	69.3	68.8	68.4	67.4	66.3	63.2	61.6	60.0	58.6
2600	78.9	72.4	72.0	71.5	71.1	70.1	68.8	65.6	63.9	62.3	60.8
2800	81.8	75.0	74.5	74.1	73.6	72.5	71.3	67.9	66.2	64.5	62.9
3000	84.5	77.5	77.0	76.5	76.0	74.9	73.6	70.1	68.3	66.5	64.9
3200	86.1	79.7	79.2	78.7	78.1	77.0	75.7	72.1	70.2	68.4	66.7
3400	86.1	81.7	81.2	80.7	80.2	79.0	77.6	73.9	72.0	70.2	68.5
3600	86.1	83.7	83.2	82.6	82.1	80.9	79.5	75.7	73.8	71.9	70.1
3800	86.1	85.6	85.1	84.5	84.0	82.8	81.3	77.5	75.5	73.5	71.7
4000	86.1	86.1	86.1	86.1	85.8	84.6	83.1	79.1	77.1	75.1	73.3
4200	86.1	86.1	86.1	86.1	86.1	86.1	84.8	80.8	78.7	76.7	74.8
4400	86.1	86.1	86.1	86.1	86.1	86.1	86.1	82.4	80.3	78.2	76.3
4600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	84.0	81.8	79.7	77.8
CLIMB LIMIT WT (1000 KG)	77.7	77.1	77.1	77.0	76.9	75.8	74.2	69.7	67.3	65.1	63.0

6000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1220	48.1	44.2	44.0	43.7	43.2	42.6	41.9	40.0	39.0	38.1	37.2
1400	52.3	48.1	47.8	47.6	47.0	46.3	45.6	43.5	42.4	41.4	40.5
1600	56.5	52.1	51.7	51.4	50.8	50.1	49.3	47.0	45.8	44.8	43.8
1800	60.4	55.6	55.3	55.0	54.3	53.5	52.7	50.2	49.0	47.8	46.7
2000	64.0	58.9	58.6	58.2	57.5	56.7	55.7	53.1	51.8	50.6	49.4
2200	67.5	62.0	61.7	61.3	60.5	59.7	58.7	55.9	54.5	53.2	52.0
2400	70.6	64.9	64.6	64.2	63.3	62.5	61.4	58.5	57.0	55.7	54.4
2600	73.4	67.5	67.1	66.6	65.8	64.9	63.8	60.8	59.2	57.8	56.4
2800	76.1	69.9	69.4	69.0	68.1	67.2	66.0	62.9	61.3	59.8	58.4
3000	78.6	72.1	71.7	71.2	70.3	69.3	68.2	64.9	63.2	61.7	60.2
3200	80.8	74.1	73.7	73.2	72.3	71.3	70.1	66.7	65.0	63.4	61.9
3400	82.9	76.1	75.6	75.1	74.1	73.1	71.9	68.4	66.7	65.0	63.5
3600	84.9	77.9	77.4	77.0	76.0	74.9	73.6	70.1	68.3	66.6	65.0
3800	86.1	79.7	79.2	78.7	77.7	76.6	75.3	71.7	69.8	68.2	66.5
4000	86.1	81.4	80.9	80.4	79.4	78.3	76.9	73.3	71.4	69.6	68.0
4200	86.1	83.1	82.6	82.1	81.0	79.9	78.5	74.8	72.8	71.1	69.4
4400	86.1	84.8	84.2	83.7	82.6	81.5	80.1	76.3	74.3	72.5	70.8
4600	86.1	86.1	85.8	85.3	84.2	83.1	81.6	77.8	75.8	73.9	72.2
CLIMB LIMIT WT (1000 KG)	72.8	72.4	72.3	72.3	71.3	70.3	68.8	64.5	62.3	60.4	58.5

With engine bleed for packs off, increase field limit weight by 350 kg and climb limit weight by 1350 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 950 kg and climb limit weight by 1500 kg.

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 5

8000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1220	44.8	41.3	41.1	40.6	40.1	39.4	38.6	36.7	35.9	35.0	34.2
1400	48.7	45.0	44.7	44.1	43.6	42.9	42.0	40.0	39.0	38.1	37.2
1600	52.7	48.6	48.3	47.7	47.1	46.4	45.5	43.2	42.2	41.2	40.3
1800	56.3	51.9	51.6	51.0	50.4	49.6	48.5	46.1	45.1	44.0	43.0
2000	59.6	55.0	54.6	54.0	53.3	52.4	51.3	48.8	47.6	46.5	45.4
2200	62.8	57.9	57.5	56.8	56.1	55.2	54.0	51.3	50.1	48.9	47.8
2400	65.8	60.6	60.2	59.5	58.7	57.8	56.5	53.7	52.4	51.2	49.9
2600	68.3	62.9	62.5	61.7	60.9	60.0	58.7	55.7	54.4	53.1	51.8
2800	70.7	65.1	64.7	63.9	63.1	62.1	60.7	57.6	56.2	54.9	53.6
3000	73.1	67.2	66.8	65.9	65.1	64.0	62.7	59.4	58.0	56.6	55.2
3200	75.1	69.1	68.6	67.8	66.9	65.8	64.4	61.1	59.6	58.2	56.7
3400	77.0	70.9	70.4	69.5	68.6	67.5	66.1	62.7	61.1	59.7	58.2
3600	78.9	72.6	72.1	71.2	70.3	69.2	67.7	64.2	62.6	61.1	59.6
3800	80.7	74.2	73.8	72.9	71.9	70.7	69.2	65.7	64.1	62.5	61.0
4000	82.4	75.9	75.4	74.4	73.5	72.3	70.7	67.1	65.5	63.9	62.3
4200	84.2	77.4	76.9	76.0	75.0	73.8	72.2	68.5	66.8	65.2	63.7
4400	85.8	79.0	78.5	77.5	76.5	75.3	73.7	69.9	68.2	66.6	64.9
4600	86.1	80.5	80.0	79.0	78.0	76.7	75.1	71.3	69.5	67.9	66.2
CLIMB LIMIT WT (1000 KG)	68.2	67.8	67.8	67.0	66.1	64.9	63.0	58.7	56.9	55.2	53.4

10000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1220	41.9	38.6	38.1	37.6	37.1	36.5	35.7	33.9	33.0	32.2	31.3
1400	45.5	42.0	41.4	40.9	40.4	39.8	38.9	36.9	35.9	35.0	34.1
1600	49.3	45.4	44.8	44.3	43.7	43.0	42.1	39.9	38.9	37.9	36.8
1800	52.6	48.5	47.9	47.3	46.6	45.9	44.9	42.6	41.5	40.4	39.3
2000	55.7	51.3	50.6	50.0	49.3	48.5	47.4	45.0	43.8	42.6	41.4
2200	58.7	53.9	53.3	52.6	51.9	51.1	49.9	47.3	46.0	44.8	43.6
2400	61.4	56.5	55.7	55.0	54.3	53.4	52.2	49.5	48.2	46.9	45.5
2600	63.8	58.6	57.8	57.1	56.3	55.4	54.2	51.3	49.9	48.6	47.2
2800	66.0	60.6	59.8	59.1	58.3	57.3	56.0	53.1	51.6	50.2	48.8
3000	68.1	62.6	61.7	60.9	60.1	59.1	57.8	54.7	53.2	51.7	50.3
3200	70.0	64.3	63.4	62.6	61.8	60.8	59.4	56.2	54.7	53.2	51.6
3400	71.8	66.0	65.1	64.2	63.4	62.3	60.9	57.7	56.1	54.5	53.0
3600	73.6	67.6	66.7	65.8	64.9	63.9	62.4	59.1	57.5	55.9	54.3
3800	75.3	69.1	68.2	67.3	66.4	65.3	63.8	60.4	58.8	57.2	55.5
4000	76.9	70.6	69.7	68.8	67.8	66.8	65.2	61.8	60.1	58.4	56.7
4200	78.5	72.1	71.1	70.2	69.3	68.2	66.6	63.1	61.3	59.6	57.9
4400	80.1	73.5	72.6	71.6	70.7	69.5	67.9	64.3	62.6	60.9	59.1
4600	81.6	75.0	74.0	73.0	72.0	70.9	69.3	65.6	63.8	62.1	60.3
CLIMB LIMIT WT (1000 KG)	64.0	63.4	62.7	61.9	61.0	59.8	58.0	54.0	52.1	50.3	48.4

With engine bleed for packs off, increase field limit weight by 350 kg and climb limit weight by 1350 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 950 kg and climb limit weight by 1500 kg.

Takeoff Field Corrections - Wet Runway

Slope Corrections

FIELD LENGTH AVAILABLE (M)	SLOPE CORRECTED FIELD LENGTH (M)								
	RUNWAY SLOPE (%)								
	-2.0	-1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	2.0
1200	1230	1220	1210	1210	1200	1190	1180	1170	1160
1400	1450	1440	1430	1410	1400	1380	1360	1340	1320
1600	1680	1660	1640	1620	1600	1570	1550	1520	1490
1800	1900	1880	1850	1830	1800	1760	1730	1690	1660
2000	2130	2100	2060	2030	2000	1960	1910	1870	1830
2200	2350	2310	2280	2240	2200	2150	2100	2050	1990
2400	2580	2530	2490	2440	2400	2340	2280	2220	2160
2600	2800	2750	2700	2650	2600	2530	2470	2400	2340
2800	3030	2970	2910	2860	2800	2730	2660	2580	2510
3000	3250	3190	3130	3060	3000	2920	2840	2760	2690
3200	3480	3410	3340	3270	3200	3120	3030	2950	2860
3400	3700	3630	3550	3480	3400	3310	3220	3130	3040
3600	3930	3850	3760	3680	3600	3500	3410	3310	3210
3800	4170	4080	3990	3890	3800	3690	3590	3480	3380
4000	4420	4320	4210	4110	4000	3880	3770	3650	3540
4200	4670	4550	4440	4320	4200	4080	3950	3830	3700
4400	4920	4790	4660	4530	4400	4270	4130	4000	3860
4600	5170	5030	4890	4740	4600	4460	4310	4170	4030
4800	5420	5270	5110	4960	4800	4650	4490	4340	4190
5000	5670	5500	5340	5170	5000	4840	4680	4510	4350

Wind Corrections

SLOPE CORR'D FIELD LENGTH (M)	SLOPE & WIND CORRECTED FIELD LENGTH (M)							
	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1200	860	970	1090	1200	1280	1360	1440	1520
1400	1030	1150	1280	1400	1480	1570	1660	1750
1600	1200	1330	1470	1600	1690	1790	1880	1980
1800	1370	1510	1660	1800	1900	2000	2100	2210
2000	1540	1690	1850	2000	2110	2210	2320	2440
2200	1710	1870	2040	2200	2310	2430	2550	2670
2400	1880	2050	2230	2400	2520	2640	2770	2890
2600	2050	2230	2420	2600	2730	2860	2990	3120
2800	2220	2410	2610	2800	2930	3070	3210	3350
3000	2390	2590	2800	3000	3140	3280	3430	3580
3200	2560	2770	2990	3200	3350	3500	3650	3810
3400	2730	2950	3180	3400	3560	3710	3870	4040
3600	2900	3130	3370	3600	3760	3930	4090	4260
3800	3060	3310	3550	3800	3970	4140	4310	4490
4000	3230	3490	3740	4000	4180	4350	4540	4720
4200	3400	3670	3930	4200	4380	4570	4760	4950
4400	3570	3850	4120	4400	4590	4780	4980	5180
4600	3740	4030	4310	4600	4800	5000	5200	5400
4800	3910	4210	4500	4800	5000	5210	5420	5630
5000	4080	4390	4690	5000	5210	5430	5640	5860

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 5

Sea Level Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1220	58.7	53.4	53.0	52.6	52.3	51.9	51.5	49.1	47.9	46.7	45.5
1400	63.7	58.0	57.5	57.1	56.7	56.3	55.9	53.2	51.9	50.6	49.3
1600	68.8	62.6	62.1	61.7	61.2	60.8	60.3	57.4	56.0	54.6	53.2
1800	73.5	66.8	66.3	65.8	65.3	64.9	64.4	61.3	59.8	58.3	56.8
2000	77.8	70.8	70.2	69.7	69.2	68.7	68.2	64.9	63.3	61.7	60.2
2200	82.0	74.5	74.0	73.4	72.9	72.3	71.8	68.4	66.6	65.0	63.3
2400	85.8	78.0	77.4	76.8	76.2	75.7	75.1	71.5	69.7	68.0	66.2
2600	86.1	81.0	80.4	79.8	79.2	78.6	78.0	74.3	72.4	70.6	68.8
2800	86.1	83.9	83.2	82.6	82.0	81.4	80.8	76.9	74.9	73.0	71.1
3000	86.1	86.1	85.9	85.2	84.6	83.9	83.3	79.3	77.2	75.3	73.3
3200	86.1	86.1	86.1	86.1	86.1	86.1	85.9	81.7	79.6	77.5	75.5
3400	86.1	86.1	86.1	86.1	86.1	86.1	86.1	84.0	81.8	79.8	77.6
3600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	84.0	81.9	79.7
3800	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	83.9	81.6
4000	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	85.8	83.5
4200	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	85.3
4400	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
4600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
CLIMB LIMIT WT (1000 KG)	86.1	86.0	85.9	85.8	85.7	85.6	85.4	79.8	77.2	74.6	71.9

2000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1220	55.2	50.2	49.8	49.5	49.1	48.8	47.9	45.7	44.6	43.5	42.5
1400	59.9	54.5	54.1	53.7	53.3	52.9	51.9	49.5	48.3	47.2	46.0
1600	64.7	58.8	58.4	57.9	57.5	57.1	56.1	53.5	52.2	50.9	49.7
1800	69.1	62.7	62.3	61.8	61.4	60.9	59.8	57.0	55.7	54.3	53.0
2000	73.2	66.5	66.0	65.5	65.0	64.6	63.4	60.4	58.9	57.5	56.1
2200	77.0	70.0	69.4	68.9	68.4	67.9	66.7	63.6	62.0	60.5	59.1
2400	80.6	73.2	72.7	72.1	71.6	71.1	69.8	66.5	64.9	63.3	61.8
2600	83.8	76.0	75.5	74.9	74.4	73.8	72.5	69.0	67.3	65.7	64.1
2800	86.1	78.7	78.1	77.5	77.0	76.4	75.0	71.4	69.7	68.0	66.3
3000	86.1	81.2	80.5	79.9	79.4	78.8	77.3	73.6	71.8	70.0	68.3
3200	86.1	83.6	83.0	82.4	81.8	81.2	79.6	75.8	73.9	72.1	70.3
3400	86.1	86.0	85.4	84.7	84.1	83.5	81.9	78.0	76.0	74.1	72.3
3600	86.1	86.1	86.1	86.1	86.1	85.7	84.1	80.0	78.0	76.1	74.2
3800	86.1	86.1	86.1	86.1	86.1	86.1	86.1	82.0	79.9	77.9	76.0
4000	86.1	86.1	86.1	86.1	86.1	86.1	86.1	83.9	81.7	79.7	77.7
4200	86.1	86.1	86.1	86.1	86.1	86.1	86.1	85.7	83.5	81.4	79.4
4400	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	85.3	83.1	81.0
4600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	84.8	82.6
CLIMB LIMIT WT (1000 KG)	82.5	82.0	81.9	81.8	81.7	81.6	79.7	74.7	72.2	69.7	67.3

With engine bleed for packs off, increase field limit weight by 350 kg and climb limit weight by 1350 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 800 kg and climb limit weight by 1500 kg.

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 5

4000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1220	51.5	46.8	46.5	46.2	45.8	45.2	44.5	42.6	41.6	40.6	39.7
1400	55.9	50.8	50.4	50.1	49.7	49.0	48.2	46.1	45.1	44.0	43.0
1600	60.3	54.8	54.4	54.0	53.6	52.9	52.0	49.8	48.6	47.4	46.4
1800	64.4	58.5	58.1	57.6	57.2	56.4	55.5	53.1	51.8	50.6	49.5
2000	68.2	61.9	61.5	61.1	60.6	59.8	58.8	56.2	54.9	53.6	52.4
2200	71.8	65.2	64.7	64.3	63.8	62.9	61.9	59.2	57.8	56.4	55.1
2400	75.1	68.2	67.7	67.2	66.7	65.8	64.7	61.9	60.4	58.9	57.6
2600	78.1	70.8	70.3	69.8	69.3	68.3	67.2	64.2	62.7	61.2	59.8
2800	80.8	73.3	72.7	72.2	71.7	70.7	69.5	66.4	64.8	63.2	61.8
3000	83.3	75.5	75.0	74.4	73.9	72.8	71.6	68.4	66.7	65.1	63.6
3200	85.9	77.8	77.2	76.7	76.1	75.0	73.7	70.4	68.7	67.0	65.5
3400	86.1	80.0	79.4	78.8	78.3	77.1	75.8	72.4	70.6	68.9	67.3
3600	86.1	82.1	81.5	80.9	80.3	79.2	77.8	74.3	72.5	70.7	69.0
3800	86.1	84.1	83.5	82.9	82.3	81.1	79.7	76.1	74.2	72.4	70.7
4000	86.1	86.1	85.4	84.8	84.2	82.9	81.5	77.8	75.9	74.0	72.3
4200	86.1	86.1	86.1	86.1	86.0	84.8	83.3	79.5	77.6	75.6	73.9
4400	86.1	86.1	86.1	86.1	86.1	86.1	85.1	81.2	79.2	77.2	75.4
4600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	82.8	80.8	78.7	76.9
CLIMB LIMIT WT (1000 KG)	77.7	77.1	77.1	77.0	76.9	75.8	74.2	69.7	67.3	65.1	63.0

6000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1220	48.0	43.7	43.4	43.1	42.5	42.0	41.3	39.5	38.6	37.7	36.9
1400	52.0	47.4	47.0	46.7	46.1	45.5	44.8	42.8	41.8	40.9	40.0
1600	56.1	51.1	50.7	50.4	49.7	49.1	48.3	46.2	45.1	44.1	43.1
1800	59.9	54.5	54.1	53.8	53.1	52.4	51.5	49.2	48.1	47.0	45.9
2000	63.4	57.7	57.3	56.9	56.2	55.4	54.5	52.1	50.9	49.7	48.6
2200	66.8	60.7	60.3	59.9	59.1	58.3	57.4	54.9	53.5	52.3	51.2
2400	69.9	63.5	63.1	62.7	61.9	61.0	60.0	57.4	56.0	54.7	53.5
2600	72.6	65.9	65.5	65.0	64.2	63.3	62.3	59.5	58.1	56.7	55.5
2800	75.1	68.2	67.7	67.2	66.4	65.5	64.4	61.5	60.0	58.6	57.3
3000	77.4	70.3	69.8	69.3	68.4	67.4	66.3	63.3	61.7	60.3	59.0
3200	79.7	72.4	71.8	71.3	70.4	69.4	68.3	65.2	63.6	62.1	60.7
3400	82.0	74.4	73.9	73.3	72.4	71.4	70.2	67.0	65.3	63.8	62.3
3600	84.2	76.4	75.8	75.3	74.3	73.2	72.0	68.7	67.0	65.5	63.9
3800	86.1	78.2	77.6	77.1	76.1	75.0	73.7	70.4	68.6	67.0	65.5
4000	86.1	80.0	79.4	78.8	77.8	76.7	75.4	72.0	70.2	68.5	66.9
4200	86.1	81.7	81.1	80.6	79.5	78.4	77.1	73.5	71.7	70.0	68.4
4400	86.1	83.4	82.8	82.2	81.2	80.0	78.7	75.0	73.2	71.4	69.8
4600	86.1	85.1	84.5	83.9	82.8	81.6	80.2	76.5	74.6	72.9	71.2
CLIMB LIMIT WT (1000 KG)	72.8	72.4	72.3	72.3	71.3	70.3	68.8	64.5	62.3	60.4	58.5

With engine bleed for packs off, increase field limit weight by 350 kg and climb limit weight by 1350 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 800 kg and climb limit weight by 1500 kg.

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 5

8000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1220	44.7	40.8	40.5	40.0	39.5	38.9	38.1	36.3	35.5	34.7	34.0
1400	48.4	44.2	43.9	43.3	42.8	42.1	41.3	39.4	38.5	37.6	36.8
1600	52.2	47.6	47.3	46.7	46.1	45.4	44.5	42.4	41.5	40.6	39.6
1800	55.7	50.8	50.5	49.8	49.2	48.4	47.5	45.2	44.2	43.2	42.3
2000	59.0	53.8	53.4	52.8	52.1	51.3	50.3	47.9	46.8	45.8	44.7
2200	62.1	56.6	56.2	55.5	54.8	54.0	52.9	50.4	49.2	48.1	47.1
2400	65.0	59.2	58.8	58.1	57.3	56.4	55.3	52.7	51.5	50.3	49.2
2600	67.5	61.4	61.0	60.2	59.5	58.5	57.3	54.6	53.4	52.1	51.0
2800	69.8	63.5	63.0	62.3	61.4	60.5	59.2	56.4	55.1	53.8	52.6
3000	71.9	65.4	64.9	64.1	63.3	62.2	61.0	58.0	56.7	55.4	54.1
3200	74.1	67.3	66.8	66.0	65.1	64.1	62.8	59.7	58.3	57.0	55.6
3400	76.1	69.2	68.7	67.8	66.9	65.9	64.5	61.3	59.9	58.5	57.1
3600	78.2	71.0	70.5	69.6	68.7	67.6	66.2	62.9	61.4	60.0	58.6
3800	80.0	72.7	72.2	71.3	70.3	69.2	67.7	64.4	62.9	61.4	60.0
4000	81.9	74.4	73.8	72.9	71.9	70.7	69.3	65.9	64.3	62.8	61.3
4200	83.7	76.0	75.4	74.5	73.5	72.3	70.8	67.3	65.7	64.1	62.6
4400	85.4	77.6	77.0	76.0	75.0	73.8	72.2	68.7	67.0	65.5	63.9
4600	86.1	79.1	78.5	77.5	76.5	75.2	73.7	70.0	68.4	66.7	65.2
CLIMB LIMIT WT (1000 KG)	68.2	67.8	67.8	67.0	66.1	64.9	63.0	58.7	56.9	55.2	53.4

10000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1220	41.7	38.0	37.5	37.0	36.6	36.0	35.3	33.6	32.7	31.9	31.1
1400	45.2	41.2	40.6	40.1	39.6	39.0	38.2	36.3	35.4	34.5	33.6
1600	48.8	44.4	43.8	43.3	42.7	42.0	41.2	39.2	38.2	37.2	36.2
1800	52.0	47.3	46.7	46.1	45.5	44.8	43.9	41.7	40.7	39.7	38.6
2000	55.1	50.1	49.5	48.8	48.2	47.5	46.4	44.2	43.1	42.0	40.9
2200	58.0	52.7	52.1	51.4	50.7	49.9	48.9	46.5	45.3	44.1	43.0
2400	60.6	55.1	54.4	53.7	53.0	52.2	51.1	48.6	47.3	46.1	44.9
2600	62.9	57.2	56.4	55.7	54.9	54.1	52.9	50.3	49.0	47.8	46.5
2800	65.0	59.1	58.3	57.5	56.8	55.9	54.6	51.9	50.6	49.3	47.9
3000	67.0	60.8	60.0	59.2	58.4	57.5	56.2	53.4	52.0	50.6	49.3
3200	69.0	62.6	61.7	60.9	60.1	59.1	57.8	54.9	53.5	52.1	50.6
3400	70.9	64.3	63.4	62.6	61.7	60.8	59.4	56.4	54.9	53.5	52.0
3600	72.8	66.0	65.1	64.2	63.3	62.3	60.9	57.8	56.3	54.8	53.3
3800	74.5	67.5	66.6	65.7	64.8	63.8	62.4	59.2	57.6	56.1	54.5
4000	76.2	69.1	68.1	67.2	66.3	65.2	63.8	60.5	58.9	57.3	55.7
4200	77.9	70.6	69.6	68.7	67.7	66.6	65.1	61.8	60.2	58.5	56.9
4400	79.5	72.0	71.0	70.1	69.1	68.0	66.5	63.1	61.4	59.7	58.1
4600	81.1	73.4	72.4	71.5	70.5	69.3	67.8	64.3	62.6	60.9	59.2
CLIMB LIMIT WT (1000 KG)	64.0	63.4	62.7	61.9	61.0	59.8	58.0	54.0	52.1	50.3	48.4

With engine bleed for packs off, increase field limit weight by 350 kg and climb limit weight by 1350 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 800 kg and climb limit weight by 1500 kg.

Takeoff Obstacle Limit Weight

Flaps 5

Sea Level, 30°C & Below, Zero Wind

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

Reference Obstacle Limit Weight (1000 KG)

OBSTACLE HEIGHT (M)	DISTANCE FROM BRAKE RELEASE (100 M)										
	25	30	35	40	45	50	55	60	65	70	75
5	74.0	80.3									
20	68.2	74.1	78.9	82.6							
40	63.2	68.8	73.4	77.1	80.1	82.6	84.6				
60	59.4	64.7	69.2	72.9	76.0	78.6	80.7	82.5	84.0		
80	56.1	61.4	65.8	69.5	72.6	75.3	77.5	79.4	81.1	82.5	83.7
100	53.3	58.5	62.8	66.5	69.6	72.3	74.7	76.7	78.4	79.9	81.2
120	50.9	56.0	60.3	63.9	67.0	69.7	72.1	74.2	76.0	77.6	79.0
140	48.6	53.7	58.0	61.6	64.7	67.4	69.8	71.9	73.8	75.5	76.9
160	46.6	51.6	55.8	59.5	62.6	65.3	67.7	69.9	71.8	73.5	75.0
180	44.7	49.7	53.9	57.5	60.6	63.4	65.8	68.0	69.9	71.6	73.2
200	43.0	48.0	52.1	55.7	58.8	61.6	64.0	66.2	68.1	69.9	71.5
220	41.5	46.4	50.5	54.1	57.2	59.9	62.4	64.5	66.5	68.3	69.9
240		44.8	49.0	52.5	55.6	58.4	60.8	63.0	65.0	66.8	68.4
260		43.4	47.5	51.0	54.2	56.9	59.3	61.5	63.5	65.3	67.0
280		42.1	46.2	49.7	52.8	55.5	58.0	60.2	62.2	64.0	65.6
300			44.9	48.4	51.5	54.2	56.6	58.9	60.9	62.7	64.4

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

OAT Adjustments

OAT (°C)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 KG)					
	40	50	60	70	80	90
30 & BELOW	0	0	0	0	0	0
32	-0.6	-0.7	-0.9	-1.1	-1.2	-1.4
34	-1.2	-1.5	-1.8	-2.1	-2.5	-2.8
36	-1.7	-2.2	-2.7	-3.2	-3.7	-4.2
38	-2.3	-3.0	-3.6	-4.3	-5.0	-5.6
40	-2.9	-3.7	-4.5	-5.4	-6.2	-7.0
42	-3.4	-4.4	-5.4	-6.4	-7.4	-8.4
44	-4.0	-5.1	-6.3	-7.4	-8.6	-9.7
46	-4.5	-5.8	-7.1	-8.4	-9.8	-11.1
48	-5.1	-6.6	-8.0	-9.5	-10.9	-12.4
50	-5.7	-7.3	-8.9	-10.5	-12.1	-13.8

Pressure Altitude Adjustments

ALT (FT)	OAT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)					
	40	50	60	70	80	90
S.L. & BELOW	0	0	0	0	0	0
1000	-1.5	-1.8	-2.1	-2.5	-2.8	-3.2
2000	-2.9	-3.6	-4.3	-5.0	-5.6	-6.3
3000	-4.3	-5.3	-6.3	-7.3	-8.3	-9.3
4000	-5.6	-7.0	-8.3	-9.7	-11.0	-12.4
5000	-6.9	-8.6	-10.2	-11.9	-13.6	-15.2
6000	-8.2	-10.2	-12.2	-14.2	-16.1	-18.1
7000	-9.3	-11.7	-14.0	-16.3	-18.7	-21.0
8000	-10.5	-13.2	-15.9	-18.5	-21.2	-23.9
9000	-11.6	-14.6	-17.6	-20.5	-23.5	-26.5
10000	-12.8	-16.0	-19.3	-22.5	-25.8	-29.1

Takeoff Obstacle Limit Weight

Flaps 5

Sea Level, 30°C & Below, Zero Wind

Wind Adjustments

WIND (KTS)	OAT & ALT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)					
	40	50	60	70	80	90
15 TW	-9.4	-9.0	-8.7	-8.3	-8.0	-7.7
10 TW	-6.2	-6.0	-5.8	-5.6	-5.3	-5.1
5 TW	-3.1	-3.0	-2.9	-2.8	-2.7	-2.6
0	0	0	0	0	0	0
10 HW	1.1	1.0	0.9	0.8	0.7	0.6
20 HW	2.3	2.1	1.9	1.7	1.5	1.3
30 HW	3.5	3.2	2.9	2.6	2.3	1.9
40 HW	4.7	4.3	3.9	3.5	3.0	2.6

With engine bleed for packs off, increase weight by 550 kg.
With engine anti-ice on, decrease weight by 250 kg.
With engine and wing anti-ice on, decrease weight by 1300 kg (optional system).

Tire Speed Limit Weight

Flaps 5 Limit Weight (1000 KG)

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
54	86.2	86.2	82.9	76.4	70.4	
52	86.2	86.2	83.5	77.0	70.9	
50	86.2	86.2	84.1	77.5	71.4	65.7
48	86.2	86.2	84.7	78.0	71.9	66.2
46	86.2	86.2	85.3	78.6	72.4	66.6
44	86.2	86.2	85.7	79.2	72.9	67.1
42	86.2	86.2	85.9	79.7	73.4	67.6
40	86.2	86.2	86.2	80.3	73.9	68.1
38	86.2	86.2	86.2	80.9	74.5	68.6
36	86.2	86.2	86.2	81.5	75.0	69.1
34	86.2	86.2	86.2	82.1	75.6	69.6
32	86.2	86.2	86.2	82.7	76.2	70.1
30	86.2	86.2	86.2	83.4	76.7	70.6
28	86.2	86.2	86.2	84.0	77.3	71.1
26	86.2	86.2	86.2	84.6	77.9	71.7
24	86.2	86.2	86.2	85.2	78.5	72.2
22	86.2	86.2	86.2	85.8	79.1	72.7
20	86.2	86.2	86.2	86.2	79.6	73.3
18	86.2	86.2	86.2	86.2	80.2	73.8
16	86.2	86.2	86.2	86.2	80.8	74.4
14	86.2	86.2	86.2	86.2	81.4	74.9
12	86.2	86.2	86.2	86.2	82.0	75.5
10	86.2	86.2	86.2	86.2	82.7	76.1
-40	86.2	86.2	86.2	86.2	86.2	86.2

Increase tire speed limit weight by 600 kg per knot headwind.
Decrease tire speed limit weight by 1100 kg per knot tailwind.

Brake Energy Limits VMBE

Maximum Brake Energy Speed

OAT (°C)	REFERENCE VMBE (KIAS)						
	PRESSURE ALTITUDE (FT)						
	-2000	0	2000	4000	6000	8000	10000
54	195	188					
50	195	189	182				
46	196	189	183	176			
42	197	190	184	177	171		
38	198	191	184	178	172	166	
34	199	192	185	179	173	167	161
30	200	192	186	180	174	168	162
26	202	194	187	181	175	169	163
22	203	195	189	182	176	170	163
18	205	197	190	183	177	171	164
14	207	198	191	185	178	172	166
10	208	200	193	186	180	173	167
6	210	202	194	188	181	174	168
2	210	203	196	189	182	176	169
-2	210	205	198	191	184	177	171
-6	210	207	199	192	185	179	172
-10	210	209	201	194	187	180	174

Weight Adjusted VMBE

WEIGHT (1000 KG)	REFERENCE VMBE (KIAS)														
	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210
42	167	174	180	186	192	198	204	210	210	210	210	210	210	210	210
46	159	165	170	176	182	188	194	200	205	210	210	210	210	210	210
50	152	157	163	168	174	179	185	190	196	201	207	210	210	210	210
54	145	151	156	161	166	172	177	182	187	193	198	203	208	210	210
58	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210
62	135	140	144	149	154	159	164	168	173	178	183	188	193	197	202
66	130	135	139	144	149	153	158	163	167	172	177	181	186	191	195
70	126	131	135	140	144	149	153	158	162	167	171	176	180	185	189
74	123	127	131	136	140	144	149	153	157	162	166	170	175	179	183
78	120	124	128	132	136	141	145	149	153	157	162	166	170	174	178
82	117	121	125	129	133	137	141	145	149	153	157	161	166	170	174
86	115	119	122	126	130	134	138	142	146	150	154	158	161	165	169

Increase VMBE by 1 knot per 1% uphill runway slope. Decrease VMBE by 4 knots per 1% downhill runway slope.
Increase VMBE by 3 knots per 10 knots headwind. Decrease VMBE by 19 knots per 10 knots tailwind.
Decrease brake release weight by 500 kg for each knot V1 exceeds VMBE.
Determine normal V1, VR, V2 speeds for lower brake release weight.

Long Range Cruise Maximum Operating Altitude

Max Cruise Thrust

ISA + 10°C and Below

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
85	32300	-10	34300*	34300*	33800	32200	30800
80	33600	-13	35800*	35800*	35100	33500	32100
75	35000	-16	37100*	37100*	36400	34900	33500
70	36400	-18	38400*	38400*	37900	36300	35000
65	38000	-18	39800*	39800*	39400	37800	36500
60	39600	-18	41000	41000	41000	39500	38200
55	41000	-18	41000	41000	41000	41000	40000
50	41000	-18	41000	41000	41000	41000	41000
45	41000	-18	41000	41000	41000	41000	41000
40	41000	-18	41000	41000	41000	41000	41000

ISA + 15°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
85	32300	-4	33000*	33000*	33000*	32200	30800
80	33600	-7	34700*	34700*	34700*	33500	32100
75	35000	-10	36200*	36200*	36200*	34900	33500
70	36400	-12	37600*	37600*	37600*	36300	35000
65	38000	-12	38900*	38900*	38900*	37800	36500
60	39600	-12	40400*	40400*	40400*	39500	38200
55	41000	-12	41000	41000	41000	41000	40000
50	41000	-12	41000	41000	41000	41000	41000
45	41000	-12	41000	41000	41000	41000	41000
40	41000	-12	41000	41000	41000	41000	41000

ISA + 20°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
85	32300	2	29400*	29400*	29400*	29400*	29400*
80	33600	-1	32200*	32200*	32200*	32200*	32100
75	35000	-4	34700*	34700*	34700*	34700*	33500
70	36400	-7	36200*	36200*	36200*	36200*	35000
65	38000	-7	37700*	37700*	37700*	37700*	36500
60	39600	-7	39100*	39100*	39100*	39100*	38200
55	41000	-7	40500*	40500*	40500*	40500*	40000
50	41000	-7	41000	41000	41000	41000	41000
45	41000	-7	41000	41000	41000	41000	41000
40	41000	-7	41000	41000	41000	41000	41000

***Denotes altitude thrust limited in level flight, 100 fpm residual rate of climb.**

Long Range Cruise Trip Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
279	259	241	226	212	200	190	181	173	166	159
556	516	481	451	424	400	382	364	349	334	321
832	774	721	676	636	600	573	547	524	503	484
1108	1030	960	900	848	800	764	730	700	672	646
1383	1286	1200	1125	1059	1000	955	914	875	840	809
1657	1542	1439	1349	1271	1200	1146	1097	1051	1009	971
1931	1797	1677	1574	1483	1400	1338	1280	1227	1178	1134
2204	2052	1916	1798	1694	1600	1529	1464	1403	1347	1297
2477	2307	2154	2022	1905	1800	1721	1647	1579	1517	1460
2749	2561	2392	2246	2117	2000	1912	1830	1755	1686	1623
3021	2815	2630	2470	2328	2200	2104	2014	1932	1856	1787
3292	3069	2868	2694	2540	2400	2295	2198	2108	2025	1950
3563	3322	3105	2917	2751	2600	2487	2382	2284	2195	2114
3832	3574	3342	3140	2962	2800	2678	2565	2461	2365	2277
4101	3826	3579	3363	3173	3000	2870	2749	2637	2535	2441
4369	4077	3814	3586	3384	3200	3061	2933	2814	2704	2605
4636	4328	4050	3808	3594	3400	3253	3116	2990	2874	2769
4902	4578	4285	4030	3805	3600	3445	3300	3166	3044	2932
5168	4827	4520	4252	4015	3800	3636	3484	3343	3214	3096
5433	5076	4755	4474	4226	4000	3828	3668	3520	3384	3260
5697	5325	4989	4696	4436	4200	4019	3851	3696	3554	3424
5961	5573	5223	4917	4647	4400	4211	4035	3873	3724	3588
6224	5820	5457	5139	4857	4600	4403	4219	4050	3894	3751
6486	6068	5690	5360	5067	4800	4594	4403	4226	4064	3915
6747	6314	5923	5581	5277	5000	4786	4587	4403	4233	4079

Long Range Cruise Trip Fuel and Time

Reference Fuel and Time Required

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	29		31		33		35		37	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	1.5	0:38	1.5	0:37	1.5	0:37	1.5	0:36	1.5	0:36
400	2.5	1:10	2.4	1:09	2.4	1:07	2.4	1:06	2.4	1:04
600	3.5	1:42	3.4	1:40	3.4	1:37	3.3	1:34	3.3	1:32
800	4.5	2:14	4.4	2:11	4.3	2:07	4.3	2:03	4.2	2:00
1000	5.5	2:45	5.4	2:41	5.3	2:36	5.2	2:32	5.1	2:28
1200	6.6	3:16	6.5	3:11	6.3	3:05	6.2	2:59	6.1	2:55
1400	7.7	3:47	7.5	3:41	7.3	3:34	7.2	3:27	7.0	3:22
1600	8.7	4:18	8.5	4:11	8.3	4:02	8.1	3:55	8.0	3:50
1800	9.8	4:49	9.6	4:40	9.3	4:31	9.1	4:23	8.9	4:17
2000	10.9	5:19	10.6	5:10	10.3	5:00	10.1	4:51	9.8	4:44
2200	12.0	5:49	11.7	5:38	11.4	5:27	11.1	5:18	10.9	5:11
2400	13.1	6:18	12.8	6:07	12.5	5:55	12.1	5:45	11.9	5:38
2600	14.3	6:48	13.9	6:35	13.5	6:23	13.1	6:13	12.9	6:05
2800	15.4	7:17	15.0	7:04	14.6	6:51	14.2	6:40	13.9	6:32
3000	16.5	7:47	16.1	7:32	15.6	7:18	15.2	7:07	14.9	6:58
3200	17.7	8:15	17.2	8:00	16.7	7:45	16.3	7:34	15.9	7:25
3400	18.9	8:43	18.4	8:27	17.8	8:12	17.3	8:01	17.0	7:52
3600	20.0	9:11	19.5	8:55	18.9	8:39	18.4	8:27	18.0	8:18
3800	21.2	9:39	20.6	9:22	20.0	9:06	19.5	8:54	19.1	8:45
4000	22.4	10:08	21.8	9:50	21.2	9:33	20.6	9:21	20.2	9:11
4200	23.6	10:35	23.0	10:16	22.3	10:00	21.7	9:47	21.3	9:38
4400	24.9	11:02	24.2	10:43	23.5	10:26	22.8	10:14	22.4	10:04
4600	26.1	11:29	25.4	11:10	24.6	10:53	24.0	10:40	23.6	10:31
4800	27.4	11:56	26.6	11:37	25.8	11:20	25.1	11:07	24.7	10:57
5000	28.6	12:24	27.8	12:04	27.0	11:46	26.3	11:33	25.9	11:24

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	LANDING WEIGHT (1000 KG)						
	40	45	50	55	60	65	70
2	-0.2	-0.1	0.0	0.1	0.3	0.4	0.5
4	-0.3	-0.2	0.0	0.2	0.5	0.7	1.0
6	-0.5	-0.2	0.0	0.3	0.7	1.1	1.7
8	-0.6	-0.3	0.0	0.5	1.0	1.6	2.4
10	-0.8	-0.4	0.0	0.6	1.3	2.1	3.2
12	-1.0	-0.5	0.0	0.7	1.6	2.6	4.0
14	-1.1	-0.6	0.0	0.9	1.9	3.1	4.9
16	-1.3	-0.7	0.0	1.0	2.2	3.8	5.9
18	-1.5	-0.8	0.0	1.2	2.6	4.4	7.0
20	-1.7	-0.9	0.0	1.4	3.0	5.1	8.1
22	-1.8	-1.0	0.0	1.6	3.4	5.8	9.3
24	-2.0	-1.0	0.0	1.8	3.8	6.6	10.6
26	-2.2	-1.1	0.0	2.0	4.3	7.4	11.9
28	-2.4	-1.2	0.0	2.2	4.8	8.3	13.3
30	-2.6	-1.3	0.0	2.4	5.3	9.2	14.8
32	-2.8	-1.4	0.0	2.7	5.8	10.1	16.4

Based on 280/.78 climb, Long Range Cruise and .78/280/250 descent.

Long Range Cruise Step Climb

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
1321	1241	1171	1108	1051	1000	954	911	873	837	804
1839	1730	1634	1548	1470	1400	1336	1278	1225	1176	1130
2354	2218	2096	1987	1889	1800	1719	1645	1577	1515	1457
2869	2704	2558	2426	2308	2200	2102	2012	1930	1854	1784
3383	3190	3019	2865	2726	2600	2485	2380	2283	2194	2112
3895	3676	3480	3304	3145	3000	2868	2747	2636	2534	2439
4407	4161	3940	3742	3563	3400	3251	3115	2990	2874	2768
4919	4645	4401	4180	3981	3800	3635	3483	3344	3215	3096
5430	5130	4861	4619	4399	4200	4018	3851	3697	3556	3424
5942	5614	5321	5057	4818	4600	4401	4219	4051	3896	3753
6453	6099	5781	5495	5236	5000	4785	4587	4405	4237	4081

Trip Fuel and Time Required

AIR DIST (NM)	TRIP FUEL (1000 KG)							TIME (HRS:MIN)
	LANDING WEIGHT (1000 KG)							
	40	45	50	55	60	65	70	
1000	4.5	4.8	5.1	5.4	5.7	6.2	6.5	2:26
1400	6.1	6.5	6.9	7.3	7.9	8.4	8.9	3:20
1800	7.8	8.3	8.8	9.4	10.1	10.8	11.3	4:14
2200	9.5	10.0	10.7	11.4	12.3	13.1	13.9	5:08
2600	11.2	11.9	12.6	13.6	14.6	15.6	16.5	6:01
3000	12.9	13.7	14.7	15.8	16.9	18.1	19.2	6:54
3400	14.7	15.7	16.8	18.0	19.4	20.7	22.0	7:46
3800	16.5	17.6	19.0	20.4	21.9	23.4	24.8	8:39
4200	18.4	19.7	21.2	22.7	24.4	26.2	27.8	9:31
4600	20.3	21.7	23.4	25.2	27.1	29.0	30.8	10:23
5000	22.2	23.9	25.7	27.7	29.8	31.9	33.9	11:16

Based on 280/.78 climb, Long Range Cruise and .78/280/250 descent.
Valid for all pressure altitudes with 4000 ft step climb to 2000 ft above optimum altitude.

Short Trip Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
93	80	69	61	55	50	46	42	39	36	34
161	143	129	118	108	100	93	87	81	77	73
227	206	188	174	161	150	140	132	125	118	112
291	267	246	229	213	200	188	178	168	160	152
355	327	304	283	266	250	236	224	212	202	193
417	387	361	338	318	300	284	270	257	245	234
480	447	418	392	370	350	332	316	301	288	276
543	507	475	447	422	400	380	362	345	330	317
607	567	533	502	475	450	428	408	390	373	358
673	629	591	557	527	500	476	453	433	415	398

Trip Fuel and Time Required

AIR DIST (NM)		LANDING WEIGHT (1000 KG)							TIME (HRS:MIN)
		40	45	50	55	60	65	70	
50	FUEL (1000 KG)	0.5	0.6	0.6	0.6	0.7	0.7	0.7	0:14
	ALT (FT)	12000	12000	11000	8000	8000	10000	8000	
100	FUEL (1000 KG)	0.8	0.9	0.9	1.0	1.0	1.1	1.1	0:23
	ALT (FT)	18000	17000	16000	15000	15000	15000	16000	
150	FUEL (1000 KG)	1.1	1.2	1.2	1.3	1.3	1.4	1.5	0:31
	ALT (FT)	25000	24000	24000	23000	23000	22000	21000	
200	FUEL (1000 KG)	1.3	1.4	1.5	1.6	1.6	1.7	1.8	0:38
	ALT (FT)	31000	29000	27000	26000	26000	25000	24000	
250	FUEL (1000 KG)	1.5	1.6	1.7	1.8	1.9	2.0	2.1	0:44
	ALT (FT)	39000	37000	35000	31000	31000	31000	29000	
300	FUEL (1000 KG)	1.7	1.8	2.0	2.1	2.2	2.3	2.4	0:51
	ALT (FT)	41000	41000	39000	37000	35000	35000	33000	
350	FUEL (1000 KG)	1.9	2.0	2.2	2.3	2.4	2.6	2.7	0:57
	ALT (FT)	41000	41000	39000	39000	37000	35000	35000	
400	FUEL (1000 KG)	2.1	2.2	2.4	2.5	2.7	2.8	3.0	1:03
	ALT (FT)	41000	41000	41000	39000	39000	37000	35000	
450	FUEL (1000 KG)	2.3	2.5	2.6	2.8	2.9	3.1	3.3	1:10
	ALT (FT)	41000	41000	41000	41000	39000	37000	35000	
500	FUEL (1000 KG)	2.5	2.7	2.8	3.0	3.2	3.4	3.5	1:17
	ALT (FT)	41000	41000	41000	41000	39000	37000	35000	

Based on 280/.78 climb, Long Range Cruise and .78/280/250 descent.

Holding Planning

Flaps Up

WEIGHT (1000 KG)	TOTAL FUEL FLOW (KG/HR)								
	PRESSURE ALTITUDE (FT)								
	1500	5000	10000	15000	20000	25000	30000	35000	41000
85	3000	2950	2920	2900	2850	2860	2910		
80	2840	2790	2760	2740	2680	2680	2720		
75	2680	2630	2600	2570	2520	2500	2540	2600	
70	2520	2470	2440	2410	2360	2320	2360	2400	
65	2370	2320	2280	2240	2210	2150	2190	2220	
60	2210	2160	2120	2080	2050	1990	2010	2030	
55	2060	2000	1960	1920	1890	1840	1840	1860	1970
50	1910	1850	1800	1770	1730	1720	1700	1710	1790
45	1750	1700	1680	1640	1600	1570	1540	1540	1600
40	1640	1580	1530	1480	1450	1420	1400	1370	1420

This table includes 5% additional fuel for holding in a racetrack pattern.

Flight Crew Oxygen Requirements

Required Pressure (PSI) for 76 Cu. Ft. Cylinder (YA701-YA706)

BOTTLE TEMPERATURE		NUMBER OF CREW USING OXYGEN		
°C	°F	2	3	4
50	122	735	1055	1360
45	113	725	1040	1340
40	104	715	1020	1320
35	95	700	1005	1300
30	86	690	990	1280
25	77	680	975	1255
20	68	670	960	1240
15	59	655	940	1215
10	50	645	925	1195
5	41	635	910	1175
0	32	620	890	1150
-5	23	610	875	1130
-10	14	600	860	1110

Required Pressure (PSI) for 114/115 Cubic Ft. Cylinder (YA707-YV754)

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

ENGINE INOP

MAX CONTINUOUS THRUST

Net Level Off Weight

PRESSURE ALTITUDE (1000 FT)	LEVEL OFF WEIGHT (1000 KG)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
30	44.3	42.9	41.4
28	47.9	46.3	44.7
26	51.7	49.9	48.3
24	56.0	54.1	52.2
22	61.0	58.8	56.7
20	66.3	63.9	61.4
18	71.2	68.5	65.6
16	76.0	73.3	70.3
14	80.4	77.7	75.1
12	85.1	82.1	78.9

Anti-Ice Adjustments

ANTI-ICE CONFIGURATION	LEVEL OFF WEIGHT ADJUSTMENT (1000 KG)								
	PRESSURE ALTITUDE (1000 FT)								
	12	14	16	18	20	22	24	26	28
ENGINE ONLY	-2.0	-1.9	-1.8	-1.8	-1.6	-1.5	-1.4	-1.3	-1.2
ENGINE & WING	-7.8	-7.3	-6.8	-6.8	-6.6	-6.0	-5.4	-5.0	

Performance Dispatch — Chapter PD
Landing — Section 52

Landing Field Limit Weight - Dry Runway

Flaps 40

Based on anti-skid operative and automatic speedbrakes

Wind Corrected Field Length (M)

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1200			1090	1200	1270	1350	1420	1500
1400	1060	1160	1270	1400	1480	1560	1640	1720
1600	1240	1340	1460	1600	1680	1770	1850	1940
1800	1420	1520	1650	1800	1890	1980	2070	2170
2000	1600	1710	1840	2000	2090	2190	2290	2390
2200	1770	1890	2030	2200	2300	2400	2500	2610
2400	1950	2070	2220	2400	2500	2610	2720	2830
2600	2110	2250	2380	2600	2710	2820	2930	3050
2800	2210	2350	2530	2800	2910	3030	3150	3280
3000	2300	2450	2680	3000	3120	3240	3360	3500
3200	2390	2540	2840	3200	3320	3450	3580	
3400	2480	2630	2990	3400	3530			
3600	2570	2730	3140	3600				
3800	2660	2820	3290					
4000	2750	2910	3450					
4200	2850	3000	3600					
4400	2940	3100						
4600	3030	3190						
4800	3120	3280						
5000	3210	3380						

Field Limit Weight (1000 KG)

WIND CORR'D FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
1200	46.2	43.6	41.1	38.7		
1400	56.0	53.2	50.2	47.3	44.5	41.8
1600	64.0	61.1	58.3	55.6	52.7	49.5
1800	72.7	69.0	65.5	62.5	59.5	56.7
2000	81.8	77.5	73.5	69.7	66.0	62.8
2200		85.6	81.6	77.3	73.2	69.2
2400			88.1	84.8	80.4	75.9
2600					85.9	81.9
2800						85.3

Decrease field limit weight by 4350 kg when using manual speedbrakes.

Landing Field Limit Weight - Dry Runway

Flaps 40

Based on anti-skid inoperative and manual speedbrakes

Wind Corrected Field Length (M)

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1200				1200	1350	1470	1650	1770
1400			1170	1400	1560	1680	1860	1990
1600		1130	1370	1600	1760	1890	2070	2210
1800	1080	1320	1560	1800	1960	2100	2290	2430
2000	1260	1500	1750	2000	2170	2310	2500	2650
2200	1440	1690	1950	2200	2370	2520	2710	2870
2400	1620	1880	2140	2400	2570	2730	2920	3090
2600	1800	2060	2330	2600	2780	2940	3130	3310
2800	1980	2250	2520	2800	2980	3150	3340	3530
3000	2160	2440	2720	3000	3180	3360	3550	3750
3200	2340	2620	2910	3200	3390	3580	3760	3970
3400	2520	2810	3100	3400	3590	3790	3970	4190
3600	2700	3000	3300	3600	3790	4000	4180	4410
3800	2890	3180	3490	3800	4000	4210	4400	4630
4000	3070	3370	3680	4000	4200	4420	4610	4850
4200	3250	3560	3870	4200	4400	4630	4820	5070
4400	3430	3750	4070	4400	4610	4840	5030	5290
4600	3610	3930	4260	4600	4810	5050	5240	5510
4800	3790	4120	4450	4800	5020	5260	5450	5730
5000	3970	4310	4650	5000	5220	5470	5660	5950

Field Limit Weight (1000 KG)

WIND CORR'D FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
2200	41.8	39.1				
2400	46.6	43.7	40.3			
2600	51.4	48.2	44.7	41.8	39.1	
2800	56.2	52.8	49.0	45.9	43.0	40.0
3000	60.9	57.3	53.3	50.0	46.8	43.7
3200	65.8	61.8	57.6	54.1	50.7	47.4
3400	71.2	66.5	61.9	58.2	54.6	51.1
3600	76.6	71.6	66.3	62.3	58.4	54.7
3800	82.2	76.8	71.2	66.5	62.3	58.4
4000	87.8	82.1	76.1	71.1	66.2	62.0
4200		87.4	81.1	75.7	70.6	65.7
4400			86.1	80.4	74.9	69.8
4600				85.1	79.4	73.9
4800					83.8	77.9
5000						82.0
5200						86.0

Landing Field Limit Weight - Wet Runway

Flaps 40

Based on anti-skid operative and automatic speedbrakes

Wind Corrected Field Length (M)

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1200				1200	1280	1360	1440	1530
1400			1270	1400	1480	1570	1660	1750
1600	1220	1330	1460	1600	1690	1780	1870	1970
1800	1390	1510	1640	1800	1890	1990	2090	2190
2000	1570	1690	1830	2000	2100	2200	2300	2410
2200	1750	1870	2020	2200	2300	2410	2520	2630
2400	1920	2050	2210	2400	2510	2620	2740	2860
2600	2100	2230	2400	2600	2710	2830	2950	3080
2800	2280	2420	2590	2800	2920	3040	3170	3300
3000	2440	2600	2740	3000	3120	3250	3380	3520
3200	2530	2700	2900	3200	3330	3460	3600	3740
3400	2620	2790	3050	3400	3530	3670	3820	3970
3600	2710	2880	3200	3600	3740	3880	4030	
3800	2800	2980	3350	3800	3940	4090		
4000	2890	3070	3510	4000				
4200	2980	3160	3660					
4400	3080	3250	3810					
4600	3170	3350	3960					
4800	3260	3440	4120					
5000	3350	3530						

Field Limit Weight (1000 KG)

WIND CORR'D FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
1200	38.4					
1400	47.1	44.5	41.9	39.5		
1600	55.6	52.8	49.8	46.9	44.1	41.5
1800	62.6	59.8	57.1	54.4	51.2	48.2
2000	70.0	66.5	63.3	60.4	57.6	54.8
2200	77.8	73.8	70.0	66.4	63.2	60.1
2400	85.3	81.3	77.0	73.0	69.1	65.4
2600		87.5	84.0	79.6	75.4	71.3
2800				85.7	81.6	77.1
3000					86.0	82.1
3200						85.0
3400						88.0

Decrease field limit weight by 4350 kg when using manual speedbrakes.

Landing Field Limit Weight - Wet Runway

Flaps 40

Based on anti-skid inoperative and manual speedbrakes

Wind Corrected Field Length (M)

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1200				1200	1370	1500	1710	1840
1400				1400	1580	1710	1920	2060
1600			1340	1600	1780	1920	2130	2280
1800		1260	1530	1800	1980	2130	2340	2500
2000	1180	1450	1730	2000	2190	2340	2550	2720
2200	1360	1640	1920	2200	2390	2550	2760	2940
2400	1540	1820	2110	2400	2590	2760	2980	3160
2600	1720	2010	2310	2600	2800	2970	3190	3380
2800	1900	2200	2500	2800	3000	3180	3400	3600
3000	2080	2380	2690	3000	3200	3390	3610	3820
3200	2260	2570	2880	3200	3410	3610	3820	4040
3400	2440	2760	3080	3400	3610	3820	4030	4260
3600	2620	2940	3270	3600	3810	4030	4240	4480
3800	2800	3130	3460	3800	4020	4240	4450	4700
4000	2980	3320	3660	4000	4220	4450	4660	4920
4200	3160	3500	3850	4200	4420	4660	4880	5140
4400	3350	3690	4040	4400	4630	4870	5090	5360
4600	3530	3880	4230	4600	4830	5080	5300	5580
4800	3710	4060	4430	4800	5040	5290	5510	5800
5000	3890	4250	4620	5000	5240	5500	5720	6020

Field Limit Weight (1000 KG)

WIND CORR'D FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
2400	39.0					
2600	43.2	40.5				
2800	47.4	44.5	41.1	38.4		
3000	51.6	48.4	44.9	42.0	39.2	
3200	55.7	52.4	48.6	45.6	42.6	39.7
3400	59.9	56.3	52.4	49.2	46.0	42.9
3600	64.1	60.3	56.2	52.7	49.4	46.1
3800	68.6	64.2	59.9	56.3	52.7	49.3
4000	73.3	68.5	63.6	59.8	56.1	52.5
4200	78.1	73.0	67.6	63.3	59.4	55.7
4400	82.9	77.5	71.9	67.0	62.8	58.8
4600	87.8	82.1	76.1	71.1	66.2	62.0
4800		86.7	80.5	75.1	70.0	65.2
5000			84.8	79.2	73.8	68.7
5200				83.3	77.6	72.3
5400				87.4	81.5	75.8
5600					85.4	79.3
5800						82.8
6000						86.4

Landing Climb Limit Weight

Valid for approach with flaps 15 and landing with flaps 40

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

AIRPORT OAT		LANDING CLIMB LIMIT WEIGHT (1000 KG)												
		AIRPORT PRESSURE ALTITUDE (FT)												
°C	°F	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
54	129	68.6	66.6	64.5										
52	126	69.8	68.3	66.2	63.6									
50	122	71.1	69.6	67.9	65.2	62.6								
48	118	72.4	70.9	69.2	66.9	64.2	61.6							
46	115	73.9	72.3	70.5	68.1	65.8	63.2	60.6						
44	111	75.2	73.6	71.7	69.3	67.0	64.7	62.1	59.6					
42	108	76.5	74.9	73.0	70.5	68.2	65.8	63.6	61.0	58.3				
40	104	77.8	76.2	74.3	71.8	69.4	67.0	64.7	62.5	59.6	56.9			
38	100	79.1	77.5	75.6	73.1	70.6	68.2	65.8	63.6	60.9	58.0	55.5		
36	97	80.4	78.8	76.9	74.5	71.8	69.5	67.1	64.7	62.1	59.2	56.5	54.1	
34	93	81.6	80.1	78.3	75.8	73.2	70.7	68.3	65.8	63.1	60.3	57.4	55.2	52.7
32	90	81.7	81.4	79.7	77.0	74.5	71.8	69.4	66.8	64.1	61.3	58.5	56.2	53.8
30	86	81.8	81.5	81.1	78.2	75.6	72.8	70.2	67.8	65.1	62.3	59.5	57.1	54.8
28	82	81.9	81.6	81.2	79.3	76.6	73.7	71.1	68.4	66.0	63.2	60.4	58.1	55.7
26	79	82.0	81.7	81.2	79.4	77.5	74.5	71.8	69.1	66.5	64.1	61.3	58.8	56.6
24	75	82.1	81.7	81.3	79.5	77.6	75.2	72.4	69.6	67.0	64.5	62.1	59.6	57.2
22	72	82.1	81.8	81.4	79.5	77.6	75.3	72.9	70.2	67.5	65.0	62.6	60.2	57.7
20	68	82.2	81.9	81.4	79.6	77.7	75.3	72.9	70.7	68.0	65.4	63.0	60.6	58.2
18	64	82.3	81.9	81.5	79.6	77.7	75.4	73.0	70.7	68.5	65.9	63.4	61.0	58.6
16	61	82.3	82.0	81.6	79.7	77.8	75.4	73.0	70.8	68.5	66.3	63.8	61.4	59.0
14	57	82.4	82.1	81.6	79.7	77.8	75.4	73.1	70.8	68.6	66.3	64.2	61.7	59.4
12	54	82.5	82.1	81.7	79.8	77.9	75.5	73.1	70.8	68.6	66.4	64.2	62.1	59.7
10	50	82.5	82.2	81.7	79.8	77.9	75.5	73.1	70.9	68.6	66.4	64.2	62.1	60.0
-40	-40	83.2	82.9	82.3	80.4	78.5	76.0	73.7	71.4	69.1	65.9	64.6	62.6	60.6

With engine bleeds for packs off, increase weight by 1250 kg.
With engine anti-ice on, decrease weight by 250 kg.
With engine and wing anti-ice on, decrease weight by 1400 kg.
When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 7350 kg.

ENGINE INOP

ADVISORY INFORMATION

Go-Around Climb Gradient

Flaps 15

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

OAT (°C)	REFERENCE GO-AROUND GRADIENT (%)					
	PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
54	2.91					
50	3.58	2.52				
46	4.09	3.17	2.12			
42	4.60	3.64	2.72	1.66		
38	5.12	4.11	3.16	2.18	1.09	
34	5.64	4.62	3.63	2.62	1.48	0.55
30	6.19	5.08	4.02	2.99	1.89	0.97
26	6.22	5.44	4.31	3.27	2.24	1.30
22	6.25	5.46	4.53	3.46	2.48	1.53
18	6.27	5.48	4.54	3.63	2.64	1.70
14	6.30	5.50	4.55	3.65	2.78	1.84
10	6.32	5.51	4.57	3.66	2.79	1.97
6	6.34	5.53	4.58	3.67	2.80	1.99
2	6.36	5.54	4.59	3.68	2.81	2.00

Gradient Adjustment for Weight (%)

WEIGHT (1000 KG)	REFERENCE GO-AROUND GRADIENT (%)							
	0	1	2	3	4	5	6	7
85	-2.90	-3.11	-3.43	-3.78	-4.09	-4.40	-4.72	-5.04
80	-2.43	-2.67	-2.95	-3.24	-3.51	-3.77	-4.05	-4.32
75	-1.93	-2.14	-2.37	-2.60	-2.81	-3.03	-3.25	-3.47
70	-1.38	-1.54	-1.70	-1.86	-2.02	-2.17	-2.33	-2.49
65	-0.75	-0.83	-0.92	-1.01	-1.09	-1.18	-1.26	-1.34
60	0	0	0	0	0	0	0	0
55	0.88	0.98	1.08	1.18	1.29	1.39	1.49	1.59
50	1.96	2.16	2.37	2.60	2.82	3.05	3.29	3.54
45	3.22	3.53	3.86	4.23	4.59	4.98	5.41	5.88
40	4.67	5.09	5.55	6.09	6.60	7.18	7.85	8.59

Gradient Adjustment for Speed (%)

SPEED (KIAS)	WEIGHT ADJUSTED GO-AROUND GRADIENT (%)													
	0	1	2	3	4	5	6	7	8	9	10	11	12	13
VREF40	-0.17	-0.16	-0.17	-0.17	-0.18	-0.18	-0.19	-0.19	-0.19	-0.19	-0.19	-0.19	-0.19	-0.18
VREF40+5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VREF40+10	0.11	0.10	0.10	0.10	0.10	0.10	0.09	0.09	0.09	0.08	0.08	0.07	0.07	0.08
VREF40+15	0.18	0.16	0.14	0.13	0.12	0.12	0.11	0.10	0.09	0.08	0.07	0.06	0.06	0.05
VREF40+20	0.20	0.16	0.13	0.11	0.09	0.07	0.06	0.04	0.03	0.01	-0.01	-0.03	-0.04	-0.05
VREF40+25	0.17	0.12	0.08	0.04	0.00	-0.03	-0.06	-0.08	-0.10	-0.13	-0.16	-0.19	-0.21	-0.23
VREF40+30	0.10	0.04	-0.02	-0.08	-0.13	-0.18	-0.22	-0.26	-0.29	-0.33	-0.36	-0.40	-0.44	-0.48

With engine bleed for packs off, increase gradient by 0.2%.
With engine anti-ice on, decrease gradient by 0.1%.
With engine and wing anti-ice on, decrease gradient by 0.3%.
When operating in icing conditions during any part of the flight with forecast landing temperatures below 10°C decrease gradient by 1.0%.

Quick Turnaround Limit Weight - Category C Steel Brakes

(Note: A placard showing carbon brakes configuration will be put at the Center Forward Panel upon modification.)

Flaps 40

AIRPORT OAT (°C)	LIMIT WEIGHT (1000 KG)					
	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
54	79.6					
50	80.2	77.2				
45	80.9	77.8	74.8			
40	81.6	78.5	75.4	72.4		
35	82.3	79.2	76.1	73.1	70.1	
30	83.0	79.9	76.7	73.7	70.8	67.9
25	83.8	80.6	77.4	74.4	71.4	68.5
20	84.6	81.3	78.1	75.1	72.1	69.1
15	85.4	82.1	78.9	75.8	72.7	69.8
10	86.1	82.9	79.6	76.5	73.4	70.4
5	86.1	83.7	80.4	77.2	74.1	71.1
0	86.1	84.5	81.2	78.0	74.9	71.8
-5	86.1	85.4	82.0	78.8	75.6	72.5
-10	86.1	86.1	82.8	79.6	76.4	73.3
-15	86.1	86.1	83.7	80.4	77.2	74.0
-20	86.1	86.1	84.6	81.2	78.0	74.8
-30	86.1	86.1	86.1	83.0	79.7	76.4
-40	86.1	86.1	86.1	84.9	81.5	78.1
-50	86.1	86.1	86.1	86.1	83.4	79.9
-54	86.1	86.1	86.1	86.1	84.1	80.7

Increase weight by 700 kg per 1% uphill slope. Decrease weight by 1200 kg per 1% downhill slope.
Increase weight by 1850 kg per 10 knots headwind. Decrease weight by 7750 kg per 10 knots tailwind.
After landing at weights exceeding those shown above, adjusted for slope and wind, wait at least 67 minutes and check that wheel thermal plugs have not melted before executing a subsequent takeoff.

As an alternate procedure, ensure that each brake pressure plate surface temperature, without artificial cooling, is less than 218°C as follows: No sooner than 10 and no later than 15 minutes after parking, measure each brake pressure plate surface temperature at a minimum of two points per brake by an accurate method (using a Doric Microtemp 450 hand held thermometer or equivalent, hold temperature probe in place for 20 seconds or until reading stabilizes). If each measured temperature is less than 218°C, immediate dispatch is allowed; otherwise the required minimum ground wait period of 67 minutes applies.

If a Brake Temperature Monitoring System (BTMS) is installed:

No sooner than 10 and no later than 15 minutes after parking, check the BRAKE TEMP light. If the BRAKE TEMP light is not on, no ground waiting period is required. If the BRAKE TEMP light is on, do not dispatch until at least 67 minutes after landing, or until all the BTMS readings on the systems Display are below 3.5 and the BRAKE TEMP light is off. Check that wheel thermal plugs have not melted before making a subsequent takeoff.
Note: If any brake temperature display digit is blank or indicates 0.0 or 0.1, then this method cannot be used.

Quick Turnaround Limit Weight - Category N Carbon Brakes

Flaps 40

OAT		LIMIT WEIGHT (1000 KG)					
		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	0	2000	4000	6000	8000	10000
54	129	73.5					
50	122	74.0	71.2				
45	113	74.6	71.8	69.0			
40	104	75.2	72.4	69.6	66.9		
35	95	75.9	73.0	70.2	67.4	64.8	
30	86	76.6	73.7	70.8	68.0	65.3	62.8
25	77	77.3	74.3	71.4	68.6	65.9	63.3
20	68	78.0	75.0	72.1	69.3	66.5	63.9
15	59	78.7	75.7	72.8	69.9	67.1	64.4
10	50	79.4	76.4	73.5	70.6	67.8	65.0
5	41	80.2	77.2	74.2	71.3	68.4	65.6
0	32	81.0	77.9	74.9	72.0	69.1	66.3
-5	23	81.8	78.7	75.6	72.7	69.8	66.9
-10	14	82.6	79.5	76.4	73.4	70.5	67.6
-15	5	83.4	80.3	77.2	74.2	71.2	68.3
-20	-4	84.3	81.1	78.0	74.9	71.9	69.0
-30	-22	86.1	82.9	79.7	76.6	73.5	70.5
-40	-40	86.1	84.7	81.5	78.3	75.2	72.1
-50	-58	86.1	86.1	83.4	80.1	77.0	73.8
-54	-65	86.1	86.1	84.1	80.9	77.7	74.5

**Increase weight by 650 kg per 1% uphill slope. Decrease weight by 1200 kg per 1% downhill slope.
Increase weight by 1550 kg per 10 knots headwind. Decrease weight by 8350 kg per 10 knots tailwind.
After landing at weights exceeding those shown above, adjusted for slope and wind, wait at least 48 minutes and check that wheel thermal plugs have not melted before executing a takeoff.**

If a Brake Temperature Monitoring System (BTMS) is installed:

**No sooner than 10 and no later than 15 minutes after parking, check the BRAKE TEMP light. If the BRAKE TEMP light is not on, no ground waiting period is required. If the BRAKE TEMP light is on, do not dispatch until at least 48 minutes after landing, or until all the BTMS readings on the systems Display are below 3.0 and the BRAKE TEMP light is off. Check that wheel thermal plugs have not melted before making a subsequent takeoff.
Note: If any brake temperature display digit is blank or indicates 0.0 or 0.1, then this method cannot be used.**

GEAR DOWN

Takeoff Climb Limit Weight

Flaps 5

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

AIRPORT OAT		TAKEOFF CLIMB WEIGHT (1000 KG)					
		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	0	2000	4000	6000	8000	10000
54	129	60.9	57.5	54.3	50.7	46.2	
52	126	62.2	57.5	54.3	51.1	47.0	
50	122	63.5	57.8	54.3	51.1	47.6	43.3
48	118	64.9	59.1	54.2	51.0	47.6	44.1
46	115	66.3	60.4	54.6	51.0	47.6	44.8
44	111	67.7	61.7	55.9	51.0	47.6	44.8
42	108	69.0	63.0	57.2	51.3	47.5	44.8
40	104	70.4	64.3	58.4	52.6	47.5	44.8
38	100	71.6	65.5	59.7	53.9	47.9	44.8
36	97	72.8	66.8	60.9	55.1	49.1	44.7
34	93	74.1	68.0	62.1	56.3	50.3	45.1
32	90	75.5	69.3	63.3	57.5	51.5	46.3
30	86	76.7	70.7	64.5	58.7	52.8	47.5
28	82	76.8	72.3	65.7	59.9	54.0	48.7
26	79	76.9	73.2	67.1	61.1	55.2	49.9
24	75	76.9	73.3	68.4	62.3	56.5	51.1
22	72	77.0	73.3	68.9	63.6	57.7	52.4
20	68	77.1	73.4	68.9	64.3	58.8	53.5
18	64	77.1	73.4	68.9	64.6	59.9	54.7
16	61	77.2	73.5	69.0	64.7	60.3	55.7
14	57	77.2	73.5	69.0	64.7	60.6	56.1
12	54	77.3	73.5	69.0	64.7	60.6	56.4
10	50	77.3	73.6	69.1	64.7	60.6	56.7

With engine bleeds for packs off, increase weight by 300 kg.
With engine anti-ice on, decrease weight by 250 kg.
With engine and wing anti-ice on, decrease weight by 1250 kg (optional system).

GEAR DOWN

Landing Climb Limit Weight

Valid for approach with Flaps 15 and Landing with Flaps 40

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

AIRPORT OAT		LANDING CLIMB LIMIT WEIGHT (1000 KG)					
		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	0	2000	4000	6000	8000	10000
54	129	56.4					
52	126	57.9					
50	122	59.4	54.8				
48	118	60.5	56.2				
46	115	61.6	57.6	53.0			
44	111	62.6	58.6	54.3			
42	108	63.7	59.6	55.6	51.0		
40	104	64.8	60.6	56.6	52.2		
38	100	66.0	61.7	57.6	53.3	48.6	
36	97	67.1	62.7	58.6	54.3	49.4	
34	93	68.3	63.9	59.7	55.2	50.2	46.1
32	90	69.6	65.0	60.6	56.1	51.2	47.1
30	86	70.7	65.9	61.3	56.9	52.0	48.0
28	82	70.8	66.7	62.0	57.6	52.8	48.7
26	79	70.9	67.5	62.6	58.1	53.6	49.5
24	75	71.0	67.6	63.1	58.5	54.3	50.0
22	72	71.0	67.6	63.6	58.9	54.7	50.4
20	68	71.1	67.7	63.6	59.4	55.0	50.9
18	64	71.1	67.7	63.6	59.7	55.3	51.2
16	61	71.2	67.8	63.7	59.8	55.7	51.5
14	57	71.2	67.8	63.7	59.8	56.0	51.8
12	54	71.3	67.8	63.7	59.8	56.0	52.1
10	50	71.3	67.9	63.7	59.8	56.0	52.4
-40	-40	71.8	68.3	64.2	60.2	56.4	52.9

With engine bleed for packs off, increase weight by 1150 kg.
With engine anti-ice on, decrease weight by 200 kg.
With engine and wing anti-ice on, decrease weight by 1250 kg.
When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 7600 kg.

GEAR DOWN

Takeoff Obstacle Limit Weight

Flaps 5

Sea Level, 30°C & Below, Zero Wind

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

Reference Obstacle Limit Weight (1000 KG)

OBSTACLE HEIGHT (M)	DISTANCE FROM BRAKE RELEASE (100 M)										
	25	30	35	40	45	50	55	60	65	70	75
5	74.3										
20	67.6	72.5	75.8	78.0							
40	62.1	66.8	70.4	73.1	75.3	76.9	78.1				
60	58.1	62.6	66.3	69.2	71.5	73.4	75.0	76.2	77.2	78.1	
80	54.8	59.3	62.9	65.9	68.4	70.4	72.1	73.5	74.7	75.8	76.6
100	52.0	56.5	60.1	63.1	65.7	67.8	69.6	71.1	72.4	73.6	74.6
120	49.5	54.0	57.7	60.7	63.3	65.4	67.3	68.9	70.3	71.6	72.6
140	47.3	51.8	55.5	58.5	61.1	63.4	65.3	67.0	68.4	69.7	70.9
160	45.3	49.8	53.5	56.6	59.2	61.5	63.4	65.1	66.6	68.0	69.2
180	43.4	48.0	51.6	54.7	57.4	59.7	61.7	63.4	65.0	66.4	67.6
200		46.3	49.9	53.1	55.7	58.1	60.1	61.9	63.5	64.9	66.2
220		44.7	48.4	51.5	54.2	56.5	58.6	60.4	62.0	63.5	64.8
240		43.2	46.9	50.0	52.7	55.1	57.2	59.0	60.7	62.1	63.5
260		41.9	45.5	48.7	51.4	53.8	55.9	57.7	59.4	60.9	62.2
280			44.2	47.4	50.1	52.5	54.6	56.5	58.2	59.7	61.1
300			43.0	46.2	48.9	51.3	53.4	55.3	57.0	58.5	59.9

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

OAT Adjustments

OAT (°C)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 KG)							
	40	45	50	55	60	65	70	75
30 & BELOW	0	0	0	0	0	0	0	0
32	-0.6	-0.7	-0.8	-0.9	-1.0	-1.1	-1.2	-1.3
34	-1.3	-1.5	-1.7	-1.9	-2.1	-2.3	-2.4	-2.6
36	-1.9	-2.2	-2.5	-2.8	-3.1	-3.4	-3.7	-4.0
38	-2.6	-2.9	-3.3	-3.7	-4.1	-4.5	-4.9	-5.3
40	-3.1	-3.6	-4.1	-4.5	-5.0	-5.5	-6.0	-6.4
42	-3.6	-4.2	-4.8	-5.3	-5.9	-6.5	-7.0	-7.6
44	-4.2	-4.9	-5.5	-6.2	-6.8	-7.5	-8.1	-8.8
46	-4.9	-5.6	-6.4	-7.1	-7.8	-8.5	-9.2	-10.0
48	-5.6	-6.4	-7.2	-8.0	-8.8	-9.6	-10.4	-11.2
50	-6.2	-7.1	-8.0	-8.9	-9.8	-10.6	-11.5	-12.4

GEAR DOWN

Takeoff Obstacle Limit Weight

Flaps 5

Sea Level, 30°C & Below, Zero Wind

Pressure Altitude Adjustments

ALT (FT)	OAT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)							
	40	45	50	55	60	65	70	75
S.L. & BELOW	0	0	0	0	0	0	0	0
1000	-1.6	-1.8	-2.0	-2.2	-2.4	-2.6	-2.8	-2.9
2000	-3.2	-3.6	-4.0	-4.4	-4.8	-5.1	-5.5	-5.9
3000	-4.1	-4.7	-5.3	-5.9	-6.5	-7.1	-7.7	-8.3
4000	-5.0	-5.8	-6.6	-7.4	-8.2	-9.1	-9.9	-10.7
5000	-6.5	-7.5	-8.4	-9.4	-10.3	-11.3	-12.2	-13.2
6000	-8.0	-9.1	-10.2	-11.3	-12.4	-13.5	-14.6	-15.7
7000	-9.4	-10.6	-11.8	-13.0	-14.2	-15.5	-16.7	-17.9
8000	-10.8	-12.1	-13.4	-14.8	-16.1	-17.5	-18.8	-20.2
9000	-11.6	-13.2	-14.7	-16.3	-17.8	-19.4	-20.9	-22.5
10000	-12.5	-14.2	-16.0	-17.8	-19.5	-21.2	-23.0	-24.8

Wind Adjustments

WIND (KTS)	OAT & ALT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)							
	40	45	50	55	60	65	70	75
15 TW	-9.0	-8.7	-8.5	-8.2	-7.9	-7.6	-7.4	-7.1
10 TW	-6.0	-5.8	-5.6	-5.5	-5.3	-5.1	-4.9	-4.7
5 TW	-3.0	-2.9	-2.8	-2.7	-2.6	-2.5	-2.5	-2.4
0	0	0	0	0	0	0	0	0
10 HW	0.9	0.8	0.8	0.7	0.6	0.6	0.5	0.4
20 HW	1.8	1.6	1.5	1.4	1.2	1.1	1.0	0.9
30 HW	2.8	2.6	2.4	2.2	2.0	1.8	1.6	1.4
40 HW	3.8	3.5	3.2	3.0	2.8	2.5	2.2	2.0

With engine bleed for packs off, increase weight by 250 kg.
With engine anti-ice on, decrease weight by 250 kg.
With engine and wing anti-ice on, decrease weight by 5850 kg (optional system).

GEAR DOWN

Long Range Cruise Altitude Capability

Max Cruise Thrust, 100 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
85	15600	12500	9400
80	18400	15500	12600
75	21100	18500	15700
70	23600	21400	18600
65	26100	24400	21800
60	28600	27100	25300
55	30800	29600	28100
50	32900	31900	30700
45	35100	34100	33000
40	37500	36500	35400

GEAR DOWN

Long Range Cruise Trip Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
340	300	266	239	218	200	187	174	164	155	147
508	449	399	359	328	300	280	262	246	233	221
675	597	531	479	437	400	374	350	329	311	295
841	745	662	598	545	500	467	438	412	389	369
1006	892	794	717	654	600	561	526	495	468	444
1170	1038	925	835	763	700	655	614	578	546	518
1332	1183	1055	954	872	800	749	703	661	625	593
1494	1328	1185	1072	980	900	843	791	745	704	668
1655	1472	1315	1190	1089	1000	937	879	828	783	743
1814	1615	1444	1308	1197	1100	1031	968	911	862	818
1973	1758	1573	1426	1305	1200	1125	1056	995	941	894
2131	1900	1701	1543	1413	1300	1218	1145	1079	1020	969
2288	2041	1829	1660	1521	1400	1313	1233	1162	1100	1045
2444	2182	1957	1777	1629	1500	1407	1322	1246	1179	1121
2599	2323	2084	1894	1737	1600	1501	1411	1330	1259	1197
2754	2463	2212	2011	1845	1700	1595	1500	1414	1339	1273
2907	2602	2338	2127	1953	1800	1689	1589	1499	1419	1350
3060	2741	2465	2243	2060	1900	1784	1678	1583	1499	1426
3212	2879	2591	2359	2168	2000	1878	1767	1668	1580	1503

Reference Fuel and Time Required

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		20		24		28	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	2.6	0:53	2.5	0:51	2.3	0:49	2.2	0:48	2.2	0:47
300	3.8	1:18	3.6	1:14	3.3	1:10	3.2	1:08	3.1	1:05
400	5.0	1:42	4.7	1:37	4.4	1:31	4.2	1:27	4.0	1:24
500	6.3	2:06	5.9	2:00	5.4	1:52	5.1	1:47	5.0	1:43
600	7.6	2:30	7.1	2:22	6.5	2:13	6.1	2:06	5.9	2:01
700	8.9	2:53	8.3	2:44	7.5	2:33	7.1	2:25	6.9	2:19
800	10.2	3:16	9.5	3:06	8.6	2:53	8.1	2:44	7.8	2:37
900	11.5	3:39	10.7	3:28	9.7	3:13	9.2	3:03	8.8	2:56
1000	12.8	4:02	11.9	3:50	10.8	3:33	10.2	3:23	9.7	3:14
1100	14.2	4:24	13.2	4:11	11.9	3:53	11.2	3:41	10.8	3:31
1200	15.5	4:46	14.5	4:32	13.1	4:12	12.3	3:59	11.8	3:49
1300	16.9	5:08	15.8	4:53	14.2	4:31	13.4	4:18	12.8	4:07
1400	18.3	5:30	17.0	5:14	15.4	4:51	14.4	4:36	13.8	4:25
1500	19.6	5:52	18.3	5:35	16.5	5:10	15.5	4:55	14.9	4:42
1600	21.1	6:13	19.7	5:55	17.7	5:29	16.6	5:13		
1700	22.5	6:34	21.0	6:15	18.9	5:48	17.8	5:31		
1800	24.0	6:55	22.4	6:35	20.1	6:06	18.9	5:48		
1900	25.4	7:16	23.7	6:55	21.3	6:25	20.0	6:06		
2000	26.9	7:37	25.1	7:16	22.5	6:44	21.1	6:24		

GEAR DOWN

Long Range Cruise Trip Fuel and Time

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	LANDING WEIGHT (1000 KG)						
	40	45	50	55	60	65	70
2	-0.2	-0.1	0.0	0.1	0.3	0.4	0.5
4	-0.4	-0.2	0.0	0.2	0.5	0.7	1.0
6	-0.6	-0.3	0.0	0.4	0.7	1.1	1.4
8	-0.8	-0.4	0.0	0.5	0.9	1.4	1.8
10	-1.0	-0.5	0.0	0.6	1.1	1.7	2.3
12	-1.1	-0.6	0.0	0.7	1.4	2.0	2.7
14	-1.3	-0.7	0.0	0.8	1.6	2.4	3.2
16	-1.5	-0.8	0.0	0.9	1.8	2.7	3.6
18	-1.7	-0.9	0.0	1.0	2.0	3.0	4.0
20	-1.9	-0.9	0.0	1.1	2.2	3.3	4.5
22	-2.1	-1.0	0.0	1.2	2.4	3.7	4.9
24	-2.3	-1.1	0.0	1.3	2.6	4.0	5.3
26	-2.4	-1.2	0.0	1.4	2.9	4.3	5.8
28	-2.6	-1.3	0.0	1.5	3.1	4.6	6.2

Based on VREF40 + 70 climb, Long Range Cruise and VREF40 + 70 descent.

GEAR DOWN

Holding Planning

Flaps Up

WEIGHT (1000 KG)	TOTAL FUEL FLOW (KG/HR)						
	PRESSURE ALTITUDE (FT)						
	1500	5000	10000	15000	20000	25000	30000
80	4240	4210	4190	4210	4220		
75	4000	3970	3940	3940	3950	4100	
70	3770	3730	3700	3690	3680	3750	
65	3550	3500	3470	3440	3430	3460	
60	3310	3260	3220	3190	3170	3180	3340
55	3090	3030	2990	2950	2920	2920	3000
50	2860	2810	2760	2720	2670	2660	2710
45	2630	2590	2540	2490	2440	2420	2450
40	2400	2360	2320	2270	2220	2180	2200

This table includes 5% additional fuel for holding in a racetrack pattern.

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Net Level Off Weight

PRESSURE ALTITUDE (1000 FT)	LEVEL OFF WEIGHT (1000 KG)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
22	42.9	41.7	
20	46.4	45.1	43.8
18	50.0	48.4	46.7
16	53.6	51.7	49.8
14	56.8	55.1	53.3
12	60.5	58.5	56.2
10	64.1	61.9	59.1
8	68.1	65.6	62.6
6	72.1	69.2	66.0
4	75.9	72.7	69.2
2	79.5	76.1	72.6
0	82.9	79.3	75.9

Anti-Ice Adjustments

ANTI-ICE CONFIGURATION	LEVEL OFF WEIGHT ADJUSTMENT (1000 KG)				
	PRESSURE ALTITUDE (1000 FT)				
	2	6	10	14	18
ENGINE ONLY	-1.7	-1.3	-1.5	-1.5	-1.3
ENGINE AND WING	-6.6	-5.9	-5.6	-5.1	-4.9

Intentionally
Blank

Performance Dispatch Chapter PD

Text Section 54

Introduction

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

Takeoff

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

Brake Energy or Tire Speed Limit Weight tables are only provided if they are limiting for the range of conditions covered in the FCOM Section PD.

Field Limit Weight - Slope and Wind Corrections

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

Field and Climb Limit Weight

Tables are presented for selected airport pressure altitudes and runway conditions and show both Field and Climb Limit Weights. Enter the appropriate table for pressure altitude and runway condition with “Slope and Wind Corrected Field Length” determined above and airport OAT to obtain Field Limit Weight. Also read Climb Limit Weight for the same OAT. Intermediate altitudes may be interpolated or use next higher altitude. When finding a maximum weight for a wet runway, the dry runway limit weight must also be determined and the lower of the two weights used.

Obstacle Limit Weight

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

Tire Speed Limit

Tire Speed Limit Weight tables are only provided if they are limiting for the range of conditions covered in the FCOM Section PD.

Maximum tire speed limited weights are presented for 225 MPH tires. To determine the tire speed limit weight, enter the table with OAT and airport pressure altitude. Adjust the tire speed limit weight according to the notes below the table to account for wind.

Brake Energy Limit VMBE

Brake Energy Limit Weight tables are only provided if they are limiting for the range of conditions covered in the FCOM Section PD.

The Maximum Brake Energy Speed table provides the Reference VMBE for a variety of airport pressure altitudes and temperatures. Enter the Weight Adjusted VMBE table to adjust the Reference VMBE for the actual brake release gross weight. Correct VMBE for slope and wind. If V1 exceeds VMBE, decrease brake release weight as indicated for each knot that V1 exceeds VMBE and determine V1, VR, and V2 for the lower brake release weight.

Enroute

Long Range Cruise Maximum Operating Altitude

These tables provide the maximum operating altitude in the same manner as the FMC. Maximum altitudes are shown for a given cruise weight and maneuver capability. Note that this table considers both thrust and buffet limits, providing the more limiting of the two. Any data that is thrust limited is denoted by an asterisk and represents only a thrust limited condition in level flight with 100 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 15° may cause the airplane to lose speed and/or altitude. The altitudes shown in the table are limited to the maximum certified altitude of 41000 ft.

Long Range Cruise Trip Fuel and Time

Long Range Cruise Trip Fuel and Time tables are provided to determine trip time and fuel required to destination.

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

Long Range Cruise Step Climb Trip Fuel and Time

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

Short Trip Fuel and Time

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

Holding Planning

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

Flight Crew Oxygen Requirements

This airplane is equipped with a chemical passenger oxygen system. Regulations require that sufficient oxygen be provided to the flight crew to account for the greater of supplemental breathing oxygen in the event of a cabin depressurization or protective breathing in the event of smoke or harmful fumes in the flight deck. The oxygen quantity associated with the above requirements is achieved with the minimum dispatch oxygen cylinder pressure.

To determine the minimum dispatch oxygen cylinder pressure enter the appropriate flight crew oxygen table with the number of crew plus observers using oxygen and read the minimum cylinder pressure required for the appropriate cylinder temperature.

Net Level Off Weight

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

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

Landing

Tables are provided for determining the maximum landing weight as limited by field length or climb requirements for a single landing flap.

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

Landing Field Limit Weight

For the expected runway condition and anti-skid system configuration, obtain wind corrected field length by entering the Wind Corrected Field Length table with field length available and wind component along the runway. Now enter the Field Limit Weight table with wind corrected field length and pressure altitude to read field limit weight.

Landing Climb Limit Weight

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

Go-Around Climb Gradient

Enter the Reference Go-Around Gradient table with airport OAT and pressure altitude to determine the reference go-around gradient. Then adjust the reference gradient for airplane weight and speed using the tables provided to determine the weight and speed adjusted go-around gradient. Apply the necessary corrections for engine bleed configuration and icing conditions as noted.

Quick Turnaround Limit Weight

Enter the appropriate table (Steel or Carbon Brakes) with airport pressure altitude and OAT to read maximum quick turnaround weight. Apply the noted adjustments as required.

If the landing weight exceeds the maximum quick turnaround weight, wait the specified time and then check that the wheel thermal plugs have not melted before executing a subsequent takeoff. For Steel Brakes, the alternate procedures on the charts can be used to ensure the brake temperature is within limits. These procedures cannot be used for carbon brakes.

Gear Down

This section provides flight planning data for revenue operation with gear down. Unless otherwise noted, the gear down tables in this section are identical in format and usage to the corresponding gear up tables previously described.

To eliminate erroneous displays the flight crew should enter only gross weight data on the PERF INIT page of the Control Display Unit (CDU). Omission of the cost index and cruise altitude entries on the PERF INIT page will render the VNAV function unavailable during flight. As a result, the following information will not be provided: VNAV guidance and speed schedules, trip fuel and ETA predictions, optimum and maximum altitude data, step climb and top of descent predictions, and the VNAV descent guidance path.

The gross weight entry allows the FMCS takeoff and approach speed schedules to be generated. In addition, the flap maneuver speed and VREF speed bugs will be available for display on the primary flight display speed tape. Except for VNAV, normal autopilot and autothrottle modes will remain available for use during the flight, as will the LNAV mode.

Takeoff/Landing Climb Limit Weight

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

Performance Dispatch — Chapter PD

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737-800WSFP1 CFM56-7B26 C M KG FAA CATC/N (FMC Model 737-800W.1)

General

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

Serial and tabulation number are supplied by Boeing.

Registry Number	Serial Number	Tabulation Number
B-6887	43884	YV604
B-6889	43914	YV605

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Takeoff Field Corrections - Dry Runway

Slope Corrections

FIELD LENGTH AVAILABLE (M)	SLOPE CORRECTED FIELD LENGTH (M)								
	RUNWAY SLOPE (%)								
	-2.0	-1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	2.0
1200	1200	1200	1200	1200	1200	1190	1180	1160	1150
1400	1430	1420	1410	1410	1400	1380	1350	1330	1300
1600	1660	1640	1630	1610	1600	1560	1530	1490	1460
1800	1890	1870	1840	1820	1800	1750	1710	1660	1610
2000	2120	2090	2060	2030	2000	1940	1880	1820	1760
2200	2350	2310	2280	2240	2200	2130	2060	1990	1920
2400	2580	2540	2490	2450	2400	2320	2230	2150	2070
2600	2810	2760	2710	2650	2600	2510	2410	2320	2220
2800	3040	2980	2920	2860	2800	2690	2590	2480	2370
3000	3270	3210	3140	3070	3000	2880	2760	2640	2530
3200	3500	3430	3350	3280	3200	3070	2940	2810	2680
3400	3740	3650	3570	3480	3400	3260	3120	2970	2830
3600	3970	3870	3780	3690	3600	3450	3290	3140	2980
3800	4200	4100	4000	3900	3800	3630	3470	3300	3140
4000	4430	4320	4210	4110	4000	3820	3640	3470	3290
4200	4660	4540	4430	4310	4200	4010	3820	3630	3440
4400	4890	4770	4640	4520	4400	4200	4000	3800	3600
4600	5120	4990	4860	4730	4600	4390	4170	3960	3750
4800	5350	5210	5080	4940	4800	4580	4350	4130	3900
5000	5580	5440	5290	5150	5000	4760	4530	4290	4050

Wind Corrections

SLOPE CORR'D FIELD LENGTH (M)	SLOPE & WIND CORRECTED FIELD LENGTH (M)							
	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1200	890	990	1100	1200	1270	1340	1410	1480
1400	1050	1170	1280	1400	1470	1550	1630	1710
1600	1220	1350	1470	1600	1680	1760	1850	1930
1800	1390	1530	1660	1800	1890	1970	2060	2150
2000	1560	1710	1850	2000	2090	2180	2280	2380
2200	1730	1890	2040	2200	2300	2400	2500	2600
2400	1900	2070	2230	2400	2500	2610	2710	2820
2600	2070	2250	2420	2600	2710	2820	2930	3050
2800	2240	2430	2610	2800	2910	3030	3150	3270
3000	2410	2610	2800	3000	3120	3240	3370	3490
3200	2580	2780	2990	3200	3320	3450	3580	3720
3400	2750	2960	3180	3400	3530	3660	3800	3940
3600	2920	3140	3370	3600	3740	3870	4020	4160
3800	3080	3320	3560	3800	3940	4090	4230	4390
4000	3250	3500	3750	4000	4150	4300	4450	4610
4200	3420	3680	3940	4200	4350	4510	4670	4830
4400	3590	3860	4130	4400	4560	4720	4890	5060
4600	3760	4040	4320	4600	4760	4930	5100	5280
4800	3930	4220	4510	4800	4970	5140	5320	5500
5000	4100	4400	4700	5000	5170	5350	5540	5730

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 5

Sea Level Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1220	59.4	54.6	54.2	53.9	53.5	53.2	52.8	50.3	49.0	47.7	46.4
1400	64.5	59.3	58.9	58.5	58.1	57.7	57.4	54.6	53.2	51.8	50.4
1600	69.7	64.1	63.6	63.2	62.8	62.4	62.0	59.0	57.5	56.0	54.5
1800	74.5	68.5	68.0	67.6	67.1	66.7	66.2	63.0	61.4	59.8	58.2
2000	79.0	72.6	72.1	71.6	71.2	70.7	70.2	66.8	65.1	63.4	61.7
2200	83.2	76.4	75.9	75.4	74.9	74.4	73.9	70.3	68.4	66.6	64.8
2400	86.1	79.8	79.2	78.7	78.2	77.7	77.1	73.4	71.4	69.5	67.6
2600	86.1	83.0	82.4	81.8	81.3	80.8	80.2	76.3	74.2	72.3	70.3
2800	86.1	85.9	85.3	84.8	84.2	83.6	83.1	79.0	76.8	74.8	72.7
3000	86.1	86.1	86.1	86.1	86.1	86.1	85.8	81.5	79.3	77.2	75.1
3200	86.1	86.1	86.1	86.1	86.1	86.1	86.1	83.8	81.5	79.3	77.1
3400	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.0	83.6	81.4	79.1
3600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	85.7	83.4	81.1
3800	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	85.3	82.9
4000	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	84.7
4200	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
4400	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
4600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
CLIMB LIMIT WT (1000 KG)	85.9	85.4	85.2	85.1	85.0	84.9	84.7	79.2	76.5	73.9	71.3

2000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1220	55.9	51.5	51.1	50.8	50.5	50.2	49.2	46.8	45.6	44.5	43.3
1400	60.8	55.9	55.5	55.2	54.9	54.5	53.5	50.9	49.6	48.3	47.1
1600	65.7	60.4	60.0	59.6	59.3	58.9	57.8	55.0	53.6	52.2	50.9
1800	70.2	64.5	64.1	63.7	63.3	62.9	61.7	58.7	57.2	55.7	54.3
2000	74.4	68.4	68.0	67.6	67.1	66.7	65.4	62.2	60.6	59.0	57.5
2200	78.3	71.9	71.5	71.0	70.6	70.1	68.8	65.4	63.7	62.0	60.4
2400	81.8	75.1	74.6	74.2	73.7	73.2	71.8	68.3	66.5	64.7	63.1
2600	85.1	78.1	77.6	77.1	76.6	76.1	74.7	70.9	69.1	67.3	65.5
2800	86.1	80.9	80.4	79.8	79.3	78.8	77.3	73.4	71.5	69.6	67.8
3000	86.1	83.5	82.9	82.4	81.9	81.4	79.8	75.8	73.8	71.8	69.9
3200	86.1	85.8	85.3	84.7	84.2	83.7	82.0	77.9	75.8	73.8	71.8
3400	86.1	86.1	86.1	86.1	86.1	85.8	84.2	79.9	77.8	75.7	73.7
3600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	81.8	79.7	77.5	75.5
3800	86.1	86.1	86.1	86.1	86.1	86.1	86.1	83.7	81.5	79.3	77.2
4000	86.1	86.1	86.1	86.1	86.1	86.1	86.1	85.5	83.2	81.0	78.9
4200	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	85.0	82.7	80.5
4400	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	84.4	82.1
4600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.0	83.7
CLIMB LIMIT WT (1000 KG)	81.8	81.3	81.3	81.2	81.1	81.0	79.1	74.0	71.6	69.1	66.7

With engine bleed for packs off, increase field limit weight by 400 kg and climb limit weight by 1400 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 950 kg and climb limit weight by 1500 kg.

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 5

4000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1220	52.2	48.1	47.8	47.5	47.2	46.5	45.8	43.6	42.6	41.5	40.5
1400	56.8	52.2	51.9	51.6	51.3	50.6	49.7	47.4	46.3	45.1	44.1
1600	61.3	56.4	56.1	55.7	55.4	54.6	53.7	51.2	50.0	48.7	47.6
1800	65.5	60.2	59.9	59.5	59.1	58.3	57.3	54.7	53.3	52.0	50.7
2000	69.5	63.9	63.5	63.1	62.7	61.8	60.7	57.9	56.5	55.0	53.7
2200	73.1	67.1	66.7	66.3	65.9	65.0	63.9	60.9	59.3	57.8	56.4
2400	76.3	70.1	69.6	69.2	68.8	67.8	66.6	63.5	61.9	60.3	58.9
2600	79.3	72.8	72.4	71.9	71.5	70.5	69.2	66.0	64.3	62.6	61.1
2800	82.2	75.4	74.9	74.4	74.0	72.9	71.7	68.2	66.5	64.8	63.2
3000	84.8	77.8	77.3	76.8	76.3	75.2	73.9	70.4	68.6	66.8	65.2
3200	86.1	80.0	79.5	79.0	78.5	77.3	76.0	72.3	70.5	68.6	67.0
3400	86.1	82.1	81.5	81.0	80.5	79.3	77.9	74.2	72.3	70.4	68.7
3600	86.1	84.1	83.5	83.0	82.5	81.3	79.8	76.0	74.0	72.1	70.3
3800	86.1	86.0	85.4	84.9	84.3	83.1	81.7	77.7	75.7	73.7	71.9
4000	86.1	86.1	86.1	86.1	86.1	84.9	83.4	79.4	77.4	75.3	73.5
4200	86.1	86.1	86.1	86.1	86.1	86.1	85.2	81.1	79.0	76.9	75.0
4400	86.1	86.1	86.1	86.1	86.1	86.1	86.1	82.7	80.6	78.4	76.5
4600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	84.3	82.1	79.9	78.0
CLIMB LIMIT WT (1000 KG)	77.0	76.5	76.4	76.3	76.3	75.1	73.6	69.1	66.8	64.5	62.5

6000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1220	48.7	44.8	44.6	44.3	43.8	43.2	42.5	40.5	39.5	38.6	37.7
1400	52.9	48.7	48.4	48.2	47.6	46.9	46.2	44.0	42.9	42.0	41.0
1600	57.1	52.6	52.3	52.0	51.4	50.7	49.9	47.6	46.4	45.3	44.3
1800	61.0	56.2	55.9	55.5	54.8	54.1	53.2	50.7	49.4	48.3	47.2
2000	64.7	59.5	59.2	58.8	58.1	57.3	56.3	53.7	52.3	51.1	49.9
2200	68.0	62.6	62.2	61.8	61.0	60.2	59.2	56.4	55.0	53.7	52.4
2400	71.0	65.3	64.9	64.5	63.7	62.8	61.8	58.9	57.3	56.0	54.7
2600	73.8	67.8	67.4	67.0	66.2	65.3	64.1	61.1	59.5	58.1	56.7
2800	76.4	70.2	69.8	69.3	68.4	67.5	66.4	63.2	61.6	60.1	58.7
3000	78.8	72.4	72.0	71.5	70.6	69.6	68.4	65.2	63.5	61.9	60.4
3200	81.0	74.4	74.0	73.5	72.5	71.5	70.3	66.9	65.2	63.6	62.1
3400	83.2	76.3	75.9	75.4	74.4	73.4	72.1	68.7	66.8	65.2	63.7
3600	85.2	78.2	77.7	77.2	76.2	75.2	73.9	70.3	68.5	66.8	65.2
3800	86.1	80.0	79.5	79.0	78.0	76.9	75.6	71.9	70.0	68.3	66.7
4000	86.1	81.7	81.2	80.7	79.7	78.6	77.2	73.5	71.6	69.8	68.1
4200	86.1	83.4	82.9	82.4	81.3	80.2	78.8	75.0	73.0	71.3	69.6
4400	86.1	85.1	84.6	84.0	82.9	81.8	80.4	76.5	74.5	72.7	70.9
4600	86.1	86.1	86.1	85.6	84.5	83.4	81.9	78.0	75.9	74.1	72.3
CLIMB LIMIT WT (1000 KG)	72.2	71.8	71.7	71.6	70.7	69.7	68.2	64.0	61.8	59.9	58.0

With engine bleed for packs off, increase field limit weight by 400 kg and climb limit weight by 1400 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 950 kg and climb limit weight by 1500 kg.

Takeoff Field & Climb Limit Weights - Dry Runway

Flaps 5

8000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1220	45.4	41.9	41.6	41.1	40.6	40.0	39.2	37.2	36.4	35.5	34.7
1400	49.3	45.5	45.3	44.7	44.2	43.5	42.6	40.5	39.6	38.7	37.8
1600	53.3	49.2	48.9	48.3	47.7	47.0	46.0	43.7	42.7	41.7	40.7
1800	56.9	52.5	52.1	51.5	50.9	50.1	49.0	46.6	45.5	44.4	43.4
2000	60.3	55.6	55.2	54.6	53.9	53.0	51.9	49.3	48.1	47.0	45.9
2200	63.3	58.4	58.0	57.3	56.6	55.7	54.5	51.8	50.5	49.4	48.2
2400	66.1	60.9	60.5	59.8	59.0	58.1	56.9	54.0	52.7	51.4	50.2
2600	68.7	63.3	62.9	62.1	61.3	60.3	59.0	56.0	54.7	53.4	52.1
2800	71.1	65.4	65.0	64.2	63.4	62.4	61.0	57.9	56.5	55.2	53.8
3000	73.3	67.5	67.0	66.2	65.3	64.3	62.9	59.7	58.2	56.8	55.4
3200	75.4	69.3	68.9	68.0	67.1	66.0	64.6	61.3	59.8	58.3	56.9
3400	77.3	71.1	70.6	69.8	68.8	67.7	66.3	62.8	61.3	59.8	58.3
3600	79.2	72.8	72.4	71.5	70.5	69.4	67.9	64.3	62.8	61.2	59.7
3800	81.0	74.5	74.0	73.1	72.1	70.9	69.4	65.8	64.2	62.6	61.1
4000	82.7	76.1	75.6	74.7	73.7	72.5	70.9	67.3	65.6	64.0	62.4
4200	84.5	77.7	77.2	76.2	75.2	74.0	72.4	68.7	67.0	65.3	63.7
4400	86.1	79.2	78.7	77.7	76.7	75.5	73.8	70.0	68.3	66.6	65.0
4600	86.1	80.8	80.2	79.2	78.2	76.9	75.3	71.4	69.6	67.9	66.2
CLIMB LIMIT WT (1000 KG)	67.6	67.2	67.1	66.4	65.5	64.3	62.4	58.2	56.4	54.7	52.9

10000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1220	42.4	39.1	38.6	38.1	37.6	37.1	36.2	34.4	33.5	32.6	31.7
1400	46.1	42.5	42.0	41.5	40.9	40.3	39.4	37.4	36.4	35.5	34.5
1600	49.8	45.9	45.3	44.8	44.2	43.5	42.5	40.4	39.3	38.3	37.2
1800	53.1	49.0	48.3	47.7	47.1	46.4	45.3	43.0	41.9	40.8	39.6
2000	56.3	51.8	51.2	50.5	49.8	49.1	48.0	45.5	44.3	43.1	41.9
2200	59.1	54.4	53.7	53.0	52.3	51.5	50.4	47.7	46.5	45.2	43.9
2400	61.7	56.8	56.0	55.3	54.6	53.7	52.5	49.7	48.4	47.1	45.8
2600	64.1	58.9	58.2	57.4	56.6	55.7	54.5	51.6	50.2	48.8	47.5
2800	66.3	60.9	60.1	59.3	58.6	57.6	56.3	53.3	51.9	50.4	49.0
3000	68.4	62.8	62.0	61.1	60.3	59.4	58.0	54.9	53.4	51.9	50.4
3200	70.2	64.5	63.6	62.8	62.0	61.0	59.5	56.4	54.8	53.3	51.7
3400	72.0	66.2	65.3	64.4	63.5	62.5	61.1	57.8	56.2	54.6	53.0
3600	73.8	67.8	66.9	66.0	65.1	64.0	62.5	59.2	57.5	55.9	54.3
3800	75.5	69.3	68.4	67.5	66.6	65.5	64.0	60.5	58.8	57.2	55.5
4000	77.1	70.8	69.9	68.9	68.0	66.9	65.4	61.8	60.1	58.4	56.8
4200	78.7	72.3	71.3	70.4	69.4	68.3	66.7	63.1	61.4	59.7	57.9
4400	80.3	73.7	72.7	71.8	70.8	69.7	68.0	64.4	62.6	60.9	59.1
4600	81.8	75.1	74.1	73.2	72.2	71.0	69.3	65.6	63.8	62.0	60.2
CLIMB LIMIT WT (1000 KG)	63.4	62.8	62.1	61.4	60.5	59.3	57.5	53.6	51.7	49.8	47.9

With engine bleed for packs off, increase field limit weight by 400 kg and climb limit weight by 1400 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 950 kg and climb limit weight by 1500 kg.

Takeoff Field Corrections - Wet Runway

Slope Corrections

FIELD LENGTH AVAILABLE (M)	SLOPE CORRECTED FIELD LENGTH (M)								
	RUNWAY SLOPE (%)								
	-2.0	-1.5	-1.0	-0.5	0.0	0.5	1.0	1.5	2.0
1200	1170	1180	1180	1190	1200	1180	1160	1140	1120
1400	1400	1400	1400	1400	1400	1370	1340	1310	1290
1600	1640	1630	1620	1610	1600	1560	1530	1490	1450
1800	1880	1860	1840	1820	1800	1750	1710	1660	1620
2000	2120	2090	2060	2030	2000	1950	1890	1840	1790
2200	2350	2320	2280	2240	2200	2140	2080	2010	1950
2400	2590	2540	2500	2450	2400	2330	2260	2190	2120
2600	2830	2770	2710	2660	2600	2520	2440	2360	2280
2800	3070	3000	2930	2870	2800	2710	2630	2540	2450
3000	3300	3230	3150	3080	3000	2900	2810	2710	2620
3200	3540	3460	3370	3290	3200	3100	2990	2890	2780
3400	3780	3680	3590	3490	3400	3290	3170	3060	2950
3600	4010	3910	3810	3700	3600	3480	3360	3240	3120
3800	4250	4140	4030	3910	3800	3670	3540	3410	3280
4000	4490	4370	4240	4120	4000	3860	3720	3590	3450
4200	4730	4600	4460	4330	4200	4050	3910	3760	3610
4400	4960	4820	4680	4540	4400	4250	4090	3940	3780
4600	5200	5050	4900	4750	4600	4440	4270	4110	3950
4800	5440	5280	5120	4960	4800	4630	4460	4290	4110
5000	5680	5510	5340	5170	5000	4820	4640	4460	4280

Wind Corrections

SLOPE CORR'D FIELD LENGTH (M)	SLOPE & WIND CORRECTED FIELD LENGTH (M)							
	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1200	860	970	1090	1200	1270	1350	1420	1500
1400	1030	1150	1280	1400	1480	1560	1650	1730
1600	1200	1330	1470	1600	1690	1780	1870	1960
1800	1370	1510	1660	1800	1890	1990	2090	2190
2000	1540	1690	1850	2000	2100	2200	2310	2420
2200	1710	1870	2040	2200	2310	2420	2530	2650
2400	1880	2050	2230	2400	2510	2630	2760	2880
2600	2050	2230	2420	2600	2720	2850	2980	3110
2800	2220	2410	2610	2800	2930	3060	3200	3340
3000	2390	2590	2800	3000	3140	3280	3420	3570
3200	2560	2770	2990	3200	3340	3490	3650	3800
3400	2730	2950	3180	3400	3550	3710	3870	4030
3600	2900	3130	3370	3600	3760	3920	4090	4260
3800	3070	3310	3560	3800	3970	4140	4310	4490
4000	3240	3490	3750	4000	4170	4350	4530	4720
4200	3410	3670	3940	4200	4380	4570	4760	4950
4400	3580	3850	4130	4400	4590	4780	4980	5180
4600	3750	4030	4320	4600	4790	4990	5200	5410
4800	3920	4210	4510	4800	5000	5210	5420	5640
5000	4090	4390	4700	5000	5210	5420	5650	5870

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 5

Sea Level Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1200	59.7	54.6	54.2	53.8	53.4	53.1	52.7	50.2	48.9	47.7	46.5
1400	65.2	59.6	59.1	58.7	58.3	57.9	57.4	54.7	53.3	52.0	50.7
1600	70.2	64.1	63.7	63.2	62.8	62.3	61.8	58.9	57.4	56.0	54.5
1800	74.8	68.3	67.8	67.3	66.9	66.4	65.9	62.7	61.2	59.6	58.1
2000	79.1	72.3	71.7	71.2	70.7	70.2	69.7	66.3	64.7	63.0	61.4
2200	83.1	76.0	75.4	74.9	74.3	73.8	73.2	69.7	68.0	66.2	64.5
2400	86.1	79.4	78.8	78.2	77.7	77.1	76.5	72.8	71.0	69.2	67.4
2600	86.1	82.5	81.9	81.3	80.7	80.1	79.5	75.7	73.7	71.9	70.0
2800	86.1	85.4	84.8	84.2	83.6	82.9	82.3	78.3	76.3	74.4	72.4
3000	86.1	86.1	86.1	86.1	86.1	85.6	84.9	80.8	78.7	76.7	74.7
3200	86.1	86.1	86.1	86.1	86.1	86.1	86.1	83.1	81.0	78.9	76.8
3400	86.1	86.1	86.1	86.1	86.1	86.1	86.1	85.4	83.2	81.1	78.9
3600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	85.4	83.2	80.9
3800	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	85.2	82.9
4000	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	84.8
4200	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
4400	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
4600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1
CLIMB LIMIT WT (1000 KG)	85.9	85.4	85.2	85.1	85.0	84.9	84.7	79.2	76.5	73.9	71.3

2000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1200	56.2	51.3	51.0	50.6	50.3	49.9	49.0	46.7	45.6	44.4	43.4
1400	61.3	56.0	55.6	55.2	54.8	54.4	53.4	50.9	49.6	48.4	47.3
1600	66.1	60.3	59.8	59.4	59.0	58.6	57.5	54.8	53.4	52.1	50.9
1800	70.4	64.2	63.8	63.3	62.8	62.4	61.3	58.4	56.9	55.5	54.2
2000	74.4	67.9	67.4	66.9	66.5	66.0	64.8	61.7	60.2	58.7	57.3
2200	78.3	71.4	70.8	70.3	69.8	69.3	68.1	64.9	63.2	61.7	60.2
2400	81.8	74.6	74.0	73.5	73.0	72.5	71.1	67.8	66.1	64.4	62.8
2600	85.0	77.5	76.9	76.4	75.8	75.3	73.9	70.3	68.6	66.9	65.2
2800	86.1	80.2	79.6	79.0	78.5	77.9	76.4	72.8	70.9	69.2	67.4
3000	86.1	82.7	82.1	81.5	80.9	80.3	78.8	75.0	73.1	71.3	69.5
3200	86.1	85.1	84.5	83.9	83.3	82.7	81.1	77.2	75.2	73.3	71.5
3400	86.1	86.1	86.1	86.1	85.6	85.0	83.4	79.3	77.3	75.3	73.4
3600	86.1	86.1	86.1	86.1	86.1	86.1	85.5	81.4	79.3	77.3	75.3
3800	86.1	86.1	86.1	86.1	86.1	86.1	86.1	83.3	81.2	79.1	77.1
4000	86.1	86.1	86.1	86.1	86.1	86.1	86.1	85.2	83.0	80.9	78.8
4200	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	84.8	82.6	80.5
4400	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	84.3	82.2
4600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.1	86.0	83.8
CLIMB LIMIT WT (1000 KG)	81.8	81.3	81.3	81.2	81.1	81.0	79.1	74.0	71.6	69.1	66.7

With engine bleed for packs off, increase field limit weight by 400 kg and climb limit weight by 1450 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 850 kg and climb limit weight by 1500 kg.

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 5

4000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1200	52.5	47.9	47.6	47.2	46.9	46.2	45.5	43.5	42.5	41.4	40.5
1400	57.3	52.2	51.8	51.5	51.1	50.4	49.6	47.4	46.2	45.1	44.1
1600	61.7	56.2	55.8	55.4	55.0	54.2	53.3	51.0	49.8	48.6	47.5
1800	65.7	59.9	59.4	59.0	58.6	57.8	56.8	54.3	53.0	51.7	50.6
2000	69.5	63.3	62.9	62.4	62.0	61.1	60.1	57.4	56.0	54.7	53.4
2200	73.0	66.5	66.0	65.6	65.1	64.2	63.1	60.3	58.9	57.4	56.1
2400	76.3	69.5	69.0	68.5	68.0	67.1	65.9	63.0	61.5	60.0	58.6
2600	79.3	72.2	71.7	71.1	70.6	69.6	68.5	65.4	63.8	62.2	60.8
2800	82.1	74.7	74.1	73.6	73.1	72.0	70.8	67.6	66.0	64.3	62.9
3000	84.6	77.0	76.4	75.9	75.3	74.3	73.0	69.7	68.0	66.3	64.8
3200	86.1	79.2	78.7	78.1	77.5	76.4	75.1	71.7	69.9	68.2	66.6
3400	86.1	81.4	80.8	80.2	79.6	78.5	77.2	73.6	71.8	70.0	68.4
3600	86.1	83.5	82.9	82.3	81.7	80.5	79.1	75.5	73.6	71.8	70.1
3800	86.1	85.5	84.9	84.3	83.7	82.4	81.0	77.3	75.4	73.5	71.8
4000	86.1	86.1	86.1	86.1	85.6	84.3	82.9	79.1	77.1	75.1	73.4
4200	86.1	86.1	86.1	86.1	86.1	86.1	84.7	80.8	78.7	76.7	74.9
4400	86.1	86.1	86.1	86.1	86.1	86.1	86.1	82.4	80.3	78.3	76.5
4600	86.1	86.1	86.1	86.1	86.1	86.1	86.1	84.0	81.9	79.8	77.9
CLIMB LIMIT WT (1000 KG)	77.0	76.5	76.4	76.3	76.3	75.1	73.6	69.1	66.8	64.5	62.5

6000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1200	48.9	44.6	44.3	44.0	43.5	42.9	42.2	40.4	39.4	38.5	37.7
1400	53.3	48.6	48.3	48.0	47.4	46.7	46.0	44.0	42.9	41.9	41.0
1600	57.4	52.4	52.0	51.6	51.0	50.3	49.5	47.3	46.2	45.1	44.1
1800	61.2	55.8	55.4	55.0	54.3	53.6	52.7	50.4	49.2	48.1	47.0
2000	64.7	59.0	58.6	58.2	57.4	56.7	55.7	53.2	52.0	50.8	49.7
2200	67.9	61.9	61.5	61.1	60.3	59.5	58.5	55.9	54.6	53.3	52.1
2400	71.0	64.7	64.3	63.8	63.0	62.2	61.1	58.4	57.0	55.7	54.4
2600	73.7	67.2	66.7	66.2	65.4	64.5	63.4	60.6	59.1	57.7	56.4
2800	76.3	69.5	69.0	68.5	67.6	66.7	65.6	62.6	61.1	59.7	58.3
3000	78.7	71.6	71.1	70.6	69.7	68.7	67.6	64.5	62.9	61.4	60.0
3200	81.0	73.7	73.1	72.6	71.7	70.7	69.5	66.3	64.7	63.2	61.7
3400	83.2	75.7	75.1	74.6	73.6	72.6	71.4	68.1	66.4	64.9	63.4
3600	85.4	77.6	77.1	76.5	75.5	74.5	73.2	69.8	68.1	66.5	64.9
3800	86.1	79.5	78.9	78.3	77.3	76.2	74.9	71.5	69.7	68.0	66.5
4000	86.1	81.3	80.7	80.1	79.1	78.0	76.6	73.1	71.2	69.6	67.9
4200	86.1	83.0	82.4	81.8	80.8	79.6	78.3	74.6	72.7	71.0	69.4
4400	86.1	84.7	84.1	83.5	82.4	81.3	79.9	76.2	74.2	72.5	70.8
4600	86.1	86.1	85.7	85.1	84.0	82.8	81.4	77.6	75.7	73.9	72.1
CLIMB LIMIT WT (1000 KG)	72.2	71.8	71.7	71.6	70.7	69.7	68.2	64.0	61.8	59.9	58.0

With engine bleed for packs off, increase field limit weight by 400 kg and climb limit weight by 1450 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 850 kg and climb limit weight by 1500 kg.

Takeoff Field & Climb Limit Weights - Wet Runway

Flaps 5

8000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1200	45.6	41.7	41.4	40.9	40.3	39.7	38.9	37.1	36.3	35.5	34.7
1400	49.7	45.4	45.1	44.5	43.9	43.3	42.4	40.4	39.5	38.6	37.7
1600	53.5	48.8	48.5	47.9	47.3	46.6	45.6	43.5	42.5	41.5	40.6
1800	57.0	52.0	51.7	51.0	50.4	49.6	48.6	46.3	45.2	44.2	43.2
2000	60.2	55.0	54.6	53.9	53.2	52.4	51.4	48.9	47.8	46.7	45.7
2200	63.3	57.8	57.4	56.6	55.9	55.0	53.9	51.4	50.2	49.1	47.9
2400	66.1	60.3	59.9	59.1	58.4	57.5	56.3	53.6	52.4	51.2	50.0
2600	68.6	62.6	62.1	61.4	60.6	59.6	58.4	55.6	54.3	53.1	51.8
2800	71.0	64.7	64.2	63.4	62.6	61.6	60.4	57.4	56.1	54.8	53.5
3000	73.2	66.7	66.2	65.3	64.5	63.5	62.2	59.1	57.7	56.4	55.1
3200	75.3	68.6	68.1	67.2	66.3	65.3	63.9	60.8	59.3	58.0	56.6
3400	77.3	70.4	69.9	69.0	68.1	67.0	65.6	62.4	60.9	59.5	58.1
3600	79.3	72.2	71.7	70.8	69.8	68.7	67.3	63.9	62.4	61.0	59.5
3800	81.2	73.9	73.4	72.4	71.5	70.3	68.8	65.4	63.9	62.4	60.9
4000	83.1	75.6	75.0	74.1	73.1	71.9	70.4	66.9	65.3	63.8	62.2
4200	84.9	77.2	76.6	75.6	74.6	73.4	71.9	68.3	66.7	65.1	63.5
4400	86.1	78.8	78.2	77.2	76.1	74.9	73.3	69.7	68.0	66.4	64.8
4600	86.1	80.3	79.7	78.7	77.6	76.4	74.7	71.0	69.3	67.7	66.0
CLIMB LIMIT WT (1000 KG)	67.6	67.2	67.1	66.4	65.5	64.3	62.4	58.2	56.4	54.7	52.9

10000 FT Pressure Altitude

CORR'D FIELD LENGTH (M)	FIELD LIMIT WEIGHT (1000 KG)										
	OAT (°C)										
	-40	10	14	18	22	26	30	38	42	46	50
1200	42.6	38.8	38.3	37.9	37.4	36.8	36.0	34.3	33.4	32.6	31.7
1400	46.4	42.3	41.8	41.2	40.7	40.1	39.2	37.3	36.3	35.4	34.5
1600	49.9	45.5	44.9	44.4	43.8	43.1	42.2	40.1	39.1	38.1	37.1
1800	53.2	48.5	47.8	47.2	46.6	45.9	44.9	42.7	41.6	40.6	39.5
2000	56.2	51.2	50.6	49.9	49.3	48.5	47.5	45.1	44.0	42.8	41.7
2200	59.0	53.8	53.1	52.4	51.7	50.9	49.8	47.4	46.2	45.0	43.8
2400	61.7	56.2	55.4	54.7	54.0	53.2	52.0	49.4	48.2	46.9	45.7
2600	64.0	58.3	57.5	56.7	56.0	55.1	53.9	51.2	49.9	48.6	47.3
2800	66.2	60.2	59.4	58.6	57.8	56.9	55.7	52.9	51.5	50.2	48.8
3000	68.2	62.0	61.2	60.4	59.5	58.6	57.3	54.4	53.0	51.6	50.2
3200	70.1	63.7	62.9	62.1	61.2	60.3	58.9	55.9	54.4	53.0	51.5
3400	72.0	65.4	64.6	63.7	62.8	61.8	60.5	57.4	55.8	54.4	52.9
3600	73.8	67.1	66.2	65.3	64.4	63.4	62.0	58.8	57.2	55.7	54.1
3800	75.6	68.7	67.7	66.8	65.9	64.9	63.4	60.1	58.5	57.0	55.4
4000	77.3	70.2	69.2	68.3	67.4	66.3	64.8	61.5	59.8	58.2	56.6
4200	79.0	71.7	70.7	69.8	68.8	67.7	66.2	62.7	61.1	59.4	57.7
4400	80.6	73.1	72.1	71.2	70.2	69.1	67.5	64.0	62.3	60.6	58.9
4600	82.1	74.5	73.5	72.5	71.5	70.4	68.8	65.2	63.5	61.7	60.0
CLIMB LIMIT WT (1000 KG)	63.4	62.8	62.1	61.4	60.5	59.3	57.5	53.6	51.7	49.8	47.9

With engine bleed for packs off, increase field limit weight by 400 kg and climb limit weight by 1450 kg.
With engine anti-ice on, decrease field limit weight by 200 kg and climb limit weight by 250 kg.
With engine and wing anti-ice on (optional system), decrease field limit weight by 850 kg and climb limit weight by 1500 kg.

Takeoff Obstacle Limit Weight

Flaps 5

Sea Level, 30°C & Below, Zero Wind

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

Reference Obstacle Limit Weight (1000 KG)

OBSTACLE HEIGHT (M)	DISTANCE FROM BRAKE RELEASE (100 M)										
	25	30	35	40	45	50	55	60	65	70	75
5	75.4	81.8									
20	69.6	75.4	79.9	83.4							
40	64.4	69.9	74.2	77.8	80.6	82.9	84.7				
60	60.4	65.6	70.0	73.5	76.5	78.9	80.9	82.6	84.0	85.2	
80	57.1	62.2	66.5	70.0	73.0	75.6	77.7	79.5	81.1	82.4	83.6
100	54.2	59.3	63.5	67.0	70.1	72.7	74.9	76.8	78.4	79.9	81.1
120	51.7	56.7	60.8	64.4	67.4	70.1	72.4	74.3	76.1	77.6	78.9
140	49.5	54.4	58.5	62.0	65.1	67.7	70.1	72.1	73.9	75.5	76.9
160	47.5	52.3	56.4	59.9	63.0	65.6	68.0	70.1	71.9	73.5	75.0
180	45.6	50.4	54.5	58.0	61.0	63.7	66.0	68.2	70.0	71.7	73.2
200	43.9	48.7	52.7	56.2	59.2	61.9	64.3	66.4	68.3	70.0	71.5
220	42.3	47.1	51.1	54.5	57.5	60.2	62.6	64.7	66.7	68.4	70.0
240		45.5	49.5	53.0	56.0	58.7	61.0	63.2	65.1	66.9	68.5
260		44.1	48.1	51.5	54.5	57.2	59.6	61.7	63.7	65.4	67.1
280		42.8	46.7	50.1	53.1	55.8	58.2	60.4	62.3	64.1	65.7
300		41.6	45.5	48.9	51.8	54.5	56.9	59.1	61.0	62.8	64.4

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

OAT Adjustments

OAT (°C)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 KG)					
	40	50	60	70	80	90
30 & BELOW	0	0	0	0	0	0
32	-0.6	-0.7	-0.9	-1.1	-1.2	-1.4
34	-1.2	-1.5	-1.8	-2.2	-2.5	-2.8
36	-1.7	-2.2	-2.7	-3.2	-3.7	-4.2
38	-2.3	-3.0	-3.6	-4.3	-5.0	-5.6
40	-2.9	-3.7	-4.6	-5.4	-6.2	-7.0
42	-3.5	-4.5	-5.4	-6.4	-7.4	-8.4
44	-4.0	-5.2	-6.3	-7.5	-8.6	-9.7
46	-4.6	-5.9	-7.2	-8.5	-9.8	-11.1
48	-5.2	-6.6	-8.1	-9.5	-11.0	-12.5
50	-5.7	-7.3	-9.0	-10.6	-12.2	-13.8

Pressure Altitude Adjustments

ALT (FT)	OAT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)					
	40	50	60	70	80	90
S.L. & BELOW	0	0	0	0	0	0
1000	-1.5	-1.8	-2.1	-2.5	-2.8	-3.2
2000	-2.9	-3.6	-4.3	-5.0	-5.6	-6.3
3000	-4.3	-5.3	-6.3	-7.3	-8.3	-9.3
4000	-5.6	-7.0	-8.3	-9.7	-11.0	-12.4
5000	-6.9	-8.6	-10.3	-11.9	-13.6	-15.2
6000	-8.2	-10.2	-12.2	-14.2	-16.2	-18.1
7000	-9.4	-11.7	-14.1	-16.4	-18.7	-21.0
8000	-10.6	-13.2	-15.9	-18.6	-21.3	-23.9
9000	-11.7	-14.6	-17.6	-20.6	-23.5	-26.5
10000	-12.8	-16.0	-19.3	-22.5	-25.8	-29.0

Takeoff Obstacle Limit Weight

Flaps 5

Sea Level, 30°C & Below, Zero Wind

Wind Adjustments

WIND (KTS)	OAT & ALT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)					
	40	50	60	70	80	90
15 TW	-9.4	-9.0	-8.7	-8.4	-8.1	-7.8
10 TW	-6.2	-6.0	-5.8	-5.6	-5.4	-5.2
5 TW	-3.1	-3.0	-2.9	-2.8	-2.7	-2.6
0	0	0	0	0	0	0
10 HW	1.1	1.0	0.9	0.8	0.7	0.6
20 HW	2.2	2.0	1.8	1.6	1.4	1.2
30 HW	3.5	3.1	2.8	2.4	2.1	1.8
40 HW	4.7	4.2	3.8	3.3	2.8	2.3

With engine bleed for packs off, increase weight by 650 kg.
With engine anti-ice on, decrease weight by 300 kg.
With engine and wing anti-ice on, decrease weight by 1750 kg (optional system).

Brake Energy Limits VMBE

Maximum Brake Energy Speed

OAT (°C)	REFERENCE VMBE (KIAS)						
	PRESSURE ALTITUDE (FT)						
	-2000	0	2000	4000	6000	8000	10000
54	197	190					
50	198	191	184				
46	199	192	185	178			
42	200	192	185	179	172		
38	201	193	186	179	173	167	
34	202	194	187	180	174	168	162
30	203	195	188	181	175	169	163
26	205	196	189	182	176	170	164
22	206	198	191	184	177	171	165
18	208	200	192	185	178	172	166
14	210	201	194	187	180	173	167
10	210	203	195	188	181	174	168
6	210	205	197	190	183	176	169
2	210	206	199	191	184	177	171
-2	210	208	200	193	186	179	172
-6	210	210	202	195	187	180	174
-10	210	210	204	196	189	182	175

Weight Adjusted VMBE

WEIGHT (1000 KG)	REFERENCE VMBE (KIAS)														
	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210
42	168	174	180	186	192	198	205	210	210	210	210	210	210	210	210
46	159	165	171	177	182	188	194	200	206	210	210	210	210	210	210
50	152	158	163	169	174	179	185	190	196	201	207	210	210	210	210
54	146	151	156	161	166	172	177	182	187	193	198	203	208	210	210
58	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210
62	135	140	145	149	154	159	164	169	173	178	183	188	192	197	202
66	131	135	140	144	149	154	158	163	167	172	177	181	186	190	195
70	127	131	136	140	145	149	153	158	162	167	171	175	180	184	189
74	124	128	132	136	141	145	149	153	157	162	166	170	174	179	183
78	121	125	129	133	137	141	145	149	153	157	161	165	170	174	178
82	118	122	126	130	134	138	141	145	149	153	157	161	165	169	173
86	115	119	123	126	130	134	138	142	146	149	153	157	161	165	168

Increase VMBE by 1 knot per 1% uphill runway slope. Decrease VMBE by 4 knots per 1% downhill runway slope.
Increase VMBE by 3 knots per 10 knots headwind. Decrease VMBE by 19 knots per 10 knots tailwind.
Decrease brake release weight by 550 kg for each knot V1 exceeds VMBE.
Determine normal V1, VR, V2 speeds for lower brake release weight.

Intentionally
Blank

Long Range Cruise Maximum Operating Altitude

Max Cruise Thrust

ISA + 10°C and Below

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
85	32300	-10	34300*	34300*	33800	32200	30800
80	33600	-13	35800*	35800*	35100	33500	32100
75	35000	-16	37100*	37100*	36400	34900	33500
70	36400	-18	38400*	38400*	37900	36300	35000
65	38000	-18	39800*	39800*	39400	37800	36500
60	39600	-18	41000	41000	41000	39500	38200
55	41000	-18	41000	41000	41000	41000	40000
50	41000	-18	41000	41000	41000	41000	41000
45	41000	-18	41000	41000	41000	41000	41000
40	41000	-18	41000	41000	41000	41000	41000

ISA + 15°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
85	32300	-4	33000*	33000*	33000*	32200	30800
80	33600	-7	34700*	34700*	34700*	33500	32100
75	35000	-10	36200*	36200*	36200*	34900	33500
70	36400	-12	37600*	37600*	37600*	36300	35000
65	38000	-12	38900*	38900*	38900*	37800	36500
60	39600	-12	40400*	40400*	40400*	39500	38200
55	41000	-12	41000	41000	41000	41000	40000
50	41000	-12	41000	41000	41000	41000	41000
45	41000	-12	41000	41000	41000	41000	41000
40	41000	-12	41000	41000	41000	41000	41000

ISA + 20°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
85	32300	2	29400*	29400*	29400*	29400*	29400*
80	33600	-1	32200*	32200*	32200*	32200*	32100
75	35000	-4	34700*	34700*	34700*	34700*	33500
70	36400	-7	36200*	36200*	36200*	36200*	35000
65	38000	-7	37700*	37700*	37700*	37700*	36500
60	39600	-7	39100*	39100*	39100*	39100*	38200
55	41000	-7	40500*	40500*	40500*	40500*	40000
50	41000	-7	41000	41000	41000	41000	41000
45	41000	-7	41000	41000	41000	41000	41000
40	41000	-7	41000	41000	41000	41000	41000

***Denotes altitude thrust limited in level flight, 100 fpm residual rate of climb.**

Long Range Cruise Trip Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
279	259	241	226	212	200	190	181	173	166	159
556	516	481	451	424	400	382	364	349	334	321
832	774	721	676	636	600	573	547	524	503	484
1108	1030	960	900	848	800	764	730	700	672	646
1383	1286	1200	1125	1059	1000	955	914	875	840	809
1657	1542	1439	1349	1271	1200	1146	1097	1051	1009	971
1931	1797	1677	1574	1483	1400	1338	1280	1227	1178	1134
2204	2052	1916	1798	1694	1600	1529	1464	1403	1347	1297
2477	2307	2154	2022	1905	1800	1721	1647	1579	1517	1460
2749	2561	2392	2246	2117	2000	1912	1830	1755	1686	1623
3021	2815	2630	2470	2328	2200	2104	2014	1932	1856	1787
3292	3069	2868	2694	2540	2400	2295	2198	2108	2025	1950
3563	3322	3105	2917	2751	2600	2487	2382	2284	2195	2114
3832	3574	3342	3140	2962	2800	2678	2565	2461	2365	2277
4101	3826	3579	3363	3173	3000	2870	2749	2637	2535	2441
4369	4077	3814	3586	3384	3200	3061	2933	2814	2704	2605
4636	4328	4050	3808	3594	3400	3253	3116	2990	2874	2769
4902	4578	4285	4030	3805	3600	3445	3300	3166	3044	2932
5168	4827	4520	4252	4015	3800	3636	3484	3343	3214	3096
5433	5076	4755	4474	4226	4000	3828	3668	3520	3384	3260
5697	5325	4989	4696	4436	4200	4019	3851	3696	3554	3424
5961	5573	5223	4917	4647	4400	4211	4035	3873	3724	3588
6224	5820	5457	5139	4857	4600	4403	4219	4050	3894	3751
6486	6068	5690	5360	5067	4800	4594	4403	4226	4064	3915
6747	6314	5923	5581	5277	5000	4786	4587	4403	4233	4079

Long Range Cruise Trip Fuel and Time

Reference Fuel and Time Required

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	29		31		33		35		37	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	1.5	0:38	1.5	0:37	1.5	0:37	1.5	0:36	1.5	0:36
400	2.5	1:10	2.4	1:09	2.4	1:07	2.4	1:06	2.4	1:04
600	3.5	1:42	3.4	1:40	3.4	1:37	3.3	1:34	3.3	1:32
800	4.5	2:14	4.4	2:11	4.3	2:07	4.3	2:03	4.2	2:00
1000	5.5	2:45	5.4	2:41	5.3	2:36	5.2	2:32	5.1	2:28
1200	6.6	3:16	6.5	3:11	6.3	3:05	6.2	2:59	6.1	2:55
1400	7.7	3:47	7.5	3:41	7.3	3:34	7.2	3:27	7.0	3:22
1600	8.7	4:18	8.5	4:11	8.3	4:02	8.1	3:55	8.0	3:50
1800	9.8	4:49	9.6	4:40	9.3	4:31	9.1	4:23	8.9	4:17
2000	10.9	5:19	10.6	5:10	10.3	5:00	10.1	4:51	9.8	4:44
2200	12.0	5:49	11.7	5:38	11.4	5:27	11.1	5:18	10.9	5:11
2400	13.1	6:18	12.8	6:07	12.5	5:55	12.1	5:45	11.9	5:38
2600	14.3	6:48	13.9	6:35	13.5	6:23	13.1	6:13	12.9	6:05
2800	15.4	7:17	15.0	7:04	14.6	6:51	14.2	6:40	13.9	6:32
3000	16.5	7:47	16.1	7:32	15.6	7:18	15.2	7:07	14.9	6:58
3200	17.7	8:15	17.2	8:00	16.7	7:45	16.3	7:34	15.9	7:25
3400	18.9	8:43	18.4	8:27	17.8	8:12	17.3	8:01	17.0	7:52
3600	20.0	9:11	19.5	8:55	18.9	8:39	18.4	8:27	18.0	8:18
3800	21.2	9:39	20.6	9:22	20.0	9:06	19.5	8:54	19.1	8:45
4000	22.4	10:08	21.8	9:50	21.2	9:33	20.6	9:21	20.2	9:11
4200	23.6	10:35	23.0	10:16	22.3	10:00	21.7	9:47	21.3	9:38
4400	24.9	11:02	24.2	10:43	23.5	10:26	22.8	10:14	22.4	10:04
4600	26.1	11:29	25.4	11:10	24.6	10:53	24.0	10:40	23.6	10:31
4800	27.4	11:56	26.6	11:37	25.8	11:20	25.1	11:07	24.7	10:57
5000	28.6	12:24	27.8	12:04	27.0	11:46	26.3	11:33	25.9	11:24

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	LANDING WEIGHT (1000 KG)						
	40	45	50	55	60	65	70
2	-0.2	-0.1	0.0	0.1	0.3	0.4	0.5
4	-0.3	-0.2	0.0	0.2	0.5	0.7	1.0
6	-0.5	-0.2	0.0	0.3	0.7	1.1	1.7
8	-0.6	-0.3	0.0	0.5	1.0	1.6	2.4
10	-0.8	-0.4	0.0	0.6	1.3	2.1	3.2
12	-1.0	-0.5	0.0	0.7	1.6	2.6	4.0
14	-1.1	-0.6	0.0	0.9	1.9	3.1	4.9
16	-1.3	-0.7	0.0	1.0	2.2	3.8	5.9
18	-1.5	-0.8	0.0	1.2	2.6	4.4	7.0
20	-1.7	-0.9	0.0	1.4	3.0	5.1	8.1
22	-1.8	-1.0	0.0	1.6	3.4	5.8	9.3
24	-2.0	-1.0	0.0	1.8	3.8	6.6	10.6
26	-2.2	-1.1	0.0	2.0	4.3	7.4	11.9
28	-2.4	-1.2	0.0	2.2	4.8	8.3	13.3
30	-2.6	-1.3	0.0	2.4	5.3	9.2	14.8
32	-2.8	-1.4	0.0	2.7	5.8	10.1	16.4

Based on 280/.78 climb, Long Range Cruise and .78/280/250 descent.

Long Range Cruise Step Climb

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
1321	1241	1171	1108	1051	1000	954	911	873	837	804
1839	1730	1634	1548	1470	1400	1336	1278	1225	1176	1130
2354	2218	2096	1987	1889	1800	1719	1645	1577	1515	1457
2869	2704	2558	2426	2308	2200	2102	2012	1930	1854	1784
3383	3190	3019	2865	2726	2600	2485	2380	2283	2194	2112
3895	3676	3480	3304	3145	3000	2868	2747	2636	2534	2439
4407	4161	3940	3742	3563	3400	3251	3115	2990	2874	2768
4919	4645	4401	4180	3981	3800	3635	3483	3344	3215	3096
5430	5130	4861	4619	4399	4200	4018	3851	3697	3556	3424
5942	5614	5321	5057	4818	4600	4401	4219	4051	3896	3753
6453	6099	5781	5495	5236	5000	4785	4587	4405	4237	4081

Trip Fuel and Time Required

AIR DIST (NM)	TRIP FUEL (1000 KG)							TIME (HRS:MIN)
	LANDING WEIGHT (1000 KG)							
	40	45	50	55	60	65	70	
1000	4.5	4.8	5.1	5.4	5.7	6.2	6.5	2:26
1400	6.1	6.5	6.9	7.3	7.9	8.4	8.9	3:20
1800	7.8	8.3	8.8	9.4	10.1	10.8	11.3	4:14
2200	9.5	10.0	10.7	11.4	12.3	13.1	13.9	5:08
2600	11.2	11.9	12.6	13.6	14.6	15.6	16.5	6:01
3000	12.9	13.7	14.7	15.8	16.9	18.1	19.2	6:54
3400	14.7	15.7	16.8	18.0	19.4	20.7	22.0	7:46
3800	16.5	17.6	19.0	20.4	21.9	23.4	24.8	8:39
4200	18.4	19.7	21.2	22.7	24.4	26.2	27.8	9:31
4600	20.3	21.7	23.4	25.2	27.1	29.0	30.8	10:23
5000	22.2	23.9	25.7	27.7	29.8	31.9	33.9	11:16

Based on 280/.78 climb, Long Range Cruise and .78/280/250 descent.
Valid for all pressure altitudes with 4000 ft step climb to 2000 ft above optimum altitude.

Short Trip Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
93	80	69	61	55	50	46	42	39	36	34
161	143	129	118	108	100	93	87	81	77	73
227	206	188	174	161	150	140	132	125	118	112
291	267	246	229	213	200	188	178	168	160	152
355	327	304	283	266	250	236	224	212	202	193
417	387	361	338	318	300	284	270	257	245	234
480	447	418	392	370	350	332	316	301	288	276
543	507	475	447	422	400	380	362	345	330	317
607	567	533	502	475	450	428	408	390	373	358
673	629	591	557	527	500	476	453	433	415	398

Trip Fuel and Time Required

AIR DIST (NM)		LANDING WEIGHT (1000 KG)							TIME (HRS:MIN)
		40	45	50	55	60	65	70	
50	FUEL (1000 KG)	0.5	0.6	0.6	0.6	0.7	0.7	0.7	0:14
	ALT (FT)	12000	12000	11000	8000	8000	10000	8000	
100	FUEL (1000 KG)	0.8	0.9	0.9	1.0	1.0	1.1	1.1	0:23
	ALT (FT)	18000	17000	16000	15000	15000	15000	16000	
150	FUEL (1000 KG)	1.1	1.2	1.2	1.3	1.3	1.4	1.5	0:31
	ALT (FT)	25000	24000	24000	23000	23000	22000	21000	
200	FUEL (1000 KG)	1.3	1.4	1.5	1.6	1.6	1.7	1.8	0:38
	ALT (FT)	31000	29000	27000	26000	26000	25000	24000	
250	FUEL (1000 KG)	1.5	1.6	1.7	1.8	1.9	2.0	2.1	0:44
	ALT (FT)	39000	37000	35000	31000	31000	31000	29000	
300	FUEL (1000 KG)	1.7	1.8	2.0	2.1	2.2	2.3	2.4	0:51
	ALT (FT)	41000	41000	39000	37000	35000	35000	33000	
350	FUEL (1000 KG)	1.9	2.0	2.2	2.3	2.4	2.6	2.7	0:57
	ALT (FT)	41000	41000	39000	39000	37000	35000	35000	
400	FUEL (1000 KG)	2.1	2.2	2.4	2.5	2.7	2.8	3.0	1:03
	ALT (FT)	41000	41000	41000	39000	39000	37000	35000	
450	FUEL (1000 KG)	2.3	2.5	2.6	2.8	2.9	3.1	3.3	1:10
	ALT (FT)	41000	41000	41000	41000	39000	37000	35000	
500	FUEL (1000 KG)	2.5	2.7	2.8	3.0	3.2	3.4	3.5	1:17
	ALT (FT)	41000	41000	41000	41000	39000	37000	35000	

Based on 280/.78 climb, Long Range Cruise and .78/280/250 descent.

Holding Planning

Flaps Up

WEIGHT (1000 KG)	TOTAL FUEL FLOW (KG/HR)								
	PRESSURE ALTITUDE (FT)								
	1500	5000	10000	15000	20000	25000	30000	35000	41000
85	3000	2950	2920	2900	2850	2860	2910		
80	2840	2790	2760	2740	2680	2680	2720		
75	2680	2630	2600	2570	2520	2500	2540	2600	
70	2520	2470	2440	2410	2360	2320	2360	2400	
65	2370	2320	2280	2240	2210	2150	2190	2220	
60	2210	2160	2120	2080	2050	1990	2010	2030	
55	2060	2000	1960	1920	1890	1840	1840	1860	1970
50	1910	1850	1800	1770	1730	1720	1700	1710	1790
45	1750	1700	1680	1640	1600	1570	1540	1540	1600
40	1640	1580	1520	1480	1450	1410	1400	1370	1420

This table includes 5% additional fuel for holding in a racetrack pattern.

Flight Crew Oxygen Requirements

Required Pressure (PSI) for 76 Cu. Ft. Cylinder (YA701-YA706)

BOTTLE TEMPERATURE		NUMBER OF CREW USING OXYGEN		
°C	°F	2	3	4
50	122	735	1055	1360
45	113	725	1040	1340
40	104	715	1020	1320
35	95	700	1005	1300
30	86	690	990	1280
25	77	680	975	1255
20	68	670	960	1240
15	59	655	940	1215
10	50	645	925	1195
5	41	635	910	1175
0	32	620	890	1150
-5	23	610	875	1130
-10	14	600	860	1110

Required Pressure (PSI) for 114/115 Cubic Ft. Cylinder (YA707-YV754)

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

ENGINE INOP

MAX CONTINUOUS THRUST

Net Level Off Weight

PRESSURE ALTITUDE (1000 FT)	LEVEL OFF WEIGHT (1000 KG)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
30	44.3	42.9	41.4
28	47.9	46.3	44.7
26	51.7	49.9	48.3
24	56.0	54.1	52.2
22	61.0	58.8	56.7
20	66.3	63.9	61.4
18	71.2	68.5	65.6
16	76.0	73.3	70.3
14	80.4	77.7	75.1
12	85.1	82.1	78.9

Anti-Ice Adjustments

ANTI-ICE CONFIGURATION	LEVEL OFF WEIGHT ADJUSTMENT (1000 KG)								
	PRESSURE ALTITUDE (1000 FT)								
	12	14	16	18	20	22	24	26	28
ENGINE ONLY	-2.0	-1.9	-1.8	-1.8	-1.6	-1.5	-1.4	-1.3	-1.2
ENGINE & WING	-7.8	-7.3	-6.8	-6.8	-6.6	-6.0	-5.4	-5.0	

Landing Field Limit Weight - Dry Runway

Flaps 40

Based on anti-skid operative and automatic speedbrakes

Wind Corrected Field Length (M)

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1000		860	900	1000	1070	1130	1200	1270
1200	940	1010	1080	1200	1270	1340	1420	1500
1400	1090	1170	1260	1400	1480	1550	1640	1720
1600	1230	1320	1430	1600	1680	1760	1850	1940
1800	1380	1480	1610	1800	1880	1970	2070	2170
2000	1530	1640	1790	2000	2090	2180	2280	2390
2200	1670	1790	1960	2200	2290	2390	2500	2610
2400	1820	1950	2140	2400	2500	2600	2720	2830
2600	1960	2100	2320	2600	2700	2810	2930	3060
2800	2110	2260	2490	2800	2910	3020	3150	3280
3000	2250	2420	2670	3000	3110	3230	3360	
3200	2400	2570	2850	3200	3320			
3400	2540	2730	3020	3400				
3600	2690	2880	3200					
3800	2830	3040	3380					
4000	2980	3200						
4200	3120	3350						
4400	3270							

Field Limit Weight (1000 KG)

WIND CORR'D FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
1000	39.4					
1200	49.9	47.2	44.4	41.8	39.3	
1400	58.9	56.2	53.6	50.9	47.9	45.1
1600	68.3	64.5	61.2	58.4	55.7	53.0
1800	77.3	73.6	69.9	66.1	62.5	59.5
2000	84.6	81.6	78.0	74.1	70.4	66.6
2200		87.5	84.4	81.3	77.6	73.5
2400				86.5	83.4	80.0
2600						84.0
2800						86.4

Decrease field limit weight by 5000 kg when using manual speedbrakes.

Landing Field Limit Weight - Dry Runway

Flaps 40

Based on anti-skid inoperative and manual speedbrakes

Wind Corrected Field Length (M)

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1800				1800	1960	2120	2260	2420
2000			1780	2000	2160	2320	2480	2640
2200		1700	1970	2200	2370	2530	2690	2860
2400	1630	1890	2160	2400	2570	2740	2910	3090
2600	1810	2070	2350	2600	2770	2950	3130	3310
2800	2000	2260	2540	2800	2970	3150	3340	3530
3000	2180	2450	2730	3000	3170	3360	3560	3750
3200	2360	2630	2920	3200	3380	3570	3770	3980
3400	2540	2820	3110	3400	3580	3770	3990	4200
3600	2720	3010	3300	3600	3780	3980	4200	4420
3800	2900	3190	3490	3800	3980	4190	4420	4650
4000	3080	3380	3680	4000	4180	4400	4640	4870
4200	3260	3570	3870	4200	4390	4600	4850	5090
4400	3440	3750	4060	4400	4590	4810	5070	5320
4600	3620	3940	4250	4600	4790	5020	5280	5540
4800	3800	4120	4440	4800	4990	5230	5500	5760
5000	3980	4310	4630	5000	5190	5430	5720	5990
5200	4160	4500	4820	5200	5400	5640	5930	
5400	4340	4680	5010	5400	5600	5850		
5600	4520	4870	5200	5600	5800			

Field Limit Weight (1000 KG)

WIND CORR'D FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
2000	39.9					
2200	44.9	42.1	38.8			
2400	50.0	46.9	43.4	40.6		
2600	55.0	51.7	48.0	44.9	42.0	39.2
2800	60.1	56.5	52.5	49.3	46.1	43.1
3000	65.3	61.2	57.1	53.6	50.2	46.9
3200	71.5	66.7	61.6	57.9	54.3	50.8
3400	76.9	72.2	66.9	62.2	58.4	54.7
3600	82.3	77.3	72.0	67.5	62.4	58.5
3800	87.8	82.5	76.9	72.1	67.5	62.3
4000		87.7	81.8	76.8	71.9	67.2
4200			86.7	81.3	76.3	71.2
4400				85.9	80.5	75.3
4600					84.8	79.2
4800						83.2
5000						87.1

Landing Field Limit Weight - Wet Runway

Flaps 40

Based on anti-skid operative and automatic speedbrakes

Wind Corrected Field Length (M)

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1000				1000	1070	1150	1220	1300
1200	960	1020	1080	1200	1280	1360	1440	1520
1400	1100	1180	1260	1400	1480	1570	1650	1740
1600	1250	1340	1440	1600	1690	1780	1870	1970
1800	1390	1490	1610	1800	1890	1990	2090	2190
2000	1540	1650	1790	2000	2100	2200	2300	2410
2200	1680	1800	1970	2200	2300	2410	2520	2630
2400	1830	1960	2140	2400	2500	2620	2730	2860
2600	1970	2120	2320	2600	2710	2830	2950	3080
2800	2120	2270	2500	2800	2910	3040	3170	3300
3000	2260	2430	2670	3000	3120	3250	3380	3530
3200	2410	2580	2850	3200	3320	3450	3600	3750
3400	2550	2740	3030	3400	3530	3660	3810	
3600	2700	2900	3200	3600	3730	3870		
3800	2840	3050	3380	3800				
4000	2990	3210	3560					
4200	3130	3360	3730					
4400	3280	3520						
4600	3420	3680						
4800	3570	3830						

Field Limit Weight (1000 KG)

WIND CORR'D FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
1200	41.7	39.3				
1400	50.8	48.0	45.3	42.6	40.1	
1600	58.5	55.9	53.3	50.5	47.6	44.7
1800	66.5	62.9	59.9	57.2	54.5	51.7
2000	74.6	71.0	67.1	63.4	60.4	57.5
2200	81.8	78.4	74.5	70.8	67.2	63.1
2400	87.3	84.2	81.2	77.4	73.5	69.7
2600			86.1	83.0	79.7	75.5
2800				87.4	84.2	81.0
3000						84.1
3200						86.1

Decrease field limit weight by 5000 kg when using manual speedbrakes.

Landing Field Limit Weight - Wet Runway

Flaps 40

Based on anti-skid inoperative and manual speedbrakes

Wind Corrected Field Length (M)

FIELD LENGTH AVAILABLE (M)	WIND COMPONENT (KTS)							
	-15	-10	-5	0	10	20	30	40
1800					1980	2150	2310	2480
2000				2000	2190	2360	2520	2700
2200			1950	2200	2390	2570	2740	2920
2400			2140	2400	2590	2780	2960	3150
2600		2020	2330	2600	2790	2980	3170	3370
2800	1920	2210	2520	2800	2990	3190	3390	3590
3000	2100	2390	2710	3000	3200	3400	3600	3820
3200	2280	2580	2900	3200	3400	3600	3820	4040
3400	2460	2770	3090	3400	3600	3810	4040	4260
3600	2640	2950	3280	3600	3800	4020	4250	4490
3800	2820	3140	3470	3800	4000	4230	4470	4710
4000	3000	3330	3660	4000	4210	4430	4680	4930
4200	3180	3510	3850	4200	4410	4640	4900	5150
4400	3360	3700	4040	4400	4610	4850	5120	5380
4600	3540	3890	4230	4600	4810	5060	5330	5600
4800	3720	4070	4420	4800	5010	5260	5550	5820
5000	3900	4260	4610	5000	5220	5470	5760	6050
5200	4080	4450	4800	5200	5420	5680	5980	6270
5400	4260	4630	4990	5400	5620	5890	6200	6490
5600	4440	4820	5180	5600	5820	6090	6410	6720

Field Limit Weight (1000 KG)

WIND CORR'D FIELD LENGTH (M)	AIRPORT PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
2400	42.1	39.4				
2600	46.5	43.5	40.2			
2800	50.9	47.7	44.2	41.4	38.6	
3000	55.3	51.9	48.2	45.1	42.2	39.4
3200	59.6	56.1	52.1	48.9	45.8	42.7
3400	64.0	60.2	56.1	52.6	49.3	46.1
3600	69.6	64.5	60.0	56.4	52.9	49.5
3800	74.3	69.7	64.0	60.1	56.4	52.8
4000	79.0	74.2	69.0	63.8	59.9	56.2
4200	83.8	78.6	73.3	68.7	63.5	59.5
4400		83.1	77.6	72.7	68.1	62.8
4600		87.7	81.8	76.8	71.9	67.2
4800			86.1	80.7	75.7	70.7
5000				84.7	79.4	74.2
5200					83.1	77.7
5400					86.8	81.1
5600						84.5
5800						87.9

Landing Climb Limit Weight

Valid for approach with Flaps 15 and landing with Flaps 40

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

AIRPORT OAT		AIRPORT LANDING CLIMB LIMIT WEIGHT (1000 KG)						
		AIRPORT PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
54	129	69.1	64.9					
52	126	70.3	66.7					
50	122	71.5	68.3	63.0				
48	118	72.8	69.7	64.7				
46	115	74.2	70.9	66.2	61.0			
44	111	75.5	72.2	67.5	62.5			
42	108	76.8	73.4	68.7	63.9	58.6		
40	104	78.1	74.7	69.9	65.1	60.0		
38	100	79.3	76.0	71.1	66.3	61.3	55.8	
36	97	80.6	77.2	72.3	67.5	62.4	56.7	
34	93	81.5	78.6	73.6	68.7	63.5	57.7	53.0
32	90	81.9	80.0	74.8	69.8	64.5	58.8	54.1
30	86	81.9	81.0	75.9	70.7	65.5	59.8	55.1
28	82	82.0	81.4	76.8	71.4	66.3	60.7	56.0
26	79	82.1	81.5	77.5	72.1	66.9	61.6	56.8
24	75	82.2	81.5	77.7	72.7	67.4	62.3	57.4
22	72	82.3	81.6	77.8	73.1	67.9	62.8	57.9
20	68	82.3	81.6	77.8	73.2	68.4	63.2	58.4
18	64	82.4	81.7	77.9	73.3	68.7	63.6	58.8
16	61	82.5	81.8	77.9	73.3	68.8	64.0	59.1
14	57	82.5	81.8	78.0	73.3	68.8	64.3	59.5
12	54	82.6	81.9	78.0	73.4	68.9	64.4	59.9
10	50	82.7	81.9	78.0	73.4	68.9	64.4	60.1
-40	-40	83.3	82.5	78.6	73.9	69.3	64.8	60.8

With engine bleed for packs off, increase weight by 1300 kg.
With engine anti-ice on, decrease weight by 250 kg.
With engine and wing anti-ice on, decrease weight by 1450 kg.
When operating in icing conditions during any part of the flight with forecast landing temperature below 10 °C, decrease weight by 6850 kg.

ENGINE INOP

ADVISORY INFORMATION

Go-Around Climb Gradient

Flaps 15, Gear Up

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

OAT (°C)	REFERENCE GO-AROUND GRADIENT (%)					
	PRESSURE ALTITUDE (FT)					
	0	2000	4000	6000	8000	10000
54	3.09					
50	3.77	2.70				
46	4.27	3.35	2.30			
42	4.78	3.82	2.90	1.84		
38	5.30	4.30	3.34	2.37	1.27	
34	5.83	4.80	3.81	2.80	1.65	0.73
30	6.38	5.27	4.20	3.17	2.07	1.15
26	6.41	5.63	4.49	3.45	2.42	1.48
22	6.44	5.65	4.71	3.64	2.66	1.71
18	6.46	5.67	4.72	3.82	2.82	1.87
14	6.49	5.68	4.74	3.83	2.96	2.01
10	6.51	5.70	4.75	3.84	2.97	2.15
6	6.53	5.71	4.76	3.85	2.98	2.16
2	6.55	5.73	4.78	3.86	2.99	2.17

Gradient Adjustment for Weight (%)

WEIGHT (1000 KG)	REFERENCE GO-AROUND GRADIENT (%)								
	0	1	2	3	4	5	6	7	8
80	-2.31	-2.61	-2.91	-3.19	-3.47	-3.73	-3.99	-4.25	-4.49
75	-1.89	-2.12	-2.36	-2.58	-2.81	-3.03	-3.24	-3.44	-3.65
70	-1.36	-1.53	-1.69	-1.85	-2.01	-2.17	-2.32	-2.47	-2.62
65	-0.73	-0.82	-0.91	-0.99	-1.08	-1.16	-1.24	-1.32	-1.40
60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
55	0.83	0.94	1.04	1.15	1.25	1.36	1.46	1.56	1.66
50	1.78	2.02	2.27	2.51	2.75	2.98	3.21	3.44	3.66

Gradient Adjustment for Speed (%)

SPEED (KIAS)	WEIGHT ADJUSTED GO-AROUND GRADIENT (%)								
	0	1	2	3	4	5	6	7	8
VREF40	-0.24	-0.25	-0.26	-0.27	-0.27	-0.28	-0.28	-0.27	-0.27
VREF40+5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
VREF40+10	0.13	0.12	0.12	0.13	0.14	0.15	0.17	0.20	0.23
VREF40+15	0.27	0.25	0.25	0.25	0.26	0.28	0.31	0.34	0.38
VREF40+20	0.40	0.38	0.37	0.37	0.37	0.38	0.40	0.42	0.46
VREF40+25	0.54	0.51	0.49	0.47	0.46	0.45	0.45	0.45	0.46
VREF40+30	0.68	0.64	0.61	0.57	0.53	0.49	0.46	0.42	0.39

With engine bleed for packs off, increase gradient by 0.4%.
With engine anti-ice on, decrease gradient by 0.1%.
With engine and wing anti-ice on, decrease gradient by 0.3%.
When operating in icing conditions during any part of the flight with forecast landing temperatures below 10°C decrease gradient by 1.0%.

Quick Turnaround Limit Weight - Category C Steel Brakes

(Note: A placard showing carbon brakes configuration will be put at the Center Forward Panel upon modification.)

Flaps 40

OAT		LIMIT WEIGHT (1000 KG)					
		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	0	2000	4000	6000	8000	10000
54	129	80.9					
50	122	81.4	78.5				
45	113	82.1	79.0	76.1			
40	104	82.8	79.7	76.7	73.8		
35	95	83.6	80.4	77.4	74.4	71.6	
30	86	84.3	81.1	78.0	75.1	72.2	69.3
25	77	85.1	81.8	78.7	75.7	72.8	69.9
20	68	85.9	82.6	79.3	76.4	73.4	70.5
15	59	86.1	83.4	80.0	77.1	74.1	71.1
10	50	86.1	84.1	80.8	77.8	74.8	71.8
5	41	86.1	84.9	81.6	78.5	75.5	72.4
0	32	86.1	85.8	82.4	79.2	76.2	73.1
-5	23	86.1	86.1	83.2	79.9	76.9	73.8
-10	14	86.1	86.1	84.0	80.7	77.7	74.5
-15	5	86.1	86.1	84.9	81.5	78.4	75.2
-20	-4	86.1	86.1	85.8	82.4	79.2	76.0
-30	-22	86.1	86.1	86.1	84.2	80.8	77.6
-40	-40	86.1	86.1	86.1	86.1	82.6	79.2
-50	-58	86.1	86.1	86.1	86.1	84.5	81.0
-54	-65	86.1	86.1	86.1	86.1	85.3	81.7

Increase weight by 700 kg per 1% uphill slope. Decrease weight by 1150 kg per 1% downhill slope.
Increase weight by 1750 kg per 10 knots headwind. Decrease weight by 7550 kg per 10 knots tailwind.
After landing at weights exceeding those shown above, adjusted for slope and wind, wait at least 67 minutes and check that wheel thermal plugs have not melted before executing a subsequent takeoff.

As an alternate procedure, ensure that each brake pressure plate surface temperature, without artificial cooling, is less than 218°C as follows: No sooner than 10 and no later than 15 minutes after parking, measure each brake pressure plate surface temperature at a minimum of two points per brake by an accurate method (using a Doric Microtemp 450 hand held thermometer or equivalent, hold temperature probe in place for 20 seconds or until reading stabilizes). If each measured temperature is less than 218°C, immediate dispatch is allowed; otherwise the required minimum ground wait period of 67 minutes applies.

If a Brake Temperature Monitoring System (BTMS) is installed:

No sooner than 10 and no later than 15 minutes after parking, check the BRAKE TEMP light. If the BRAKE TEMP light is not on, no ground waiting period is required. If the BRAKE TEMP light is on, do not dispatch until at least 67 minutes after landing, or until all the BTMS readings on the systems Display are below 3.5 and the BRAKE TEMP light is off. Check that wheel thermal plugs have not melted before making a subsequent takeoff.
Note: If any brake temperature display digit is blank or indicates 0.0 or 0.1, then this method cannot be used.

Quick Turnaround Limit Weight - Category N Carbon Brakes

Flaps 40

OAT		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	0	2000	4000	6000	8000	10000
54	129	74.9					
50	122	75.3	72.6				
45	113	76.0	73.2	70.4			
40	104	76.6	73.8	71.0	68.3		
35	95	77.3	74.4	71.6	68.9	66.1	
30	86	77.9	75.1	72.2	69.5	66.8	63.7
25	77	78.6	75.7	72.8	70.1	67.4	64.2
20	68	79.3	76.4	73.5	70.7	68.0	64.8
15	59	80.0	77.1	74.1	71.3	68.6	65.4
10	50	80.7	77.8	74.8	72.0	69.2	66.5
5	41	81.5	78.5	75.5	72.6	69.8	67.1
0	32	82.2	79.2	76.2	73.3	70.5	67.7
-5	23	83.0	79.9	76.9	74.0	71.2	68.4
-10	14	83.9	80.7	77.7	74.7	71.8	69.0
-15	5	84.7	81.5	78.5	75.5	72.6	69.7
-20	-4	85.6	82.3	79.2	76.2	73.3	70.4
-30	-22	86.1	84.1	80.9	77.9	74.8	71.8
-40	-40	86.1	86.0	82.7	79.5	76.5	73.4
-50	-58	86.1	86.1	84.6	81.3	78.2	75.1
-54	-65	86.1	86.1	85.4	82.0	78.9	75.8

Increase weight by 600 kg per 1% uphill slope. Decrease weight by 1150 kg per 1% downhill slope. Increase weight by 1550 kg per 10 knots headwind. Decrease weight by 8150 kg per 10 knots tailwind. After landing at weights exceeding those shown above, adjusted for slope and wind, wait at least 48 minutes and check that wheel thermal plugs have not melted before executing a takeoff.

If a Brake Temperature Monitoring System (BTMS) is installed:

No sooner than 10 and no later than 15 minutes after parking, check the BRAKE TEMP light. If the BRAKE TEMP light is not on, no ground waiting period is required. If the BRAKE TEMP light is on, do not dispatch until at least 48 minutes after landing, or until all the BTMS readings on the systems Display are below 3.0 and the BRAKE TEMP light is off. Check that wheel thermal plugs have not melted before making a subsequent takeoff.
Note: If any brake temperature display digit is blank or indicates 0.0 or 0.1, then this method cannot be used.

GEAR DOWN

Takeoff Climb Limit Weight

Flaps 5

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

AIRPORT OAT		TAKEOFF CLIMB WEIGHT (1000 KG)					
		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	0	2000	4000	6000	8000	10000
54	129	59.0	55.7	52.6	49.4	45.7	
52	126	60.3	55.7	52.6	49.4	45.9	
50	122	61.6	56.0	52.5	49.3	45.9	42.9
48	118	63.0	57.3	52.5	49.3	45.9	43.2
46	115	64.4	58.6	52.8	49.3	45.9	43.1
44	111	65.9	59.8	54.1	49.3	45.9	43.1
42	108	67.3	61.1	55.4	49.6	45.8	43.1
40	104	68.6	62.4	56.6	50.9	45.8	43.1
38	100	69.9	63.6	57.8	52.1	46.2	43.1
36	97	71.1	64.8	59.0	53.3	47.4	43.1
34	93	72.5	66.3	60.2	54.5	48.6	43.4
32	90	74.0	67.5	61.4	55.7	49.8	44.6
30	86	75.5	68.9	62.6	56.8	51.0	45.8
28	82	76.4	70.4	63.8	58.0	52.2	46.9
26	79	76.4	71.9	65.1	59.2	53.4	48.1
24	75	76.5	72.9	66.8	60.4	54.6	49.3
22	72	76.6	72.9	68.2	61.7	55.8	50.5
20	68	76.6	73.0	68.6	63.0	56.9	51.7
18	64	76.7	73.0	68.6	64.2	58.1	52.8
16	61	76.7	73.0	68.6	64.4	59.3	53.9
14	57	76.8	73.1	68.7	64.4	60.3	54.9
12	54	76.8	73.1	68.7	64.4	60.3	55.9
10	50	76.9	73.2	68.7	64.4	60.3	56.5

With engine bleeds for packs off, increase weight by 250 kg.
With engine anti-ice on, decrease weight by 1100 kg.
With engine and wing anti-ice on, decrease weight by 5700 kg (optional system).

GEAR DOWN

Landing Climb Limit Weight

Valid for approach with Flaps 15 and Landing with Flaps 40

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

AIRPORT OAT		LANDING CLIMB LIMIT WEIGHT (1000 KG)					
		AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F	0	2000	4000	6000	8000	10000
54	129	58.5					
52	126	60.0					
50	122	61.6	56.8				
48	118	62.7	58.3				
46	115	63.9	59.7	55.0			
44	111	65.0	60.7	56.3			
42	108	66.4	61.8	57.7	52.9		
40	104	67.5	62.9	58.7	54.1		
38	100	68.7	64.0	59.7	55.3	50.3	
36	97	69.9	65.0	60.8	56.3	51.2	
34	93	71.1	66.6	61.9	57.3	52.0	47.8
32	90	72.3	67.7	62.8	58.1	53.0	48.8
30	86	73.5	68.6	63.6	59.0	53.9	49.7
28	82	73.6	69.5	64.3	59.7	54.8	50.5
26	79	73.7	70.2	64.9	60.2	55.5	51.3
24	75	73.7	70.3	65.4	60.6	56.2	51.8
22	72	73.8	70.3	66.1	61.1	56.6	52.2
20	68	73.8	70.4	66.1	61.5	57.0	52.6
18	64	73.9	70.4	66.2	61.8	57.3	53.0
16	61	73.9	70.5	66.2	61.9	57.6	53.3
14	57	74.0	70.5	66.3	61.9	58.0	53.6
12	54	74.0	70.5	66.3	61.9	58.0	53.9
10	50	74.1	70.6	66.3	61.9	58.0	54.3
-40	-40	74.6	71.0	66.8	62.3	58.4	54.8

With engine bleed for packs off, increase weight by 1200 kg.
With engine anti-ice on, decrease weight by 250 kg.
With engine and wing anti-ice on, decrease weight by 1400 kg.
When operating in icing conditions during any part of the flight with forecast landing temperature below 10°C, decrease weight by 7000 kg.

GEAR DOWN

Takeoff Obstacle Limit Weight

Flaps 5

Sea Level, 30°C & Below, Zero Wind

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

Reference Obstacle Limit Weight (1000 KG)

OBSTACLE HEIGHT (M)	DISTANCE FROM BRAKE RELEASE (100 M)										
	25	30	35	40	45	50	55	60	65	70	75
5	74.2										
20	67.7	72.3									
40	62.3	66.8	70.3	72.9	75.0	76.5					
60	58.3	62.7	66.2	69.1	71.3	73.2	74.7	75.9			
80	55.0	59.4	63.0	65.9	68.3	70.3	71.9	73.3	74.4	75.4	76.3
100	52.3	56.6	60.2	63.1	65.6	67.7	69.4	70.9	72.2	73.3	74.3
120	49.9	54.2	57.8	60.7	63.2	65.4	67.2	68.8	70.2	71.4	72.4
140	47.7	52.0	55.6	58.6	61.1	63.3	65.2	66.8	68.3	69.6	70.7
160	45.7	50.1	53.6	56.6	59.2	61.4	63.3	65.0	66.5	67.9	69.0
180	44.0	48.3	51.8	54.8	57.4	59.7	61.6	63.4	64.9	66.3	67.5
200	42.3	46.6	50.2	53.2	55.8	58.1	60.1	61.8	63.4	64.8	66.0
220		45.1	48.6	51.7	54.3	56.6	58.6	60.4	62.0	63.4	64.7
240		43.6	47.2	50.2	52.9	55.2	57.2	59.0	60.6	62.1	63.4
260		42.3	45.8	48.9	51.5	53.8	55.9	57.7	59.3	60.8	62.2
280			44.6	47.6	50.3	52.6	54.6	56.5	58.1	59.6	61.0
300			43.4	46.4	49.1	51.4	53.5	55.3	57.0	58.5	59.9

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

OAT Adjustments

OAT (°C)	REFERENCE OBSTACLE LIMIT WEIGHT (1000 KG)							
	40	45	50	55	60	65	70	75
30 & BELOW	0	0	0	0	0	0	0	0
32	-0.6	-0.7	-0.8	-0.9	-1.0	-1.1	-1.2	-1.3
34	-1.1	-1.3	-1.5	-1.7	-1.9	-2.1	-2.3	-2.5
36	-1.7	-2.0	-2.3	-2.6	-2.9	-3.2	-3.5	-3.8
38	-2.2	-2.6	-3.0	-3.4	-3.8	-4.2	-4.6	-5.0
40	-2.8	-3.3	-3.8	-4.3	-4.8	-5.3	-5.8	-6.3
42	-3.4	-3.9	-4.5	-5.1	-5.7	-6.3	-6.8	-7.4
44	-3.9	-4.6	-5.2	-5.9	-6.5	-7.2	-7.9	-8.5
46	-4.5	-5.2	-5.9	-6.7	-7.4	-8.2	-8.9	-9.6
48	-5.0	-5.8	-6.6	-7.5	-8.3	-9.1	-9.9	-10.7
50	-5.6	-6.5	-7.4	-8.3	-9.2	-10.1	-11.0	-11.9

GEAR DOWN

Takeoff Obstacle Limit Weight

Flaps 5

Sea Level, 30°C & Below, Zero Wind

Pressure Altitude Adjustments

ALT (FT)	OAT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)							
	40	45	50	55	60	65	70	75
S.L. & BELOW	0	0	0	0	0	0	0	0
1000	-1.5	-1.7	-1.9	-2.1	-2.2	-2.4	-2.6	-2.8
2000	-3.0	-3.4	-3.8	-4.1	-4.5	-4.9	-5.2	-5.6
3000	-4.2	-4.7	-5.3	-5.8	-6.4	-7.0	-7.5	-8.1
4000	-5.3	-6.0	-6.8	-7.6	-8.3	-9.1	-9.8	-10.6
5000	-6.6	-7.5	-8.4	-9.3	-10.2	-11.1	-12.0	-12.9
6000	-7.8	-8.9	-10.0	-11.0	-12.1	-13.2	-14.2	-15.3
7000	-9.2	-10.4	-11.7	-12.9	-14.1	-15.3	-16.5	-17.8
8000	-10.6	-12.0	-13.3	-14.7	-16.1	-17.5	-18.9	-20.2
9000	-11.7	-13.2	-14.7	-16.3	-17.8	-19.3	-20.9	-22.4
10000	-12.8	-14.4	-16.1	-17.8	-19.5	-21.2	-22.9	-24.6

Wind Adjustments

WIND (KTS)	OAT & ALT ADJUSTED OBSTACLE LIMIT WEIGHT (1000 KG)							
	40	45	50	55	60	65	70	75
15 TW	-9.5	-9.2	-9.0	-8.7	-8.4	-8.2	-7.9	-7.6
10 TW	-6.3	-6.1	-6.0	-5.8	-5.6	-5.4	-5.3	-5.1
5 TW	-3.2	-3.1	-3.0	-2.9	-2.8	-2.7	-2.6	-2.5
0	0	0	0	0	0	0	0	0
10 HW	1.0	0.9	0.8	0.8	0.7	0.6	0.5	0.4
20 HW	2.1	1.9	1.7	1.5	1.3	1.1	0.9	0.7
30 HW	3.3	3.0	2.7	2.5	2.2	1.9	1.6	1.4
40 HW	4.4	4.1	3.7	3.4	3.1	2.7	2.4	2.0

With engine bleed for packs off, increase weight by 200 kg.
With engine anti-ice on, decrease weight by 2050 kg.
With engine and wing anti-ice on, decrease weight by 7700 kg (optional system).

GEAR DOWN

Long Range Cruise Altitude Capability

Max Cruise Thrust, 100 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
85	15600	12500	9400
80	18400	15500	12600
75	21100	18500	15700
70	23600	21400	18600
65	26100	24400	21800
60	28600	27100	25300
55	30800	29600	28100
50	32900	31900	30700
45	35100	34100	33000
40	37500	36500	35400

GEAR DOWN

Long Range Cruise Trip Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
340	300	266	239	218	200	187	174	164	155	147
508	449	399	359	328	300	280	262	246	233	221
675	597	531	479	437	400	374	350	329	311	295
841	745	662	598	545	500	467	438	412	389	369
1006	892	794	717	654	600	561	526	495	468	444
1170	1038	925	835	763	700	655	614	578	546	518
1332	1183	1055	954	872	800	749	703	661	625	593
1494	1328	1185	1072	980	900	843	791	745	704	668
1655	1472	1315	1190	1089	1000	937	879	828	783	743
1814	1615	1444	1308	1197	1100	1031	968	911	862	818
1973	1758	1573	1426	1305	1200	1125	1056	995	941	894
2131	1900	1701	1543	1413	1300	1218	1145	1079	1020	969
2288	2041	1829	1660	1521	1400	1313	1233	1162	1100	1045
2444	2182	1957	1777	1629	1500	1407	1322	1246	1179	1121
2599	2323	2084	1894	1737	1600	1501	1411	1330	1259	1197
2754	2463	2212	2011	1845	1700	1595	1500	1414	1339	1273
2907	2602	2338	2127	1953	1800	1689	1589	1499	1419	1350
3060	2741	2465	2243	2060	1900	1784	1678	1583	1499	1426
3212	2879	2591	2359	2168	2000	1878	1767	1668	1580	1503

Reference Fuel and Time Required

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		20		24		28	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	2.6	0:53	2.5	0:51	2.3	0:49	2.2	0:48	2.2	0:47
300	3.8	1:18	3.6	1:14	3.3	1:10	3.2	1:08	3.1	1:05
400	5.0	1:42	4.7	1:37	4.4	1:31	4.2	1:27	4.0	1:24
500	6.3	2:06	5.9	2:00	5.4	1:52	5.1	1:47	5.0	1:43
600	7.6	2:30	7.1	2:22	6.5	2:13	6.1	2:06	5.9	2:01
700	8.9	2:53	8.3	2:44	7.5	2:33	7.1	2:25	6.9	2:19
800	10.2	3:16	9.5	3:06	8.6	2:53	8.1	2:44	7.8	2:37
900	11.5	3:39	10.7	3:28	9.7	3:13	9.2	3:03	8.8	2:56
1000	12.8	4:02	11.9	3:50	10.8	3:33	10.2	3:23	9.7	3:14
1100	14.2	4:24	13.2	4:11	11.9	3:53	11.2	3:41	10.8	3:31
1200	15.5	4:46	14.5	4:32	13.1	4:12	12.3	3:59	11.8	3:49
1300	16.9	5:08	15.8	4:53	14.2	4:31	13.4	4:18	12.8	4:07
1400	18.3	5:30	17.0	5:14	15.4	4:51	14.4	4:36	13.8	4:25
1500	19.6	5:52	18.3	5:35	16.5	5:10	15.5	4:55	14.9	4:42
1600	21.1	6:13	19.7	5:55	17.7	5:29	16.6	5:13		
1700	22.5	6:34	21.0	6:15	18.9	5:48	17.8	5:31		
1800	24.0	6:55	22.4	6:35	20.1	6:06	18.9	5:48		
1900	25.4	7:16	23.7	6:55	21.3	6:25	20.0	6:06		
2000	26.9	7:37	25.1	7:16	22.5	6:44	21.1	6:24		

GEAR DOWN

Long Range Cruise Trip Fuel and Time

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	LANDING WEIGHT (1000 KG)						
	40	45	50	55	60	65	70
2	-0.2	-0.1	0.0	0.1	0.3	0.4	0.5
4	-0.4	-0.2	0.0	0.2	0.5	0.7	1.0
6	-0.6	-0.3	0.0	0.4	0.7	1.1	1.4
8	-0.8	-0.4	0.0	0.5	0.9	1.4	1.8
10	-1.0	-0.5	0.0	0.6	1.1	1.7	2.3
12	-1.1	-0.6	0.0	0.7	1.4	2.0	2.7
14	-1.3	-0.7	0.0	0.8	1.6	2.4	3.2
16	-1.5	-0.8	0.0	0.9	1.8	2.7	3.6
18	-1.7	-0.9	0.0	1.0	2.0	3.0	4.0
20	-1.9	-0.9	0.0	1.1	2.2	3.3	4.5
22	-2.1	-1.0	0.0	1.2	2.4	3.7	4.9
24	-2.3	-1.1	0.0	1.3	2.6	4.0	5.3
26	-2.4	-1.2	0.0	1.4	2.9	4.3	5.8
28	-2.6	-1.3	0.0	1.5	3.1	4.6	6.2

Based on VREF40 + 70 climb, Long Range Cruise and VREF40 + 70 descent.

GEAR DOWN

Holding Planning

Flaps Up

WEIGHT (1000 KG)	TOTAL FUEL FLOW (KG/HR)							
	PRESSURE ALTITUDE (FT)							
	1500	5000	10000	15000	20000	25000	30000	35000
85	4480	4450	4430	4460	4510			
80	4230	4200	4170	4190	4210			
75	3980	3950	3920	3920	3930			
70	3740	3700	3670	3660	3660	3720		
65	3530	3480	3450	3420	3410	3440		
60	3300	3240	3210	3170	3150	3160	3320	
55	3070	3020	2970	2940	2900	2900	2980	
50	2840	2790	2740	2700	2660	2650	2690	
45	2620	2570	2520	2480	2420	2400	2440	2530
40	2390	2350	2300	2260	2200	2160	2190	2220

This table includes 5% additional fuel for holding in a racetrack pattern.

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Net Level Off Weight

PRESSURE ALTITUDE (1000 FT)	LEVEL OFF WEIGHT (1000 KG)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
22	42.9	41.7	
20	46.4	45.1	43.8
18	50.0	48.4	46.7
16	53.6	51.7	49.8
14	56.8	55.1	53.3
12	60.5	58.5	56.2
10	64.1	61.9	59.1
8	68.1	65.6	62.6
6	72.1	69.2	66.0
4	75.9	72.7	69.2
2	79.5	76.1	72.6
0	82.9	79.3	75.9

Anti-Ice Adjustments

ANTI-ICE CONFIGURATION	LEVEL OFF WEIGHT ADJUSTMENT (1000 KG)				
	PRESSURE ALTITUDE (1000 FT)				
	2	6	10	14	18
ENGINE ONLY	-1.7	-1.3	-1.5	-1.5	-1.3
ENGINE AND WING	-6.6	-5.9	-5.6	-5.1	-4.9

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Introduction

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

Takeoff

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

Brake Energy or Tire Speed Limit Weight tables are only provided if they are limiting for the range of conditions covered in the FCOM Section PD.

Field Limit Weight - Slope and Wind Corrections

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

Field and Climb Limit Weight

Tables are presented for selected airport pressure altitudes and runway conditions and show both Field and Climb Limit Weights. Enter the appropriate table for pressure altitude and runway condition with “Slope and Wind Corrected Field Length” determined above and airport OAT to obtain Field Limit Weight. Also read Climb Limit Weight for the same OAT. Intermediate altitudes may be interpolated or use next higher altitude. When finding a maximum weight for a wet runway, the dry runway limit weight must also be determined and the lower of the two weights used.

Obstacle Limit Weight

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

Tire Speed Limit

Tire Speed Limit Weight tables are only provided if they are limiting for the range of conditions covered in the FCOM Section PD.

Maximum tire speed limited weights are presented for 225 MPH tires. To determine the tire speed limit weight, enter the table with OAT and airport pressure altitude. Adjust the tire speed limit weight according to the notes below the table to account for wind.

Brake Energy Limit VMBE

Brake Energy Limit Weight tables are only provided if they are limiting for the range of conditions covered in the FCOM Section PD.

The Maximum Brake Energy Speed table provides the Reference VMBE for a variety of airport pressure altitudes and temperatures. Enter the Weight Adjusted VMBE table to adjust the Reference VMBE for the actual brake release gross weight. Correct VMBE for slope and wind. If V1 exceeds VMBE, decrease brake release weight as indicated for each knot that V1 exceeds VMBE and determine V1, VR, and V2 for the lower brake release weight.

Enroute

Long Range Cruise Maximum Operating Altitude

These tables provide the maximum operating altitude in the same manner as the FMC. Maximum altitudes are shown for a given cruise weight and maneuver capability. Note that this table considers both thrust and buffet limits, providing the more limiting of the two. Any data that is thrust limited is denoted by an asterisk and represents only a thrust limited condition in level flight with 100 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 15° may cause the airplane to lose speed and/or altitude. The altitudes shown in the table are limited to the maximum certified altitude of 41000 ft.

Long Range Cruise Trip Fuel and Time

Long Range Cruise Trip Fuel and Time tables are provided to determine trip time and fuel required to destination.

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

Long Range Cruise Step Climb Trip Fuel and Time

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

Short Trip Fuel and Time

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

Holding Planning

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

Flight Crew Oxygen Requirements

This airplane is equipped with a chemical passenger oxygen system. Regulations require that sufficient oxygen be provided to the flight crew to account for the greater of supplemental breathing oxygen in the event of a cabin depressurization or protective breathing in the event of smoke or harmful fumes in the flight deck. The oxygen quantity associated with the above requirements is achieved with the minimum dispatch oxygen cylinder pressure.

To determine the minimum dispatch oxygen cylinder pressure enter the appropriate flight crew oxygen table with the number of crew plus observers using oxygen and read the minimum cylinder pressure required for the appropriate cylinder temperature.

Net Level Off Weight

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

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

Landing

Tables are provided for determining the maximum landing weight as limited by field length or climb requirements for a single landing flap.

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

Landing Field Limit Weight

For the expected runway condition and anti-skid system configuration, obtain wind corrected field length by entering the Wind Corrected Field Length table with field length available and wind component along the runway. Now enter the Field Limit Weight table with wind corrected field length and pressure altitude to read field limit weight.

Landing Climb Limit Weight

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

Go-Around Climb Gradient

Enter the Reference Go-Around Gradient table with airport OAT and pressure altitude to determine the reference go-around gradient. Then adjust the reference gradient for airplane weight and speed using the tables provided to determine the weight and speed adjusted go-around gradient. Apply the necessary corrections for engine bleed configuration and icing conditions as noted.

Quick Turnaround Limit Weight

Enter the appropriate table (Steel or Carbon Brakes) with airport pressure altitude and OAT to read maximum quick turnaround weight. Apply the noted adjustments as required.

If the landing weight exceeds the maximum quick turnaround weight, wait the specified time and then check that the wheel thermal plugs have not melted before executing a subsequent takeoff. For Steel Brakes, the alternate procedures on the charts can be used to ensure the brake temperature is within limits. These procedures cannot be used for carbon brakes.

Gear Down

This section provides flight planning data for revenue operation with gear down. Unless otherwise noted, the gear down tables in this section are identical in format and usage to the corresponding gear up tables previously described.

To eliminate erroneous displays the flight crew should enter only gross weight data on the PERF INIT page of the Control Display Unit (CDU). Omission of the cost index and cruise altitude entries on the PERF INIT page will render the VNAV function unavailable during flight. As a result, the following information will not be provided: VNAV guidance and speed schedules, trip fuel and ETA predictions, optimum and maximum altitude data, step climb and top of descent predictions, and the VNAV descent guidance path.

The gross weight entry allows the FMCS takeoff and approach speed schedules to be generated. In addition, the flap maneuver speed and VREF speed bugs will be available for display on the primary flight display speed tape. Except for VNAV, normal autopilot and autothrottle modes will remain available for use during the flight, as will the LNAV mode.

Takeoff/Landing Climb Limit Weight

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

Performance Inflight Chapter PI

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Performance Inflight — Chapter PI

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737-700 CFM56-7B22 KG M FAA CATA

General

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

Serial and tabulation number are supplied by Boeing.

Registry Number	Serial Number	Tabulation Number
B-2998	29042	YA701
B-2999	29084	YA702
B-2991	29085	YA703
B-2992	29086	YA704
B-2658	30512	YA705
B-2659	30513	YA706
B-5029	30634	YA707

Registry Number	**Serial Number**	**Tabulation Number**
B-5028	30034	YA708
B-5038	30656	YA709
B-5039	28258	YA710

Performance Inflight — Chapter PI

General — Section 10

Takeoff Speeds - Dry Runway

V1, VR, V2 for Max Takeoff Thrust

WEIGHT (1000 KG)	FLAPS1			FLAPS5			FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
72	144	146	151	141	143	147	135	136	140						
68	140	141	147	137	138	143	131	131	137						
64	135	136	143	132	134	139	126	127	133	124	125	130	123	123	129
60	130	131	138	127	128	135	121	122	129	119	120	126	118	118	125
56	124	125	133	121	123	130	116	117	124	114	115	122	113	114	121
52	118	119	128	115	117	126	111	112	120	109	110	118	108	109	117
48	112	113	123	109	111	121	105	107	116	104	105	114	103	104	113
44	106	107	118	103	105	115	100	101	111	98	99	110	97	98	109
40	99	101	113	97	99	110	93	95	107	92	94	105	91	93	104

Check V1(MCG).

V1, VR, V2 Adjustments*

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

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
72	-3	-1	0	1	2	-1	-1	0	0	0	1	1	1
68	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
64	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
60	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
56	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
52	-1	-1	0	1	1	-2	-1	0	0	0	1	1	1
48	-1	-1	0	1	1	-2	-1	0	0	0	1	1	1
44	-1	0	0	1	1	-2	-1	0	0	0	1	1	1
40	-1	0	0	1	1	-2	-1	0	0	0	1	1	1

***V1 not to exceed VR.**

V1(MCG)

Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	98	96					
60	140	98	96	95	93			
50	122	100	98	95	93	91	89	87
40	104	105	103	99	96	92	89	87
30	86	108	108	104	100	97	92	89
20	68	108	108	106	104	101	96	93
-60	-76	110	109	107	105	103	100	98

Takeoff Speeds - Wet Runway
V1, VR, V2 for Max Takeoff Thrust

WEIGHT (1000 KG)	FLAPS1			FLAPS5			FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
72	139	146	151	135	143	147	129	136	140						
68	134	141	147	130	138	143	125	131	137						
64	128	136	143	125	134	139	120	127	133	120	125	130	118	123	129
60	122	131	138	119	128	135	114	122	129	114	120	126	113	118	125
56	116	125	133	113	123	130	109	117	124	108	115	122	107	114	121
52	110	119	128	107	117	126	103	112	120	103	110	118	101	109	117
48	103	113	123	101	111	121	97	107	116	97	105	114	96	104	113
44	97	107	118	94	105	115	92	101	111	91	99	110	90	98	109
40	90	101	113	88	99	110	85	95	107	84	94	105	83	93	104

Check V1(MCG).

V1, VR, V2 Adjustments*

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

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
72	-4	-2	0	2	4	-3	-2	-1	0	1	1	2	2
68	-4	-2	0	2	4	-3	-2	-1	0	1	1	2	2
64	-4	-2	0	2	4	-3	-2	-1	0	1	1	2	3
60	-3	-2	0	2	4	-3	-2	-1	0	1	1	2	3
56	-3	-2	0	2	3	-4	-2	-1	0	1	2	2	3
52	-3	-1	0	2	3	-4	-2	-1	0	1	2	2	3
48	-3	-1	0	1	3	-4	-2	-1	0	1	2	3	3
44	-2	-1	0	2	3	-4	-3	-1	0	1	2	3	4
40	-2	-1	0	1	2	-4	-3	-1	0	1	2	3	4

***V1 not to exceed VR.**

V1(MCG)
Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	98	96					
60	140	98	96	95	93			
50	122	100	98	95	93	91	89	87
40	104	105	103	99	96	92	89	87
30	86	108	108	104	100	97	92	89
20	68	108	108	106	104	101	96	93
-60	-76	110	109	107	105	103	100	98

Maximum Allowable Clearway

FIELD LENGTH (M)	MAX ALLOWABLE CLEARWAY FOR V1 REDUCTION (M)
1200	140
1600	190
2000	230
2400	270
2800	320
3200	360

Clearway and Stopway V1 Adjustments

CLEARWAY MINUS STOPWAY (M)	NORMAL V1 (KIAS)					
	DRY RUNWAY			WET RUNWAY		
	100	120	140	100	120	140
300	-2	-3	-4			
200	-2	-3	-4			
100	-1	-2	-2			
0	0	0	0	0	0	0
-100	1	1	1	2	2	1
-200	2	2	2	4	3	2
-300	2	2	2	5	4	3

Use of clearway not allowed on wet runways.
V1 not to exceed VR.

Stab Trim Setting

Max Takeoff Thrust

Flaps 1 and 5

WEIGHT (1000 KG)	C.G. (%MAC)									
	9	10	12	13	16	20	24	28	31	33
70-80	8 1/2	8 1/2	8 1/2	8 1/4	7 3/4	6 3/4	6	5 1/4	4 3/4	4 1/4
60	8 1/2	8 1/2	8	7 3/4	7	6 1/4	5 1/2	4 3/4	4 1/4	3 3/4
50	8	7 3/4	7 1/4	7	6 1/2	5 3/4	5	4 1/4	3 1/2	3 1/4
35 - 45	7	7	6 1/2	6 1/2	6	5 1/4	4 1/2	4	3 1/2	3

Flaps 10, 15 and 25

WEIGHT (1000 KG)	C.G. (%MAC)									
	9	10	12	13	16	20	24	28	31	33
70-80	8 1/2	8 1/2	8 1/2	8 1/4	7 1/4	6 1/2	5 1/2	4 3/4	4	3 3/4
60	8 1/2	8 1/2	7 3/4	7 1/2	6 3/4	6	5	4 1/4	3 1/2	3 1/4
50	8	7 3/4	7 1/4	6 3/4	6	5 1/4	4 1/4	3 1/2	3	2 3/4
35 - 45	6 3/4	6 1/2	6	6	5 1/2	4 3/4	4	3 1/4	2 3/4	2 3/4

VREF

WEIGHT (1000 KG)	FLAPS		
	40	30	15
80	154	156	162
75	149	151	157
70	144	146	152
65	139	141	147
60	133	135	140
55	127	129	134
50	120	123	127
45	114	117	121
40	107	110	114

Flap Maneuver Speeds

FLAP POSITION	MANEUVER SPEED
UP	VREF40 + 70
1	VREF40 + 50
5	VREF40 + 30
10	VREF40 + 30
15	VREF40 + 20
25	VREF40 + 10
30	VREF30
40	VREF40

ADVISORY INFORMATION

Slush/Standing Water Takeoff

Maximum Reverse Thrust

Weight Adjustments (1000 KG)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-14.8	-16.9	-18.9	-18.4	-20.5	-22.5	-26.3	-28.4	-30.4
85	-12.7	-14.7	-16.8	-15.6	-17.6	-19.7	-21.9	-23.9	-26.0
80	-10.6	-12.6	-14.7	-12.8	-14.8	-16.8	-17.8	-19.8	-21.8
75	-8.8	-10.8	-12.9	-10.4	-12.5	-14.5	-14.3	-16.3	-18.4
70	-7.4	-9.4	-11.5	-8.6	-10.7	-12.7	-11.5	-13.5	-15.5
65	-6.4	-8.4	-10.5	-7.4	-9.4	-11.4	-9.5	-11.5	-13.6
60	-5.5	-7.5	-9.6	-6.3	-8.3	-10.4	-8.0	-10.0	-12.1
55	-4.8	-6.8	-8.8	-5.3	-7.4	-9.4	-6.7	-8.7	-10.7
50	-4.1	-6.2	-8.2	-4.6	-6.6	-8.7	-5.5	-7.6	-9.6
45	-3.7	-5.7	-7.7	-4.0	-6.0	-8.1	-4.6	-6.6	-8.7
40	-3.3	-5.4	-7.4	-3.5	-5.6	-7.6	-3.9	-5.9	-7.9

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1400	31.4			34.0			38.9		
1600	45.0			47.7			52.0	32.3	
1800	59.3	37.8		62.0	40.5		66.3	45.0	
2000	74.3	51.7	30.8	76.8	54.4	33.3	82.0	58.6	38.3
2200	90.3	66.3	44.4	92.3	68.9	47.0	99.0	73.5	51.4
2400		81.8	58.6		84.1	61.3		90.0	65.6
2600		98.1	73.6		99.8	76.1			81.2
2800			89.5			91.6			98.2

1. **Enter Weight Adjustment table with slush/standing water depth and dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -40 m/+35 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff

Maximum Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-10	-8	-5	0	0	0	0	0	0
85	-12	-9	-7	-2	0	0	0	0	0
80	-13	-11	-8	-5	-3	0	0	0	0
75	-15	-12	-10	-8	-6	-3	-1	0	0
70	-16	-13	-11	-11	-8	-6	-2	0	0
65	-17	-14	-12	-13	-10	-8	-4	-2	0
60	-18	-15	-13	-15	-12	-10	-7	-5	-2
55	-19	-16	-14	-16	-14	-11	-10	-7	-5
50	-20	-18	-15	-18	-15	-13	-13	-10	-8
45	-21	-19	-16	-19	-17	-14	-15	-13	-10
40	-22	-20	-17	-21	-18	-16	-18	-15	-13

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff

No Reverse Thrust

Weight Adjustments (1000 KG)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-16.1	-19.1	-22.0	-19.0	-21.9	-24.9	-25.3	-28.2	-31.2
85	-14.1	-17.1	-20.0	-16.5	-19.5	-22.4	-21.7	-24.7	-27.6
80	-12.2	-15.2	-18.1	-14.2	-17.2	-20.1	-18.5	-21.4	-24.4
75	-10.5	-13.5	-16.4	-12.2	-15.1	-18.0	-15.6	-18.5	-21.5
70	-9.1	-12.0	-15.0	-10.4	-13.3	-16.3	-13.1	-16.0	-19.0
65	-7.8	-10.8	-13.7	-8.8	-11.8	-14.7	-11.0	-13.9	-16.9
60	-6.8	-9.7	-12.7	-7.6	-10.5	-13.4	-9.3	-12.2	-15.2
55	-5.9	-8.9	-11.8	-6.5	-9.5	-12.4	-8.0	-10.9	-13.9
50	-5.3	-8.2	-11.2	-5.7	-8.7	-11.6	-7.0	-9.9	-12.8
45	-4.6	-7.6	-10.5	-4.9	-7.9	-10.8	-6.0	-8.9	-11.9
40	-4.0	-6.9	-9.9	-4.2	-7.1	-10.1	-5.0	-8.0	-10.9

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1600							33.7		
1800	30.3			37.5			47.9		
2000	46.5			53.2	33.0		62.8	43.7	
2200	63.2	41.6		69.4	48.5		78.4	58.3	39.5
2400	80.7	58.2	36.8	86.3	64.5	43.8	94.9	73.7	53.9
2600	98.7	75.5	53.2		81.3	59.7		90.0	69.1
2800		93.3	70.3		98.5	76.3			85.1
3000			88.0			93.4			

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 -45 m/+40 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-16	-11	-6	0	0	0	0	0	0
85	-17	-12	-7	-4	0	0	0	0	0
80	-19	-14	-9	-8	-3	0	0	0	0
75	-20	-15	-10	-12	-7	-2	0	0	0
70	-21	-16	-11	-15	-10	-5	0	0	0
65	-23	-18	-13	-18	-13	-8	-5	0	0
60	-24	-19	-14	-20	-15	-10	-10	-5	0
55	-25	-20	-15	-22	-17	-12	-14	-9	-4
50	-26	-21	-16	-23	-18	-13	-17	-12	-7
45	-27	-22	-17	-25	-20	-15	-20	-15	-10
40	-28	-23	-18	-27	-22	-17	-23	-18	-13

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff

Maximum Reverse Thrust

Weight Adjustment (1000 KG)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-2.3	-2.3	-2.3	-7.6	-7.6	-7.6	-12.4	-12.4	-12.4
85	-2.0	-2.0	-2.0	-6.9	-6.9	-6.9	-11.3	-11.3	-11.3
80	-1.7	-1.7	-1.7	-6.3	-6.3	-6.3	-10.2	-10.2	-10.2
75	-1.4	-1.4	-1.4	-5.6	-5.6	-5.6	-9.2	-9.2	-9.2
70	-1.2	-1.2	-1.2	-5.1	-5.1	-5.1	-8.3	-8.3	-8.3
65	-1.1	-1.1	-1.1	-4.7	-4.7	-4.7	-7.6	-7.6	-7.6
60	-1.1	-1.1	-1.1	-4.3	-4.3	-4.3	-7.0	-7.0	-7.0
55	-1.1	-1.1	-1.1	-4.1	-4.1	-4.1	-6.5	-6.5	-6.5
50	-1.2	-1.2	-1.2	-3.9	-3.9	-3.9	-6.2	-6.2	-6.2
45	-1.4	-1.4	-1.4	-3.9	-3.9	-3.9	-6.0	-6.0	-6.0
40	-1.7	-1.7	-1.7	-3.9	-3.9	-3.9	-6.0	-6.0	-6.0

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1200	50.3	32.0							
1400	72.5	53.9	35.5	35.2					
1600	95.0	76.1	57.5	51.3	33.0				
1800		98.7	79.8	68.4	48.9	30.8	34.3		
2000				86.9	65.9	46.6	45.1		
2200					84.2	63.4	56.5	37.0	
2400						81.5	68.6	47.9	
2600							81.6	59.4	39.6
2800							95.6	71.8	50.7
3000								85.0	62.4
3200								99.1	74.9
3400									88.5

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 -25 m/+20 m for every 5°C above/below 4°C.**
   Adjust “Medium” field length available by -25 m/+20 m for every 5°C above/below 4°C.
   Adjust “Poor” field length available by -40 m/+35 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff

Maximum Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-6	-5	-4	-13	-11	-10	-24	-22	-21
85	-6	-4	-3	-13	-12	-11	-24	-22	-21
80	-6	-4	-3	-14	-12	-11	-24	-23	-22
75	-6	-5	-4	-15	-13	-12	-25	-24	-23
70	-7	-5	-4	-16	-14	-13	-27	-26	-24
65	-7	-6	-5	-17	-16	-14	-29	-27	-26
60	-8	-7	-6	-18	-17	-16	-30	-29	-28
55	-9	-8	-7	-20	-19	-17	-32	-31	-30
50	-11	-9	-8	-21	-20	-19	-34	-33	-32
45	-12	-10	-9	-23	-22	-20	-36	-35	-34
40	-13	-11	-10	-25	-23	-22	-38	-37	-35

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff

No Reverse Thrust

Weight Adjustments (1000 KG)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-3.2	-3.2	-3.2	-9.8	-9.8	-9.8	-15.7	-15.7	-15.7
85	-2.9	-2.9	-2.9	-8.8	-8.8	-8.8	-14.1	-14.1	-14.1
80	-2.5	-2.5	-2.5	-8.0	-8.0	-8.0	-12.6	-12.6	-12.6
75	-2.2	-2.2	-2.2	-7.2	-7.2	-7.2	-11.4	-11.4	-11.4
70	-2.0	-2.0	-2.0	-6.6	-6.6	-6.6	-10.3	-10.3	-10.3
65	-1.9	-1.9	-1.9	-6.1	-6.1	-6.1	-9.3	-9.3	-9.3
60	-1.8	-1.8	-1.8	-5.7	-5.7	-5.7	-8.6	-8.6	-8.6
55	-1.8	-1.8	-1.8	-5.3	-5.3	-5.3	-8.0	-8.0	-8.0
50	-1.9	-1.9	-1.9	-5.1	-5.1	-5.1	-7.5	-7.5	-7.5
45	-2.0	-2.0	-2.0	-5.1	-5.1	-5.1	-7.3	-7.3	-7.3
40	-2.2	-2.2	-2.2	-5.1	-5.1	-5.1	-7.2	-7.2	-7.2

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1200	40.7								
1400	64.9	46.5							
1600	88.8	70.7	52.3						
1800		94.5	76.4	45.1					
2000				65.9	43.8				
2200				87.7	64.5	42.5			
2400					86.2	63.2			
2600						84.8	38.4		
2800							52.6	30.1	
3000							67.7	44.0	
3200							83.8	58.6	35.6
3400								74.0	49.7
3600								90.6	64.6
3800									80.5
4000									97.3

1. **Enter Weight Adjustment table with reported braking action and dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -30 m/+25 m for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -30 m/+25 m for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -50 m/+45 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-6	-4	-1	-16	-13	-11	-31	-28	-26
85	-6	-4	-1	-16	-14	-11	-32	-30	-27
80	-7	-4	-2	-17	-15	-12	-33	-31	-28
75	-7	-5	-2	-19	-16	-14	-35	-33	-30
70	-8	-6	-3	-20	-18	-15	-37	-35	-32
65	-9	-7	-4	-22	-19	-17	-39	-37	-34
60	-10	-8	-5	-23	-21	-18	-41	-39	-36
55	-11	-9	-6	-25	-23	-20	-44	-41	-39
50	-13	-10	-8	-27	-25	-22	-46	-43	-41
45	-14	-12	-9	-29	-27	-24	-48	-45	-43
40	-16	-13	-11	-31	-29	-26	-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.**

Takeoff %N1

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

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
60	87.7	88.3	88.7	88.8	88.9	89.1	89.2	89.2	89.1	88.6	88.3	88.7	89.2
55	88.5	89.1	89.5	89.7	89.8	89.9	90.0	90.0	90.0	89.5	89.0	88.8	88.6
50	89.3	89.8	90.4	90.5	90.6	90.7	90.9	90.8	90.8	90.4	89.9	89.7	89.6
45	90.2	90.7	91.2	91.3	91.4	91.5	91.7	91.6	91.6	91.2	90.8	90.7	90.5
40	91.1	91.6	92.1	92.2	92.3	92.4	92.5	92.4	92.4	92.1	91.7	91.6	91.5
35	91.9	92.5	93.0	93.1	93.2	93.2	93.3	93.3	93.2	92.9	92.5	92.5	92.4
30	91.5	92.6	93.8	93.9	94.0	94.0	94.1	94.0	93.9	93.7	93.4	93.3	93.2
25	90.8	91.9	93.1	93.7	94.4	94.8	94.9	94.8	94.8	94.4	94.0	94.0	94.0
20	90.0	91.1	92.3	93.0	93.6	94.3	95.0	95.6	95.6	95.3	94.9	94.8	94.7
15	89.3	90.4	91.6	92.2	92.8	93.6	94.3	94.8	95.3	95.9	96.1	95.9	95.5
10	88.5	89.6	90.8	91.4	92.1	92.8	93.5	94.0	94.5	95.1	95.7	96.4	97.1
5	87.8	88.9	90.0	90.7	91.3	92.0	92.7	93.2	93.7	94.3	94.9	95.6	96.3
0	87.0	88.1	89.2	89.9	90.5	91.2	91.9	92.4	92.9	93.5	94.1	94.8	95.5
-5	86.2	87.3	88.4	89.1	89.7	90.4	91.1	91.6	92.1	92.7	93.3	94.0	94.7
-10	85.4	86.5	87.6	88.3	88.9	89.6	90.3	90.8	91.3	91.9	92.5	93.2	93.9
-15	84.6	85.7	86.8	87.5	88.1	88.8	89.4	90.0	90.5	91.1	91.7	92.4	93.1
-20	83.8	84.9	86.0	86.6	87.3	87.9	88.6	89.1	89.7	90.3	90.8	91.6	92.3
-25	83.0	84.1	85.2	85.8	86.4	87.1	87.8	88.3	88.8	89.4	90.0	90.7	91.5
-30	82.2	83.3	84.4	85.0	85.6	86.3	86.9	87.4	88.0	88.6	89.2	89.9	90.6
-35	81.4	82.4	83.5	84.1	84.7	85.4	86.1	86.6	87.1	87.7	88.3	89.0	89.8
-40	80.6	81.6	82.7	83.3	83.9	84.5	85.2	85.7	86.2	86.8	87.4	88.2	88.9
-45	79.7	80.7	81.8	82.4	83.0	83.7	84.3	84.8	85.3	86.0	86.6	87.3	88.0
-50	78.9	79.9	80.9	81.5	82.1	82.8	83.4	83.9	84.5	85.1	85.7	86.4	87.2

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.9	0.9	0.9

Assumed Temperature Reduced Thrust

Maximum Assumed Temperature (Table 1 of 3)

Based on 25% Takeoff Thrust Reduction

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
55	73	71	69	67								
50	73	71	69	67	65	63						
45	73	71	69	67	65	63	61	59	57			
40	72	71	69	67	65	63	61	59	57	55		
35	66	66	66	66	65	63	61	59	57	55	53	
30	63	61	61	61	61	61	61	59	57	55	53	51
25	63	61	59	57	56	56	56	56	56	55	53	51
20	63	61	59	57	55	53	51	51	51	50	50	50
15	63	61	59	57	55	53	51	50	47	45	45	45
10 & BELOW	63	61	59	57	55	53	51	50	47	45	43	41

Takeoff %N1 (Table 2 of 3)

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

ASSUMED TEMP (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
75	85.7	86.0	86.7	87.4	88.2	88.9	89.5	90.1	90.2	90.2	90.6	91.1
70	86.6	87.0	87.1	87.1	87.5	88.3	88.9	89.4	89.5	89.6	90.0	90.4
65	87.4	87.8	88.0	88.0	88.2	88.3	88.3	88.8	88.9	88.9	89.4	89.8
60	88.3	88.7	88.8	88.9	89.1	89.2	89.2	89.1	88.6	88.3	88.7	89.2
55	89.1	89.5	89.7	89.8	89.9	90.0	90.0	90.0	89.5	89.0	88.8	88.6
50	89.8	90.4	90.5	90.6	90.7	90.9	90.8	90.8	90.4	89.9	89.7	89.6
45	90.7	91.2	91.3	91.4	91.5	91.7	91.6	91.6	91.2	90.8	90.7	90.5
40	91.6	92.1	92.2	92.3	92.4	92.5	92.4	92.4	92.1	91.7	91.6	91.5
35	92.5	93.0	93.1	93.2	93.2	93.3	93.3	93.2	92.9	92.5	92.5	92.4
30	92.6	93.8	93.9	94.0	94.0	94.1	94.0	93.9	93.7	93.4	93.3	93.2
25	91.9	93.1	93.7	94.4	94.8	94.9	94.8	94.8	94.4	94.0	94.0	94.0
20	91.1	92.3	93.0	93.6	94.3	95.0	95.6	95.6	95.3	94.9	94.8	94.7
15	90.4	91.6	92.2	92.8	93.6	94.3	94.8	95.3	95.9	96.1	95.9	95.5
10	89.6	90.8	91.4	92.1	92.8	93.5	94.0	94.5	95.1	95.7	96.4	97.1
MINIMUM ASSUMED TEMP (°C)	32	30	28	26	24	22	20	18	16	15	12	10

With engine bleed for packs off, increase %N1 by 0.9.

Assumed Temperature Reduced Thrust

%N1 Adjustment for Temperature Difference (Table 3 of 3)

ASSUMED TEMP MINUS OAT (°C)	OUTSIDE AIR TEMPERATURE (°C)													
	-40	-20	0	5	10	15	20	25	30	35	40	45	50	55
110	11.6													
100	10.3	7.9												
90	10.8	8.4												
80	12.2	7.1	5.0											
70	11.0	7.6	5.4	5.2	3.5									
60	9.6	9.0	4.1	4.0	3.9	3.8	2.1							
50	8.0	7.7	4.5	2.8	2.6	2.7	2.6	2.4	0.8					
40		6.2	5.9	4.7	3.0	2.6	2.7	2.8	2.6	2.5	2.9			
30		4.7	4.6	4.5	4.4	4.2	4.1	4.0	4.0	3.9	3.8	3.7	3.6	
20			3.1	3.0	3.0	3.0	2.9	2.8	2.7	2.7	2.6	2.6	2.5	2.4
10			1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.3	1.3	1.3
0			0	0	0	0	0	0	0	0	0	0	0	0

1. **Determine Maximum Assumed Temperature allowed from Table 1.**
2. **Find Maximum %N1 from Table 2 using the desired assumed temperature (no greater than temperature from Table 1).**
3. **Use the difference between assumed temperature and OAT to determine the %N1 adjustment from Table 3.**
4. **Subtract %N1 adjustment from Maximum %N1 in Table 2.**

Takeoff Speeds - Dry Runway (20K Derate)
Flaps 1 and 5
V1, VR, V2

WEIGHT (1000 KG)	FLAPS 1			FLAPS 5		
	V1	VR	V2	V1	VR	V2
72	146	147	150			
68	142	143	147	140	140	143
64	138	138	142	134	135	139
60	132	133	138	129	130	135
56	126	127	133	124	125	130
52	120	121	128	118	119	125
48	114	115	123	112	113	120
44	108	109	118	106	107	115
40	101	102	112	99	101	110

Check V1(MCG).

V1, VR, V2 Adjustments*

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

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
72	-2	-1	0	1	1	-1	0	0	0	0	1	1	1
68	-2	-1	0	1	1	-1	0	0	0	0	1	1	1
64	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
60	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
56	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
52	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
48	-1	0	0	1	1	-1	-1	0	0	0	1	1	1
44	-1	0	0	1	1	-1	-1	0	0	0	1	1	1
40	0	0	0	1	1	-1	0	0	0	0	1	1	1

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	93	91					
60	140	93	91	92	93			
50	122	95	93	92	93	91	88	84
40	104	100	98	97	96	92	88	84
30	86	103	103	102	101	97	92	86
20	68	103	103	102	101	99	96	90
-60	-76	105	104	104	102	100	97	95

Takeoff Speeds - Dry Runway (20K Derate)
Flaps 10, 15 and 25
V1, VR, V2

WEIGHT	FLAPS 10			FLAPS 15			FLAPS 25		
(1000 KG)	V1	VR	V2	V1	VR	V2	V1	VR	V2
64	128	129	133	126	126	130			
60	123	124	129	121	121	126	120	120	125
56	118	119	125	117	117	122	115	115	121
52	113	114	121	112	112	118	110	111	117
48	108	109	116	107	107	114	105	106	113
44	102	103	112	101	102	110	100	100	109
40	96	98	107	95	96	105	94	95	104

Check V1(MCG).

V1, VR, V2 Adjustments*

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

Slope and Wind V1 Adjustments*

WEIGHT	SLOPE (%)					WIND (KTS)							
(1000 KG)	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
64	-2	-1	0	0	0	-1	-1	0	0	0	0	0	0
60	-2	-1	0	0	0	-1	-1	0	0	0	0	0	0
56	-2	-1	0	0	0	-1	-1	0	0	0	0	0	0
52	-2	-1	0	0	0	-1	-1	0	0	0	0	0	0
48	-1	-1	0	0	1	-1	-1	0	0	0	0	0	0
44	-1	0	0	1	1	-2	-1	0	0	0	1	1	1
40	-1	0	0	1	1	-2	-1	0	0	0	1	1	1

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	93	91					
60	140	93	91	92	93			
50	122	95	93	92	93	91	88	84
40	104	100	98	97	96	92	88	84
30	86	103	103	102	101	97	92	86
20	68	103	103	102	101	99	96	90
-60	-76	105	104	104	102	100	97	95

Takeoff Speeds - Wet Runway (20K Derate)
Flaps 1 and 5
V1, VR, V2

WEIGHT	FLAPS 1			FLAPS 5		
(1000 KG)	V1	VR	V2	V1	VR	V2
72	142	147	150			
68	137	143	147	134	140	143
64	131	138	142	128	135	139
60	126	133	138	122	130	135
56	120	127	133	117	125	130
52	113	121	128	110	119	125
48	107	115	123	104	113	120
44	100	109	118	97	107	115
40	93	102	112	91	101	110

Check V1(MCG).

V1, VR, V2 Adjustments*

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

Slope and Wind V1 Adjustments*

WEIGHT	SLOPE (%)					WIND (KTS)							
(1000 KG)	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
72	-4	-2	0	3	5	-2	-1	0	0	1	2	2	3
68	-4	-2	0	3	5	-2	-1	-1	0	1	2	2	3
64	-4	-2	0	2	4	-3	-2	-1	0	1	1	2	3
60	-3	-2	0	2	4	-3	-2	-1	0	1	1	2	3
56	-3	-1	0	2	4	-3	-2	-1	0	1	2	2	3
52	-3	-1	0	2	3	-3	-2	-1	0	1	2	2	3
48	-2	-1	0	2	3	-3	-2	-1	0	1	2	3	3
44	-2	-1	0	2	3	-3	-2	-1	0	1	2	3	4
40	-1	0	0	2	3	-4	-2	-1	0	1	2	3	4

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	93	91					
60	140	93	91	92	93			
50	122	95	93	92	93	91	88	84
40	104	100	98	97	96	92	88	84
30	86	103	103	102	101	97	92	86
20	68	103	103	102	101	99	96	90
-60	-76	105	104	104	102	100	97	95

Takeoff Speeds - Wet Runway (20K Derate)

Flaps 10, 15 and 25

V1, VR, V2

WEIGHT (1000 KG)	FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2
64	123	129	133	124	126	130			
60	118	124	129	118	121	126	116	120	125
56	112	119	125	112	117	122	111	115	121
52	107	114	121	106	112	118	105	111	117
48	101	109	116	100	107	114	99	106	113
44	95	103	112	94	102	110	93	100	109
40	89	98	107	88	96	105	87	95	104

Check V1(MCG).

V1, VR, V2 Adjustments*

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

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
64	-3	-1	0	2	4	-3	-2	-1	0	1	1	2	3
60	-3	-1	0	2	3	-3	-2	-1	0	1	1	2	3
56	-3	-1	0	2	3	-3	-2	-1	0	1	1	2	3
52	-3	-1	0	2	3	-3	-2	-1	0	1	2	2	3
48	-2	-1	0	1	3	-3	-2	-1	0	1	2	2	3
44	-2	-1	0	1	3	-4	-2	-1	0	1	2	3	3
40	-2	-1	0	1	2	-4	-2	-1	0	1	2	3	4

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	93	91					
60	140	93	91	92	93			
50	122	95	93	92	93	91	88	84
40	104	100	98	97	96	92	88	84
30	86	103	103	102	101	97	92	86
20	68	103	103	102	101	99	96	90
-60	-76	105	104	104	102	100	97	95

Maximum Allowable Clearway (20K Derate)

FIELD LENGTH (M)	MAX ALLOWABLE CLEARWAY FOR V1 REDUCTION (M)
1200	140
1800	200
2400	250
3000	310
3600	430
4200	470

Clearway and Stopway V1 Adjustments (20K Derate)

CLEARWAY MINUS STOPWAY (M)	NORMAL V1 (KIAS)					
	DRY RUNWAY			WET RUNWAY		
	100	120	140	100	120	140
300	-4	-4	-3			
200	-4	-4	-3			
100	-3	-2	-2			
0	0	0	0	0	0	0
-100	1	0	0	3	2	1
-200	1	0	0	4	3	2
-300	1	0	0	4	3	2

Use of clearway not allowed on wet runways.
V1 not to exceed VR.

Stab Trim Setting (20K Derate)

Flaps 1 and 5

WEIGHT (1000 KG)	C.G. (%MAC)									
	9	10	12	13	16	20	24	28	31	33
70-80	8 1/2	8 1/2	8 1/2	8 1/2	7 3/4	7	6 1/4	5 1/4	4 3/4	4 1/4
60	8 1/2	8 1/2	8	8	7 1/4	6 1/2	5 3/4	5	4 1/4	3 3/4
50	8 1/4	8	7 1/2	7 1/4	6 3/4	6	5	4 1/4	3 1/2	3 1/4
35-45	7 3/4	7 1/2	7	6 3/4	6 1/4	5 1/2	4 3/4	4	3 1/4	3

Flaps 10, 15 and 25

WEIGHT (1000 KG)	C.G. (%MAC)									
	9	10	12	13	16	20	24	28	31	33
70-80	8 1/2	8 1/2	8 1/2	8 1/4	7 1/2	6 3/4	5 3/4	5	4 1/4	3 3/4
60	8 1/2	8 1/2	8	7 3/4	7	6 1/4	5 1/4	4 1/2	3 3/4	3 1/2
50	8	7 3/4	7 1/4	7 1/4	6 1/2	5 3/4	4 3/4	4	3 1/4	3
35-45	7 1/4	7	6 1/2	6 1/2	6	5 1/4	4 1/2	3 1/2	3	2 3/4

ADVISORY INFORMATION

Slush/Standing Water Takeoff (20K Derate)

Maximum Reverse Thrust

Weight Adjustments (1000 KG)

20K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-14.9	-16.5	-18.1	-18.4	-20.0	-21.6	-30.0	-31.6	-33.1
85	-12.9	-14.5	-16.1	-15.8	-17.4	-19.0	-25.0	-26.6	-28.2
80	-11.0	-12.6	-14.2	-13.4	-15.0	-16.6	-20.4	-22.0	-23.6
75	-9.3	-10.9	-12.5	-11.3	-12.9	-14.5	-16.5	-18.1	-19.7
70	-8.0	-9.6	-11.2	-9.4	-11.0	-12.6	-13.1	-14.7	-16.3
65	-6.6	-8.1	-9.7	-7.8	-9.4	-10.9	-10.4	-12.0	-13.6
60	-5.5	-7.1	-8.6	-6.4	-8.0	-9.6	-8.4	-10.0	-11.6
55	-4.6	-6.2	-7.8	-5.3	-6.9	-8.5	-6.8	-8.4	-10.0
50	-3.9	-5.5	-7.1	-4.5	-6.1	-7.7	-5.7	-7.3	-8.8
45	-3.6	-5.2	-6.8	-4.0	-5.6	-7.2	-4.9	-6.5	-8.1
40	-3.4	-5.0	-6.6	-3.7	-5.3	-6.9	-4.6	-6.2	-7.7

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1200							31.8		
1400	40.0			42.1			45.5		
1600	54.7	32.5		56.7	34.7		59.7	38.3	
1800	70.1	46.9		72.1	49.0		74.7	52.1	31.1
2000	86.6	61.9	39.3	88.3	63.9	41.4	90.7	66.7	44.8
2200		77.8	53.9		79.7	56.0		82.2	59.0
2400		94.7	69.4		96.3	71.3		98.5	74.0
2600			85.8			87.5			89.9

1. **Enter Weight Adjustment table with slush/standing water depth and 20K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -35 m/+30 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (20K Derate)
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-3	0	0	0	0	0	0	0	0
85	-5	0	0	0	0	0	0	0	0
80	-8	-3	0	0	0	0	0	0	0
75	-10	-5	0	-2	0	0	0	0	0
70	-12	-7	-2	-6	-1	0	0	0	0
65	-14	-9	-4	-9	-4	0	0	0	0
60	-15	-10	-5	-12	-7	-2	-3	0	0
55	-17	-12	-7	-14	-9	-4	-7	-2	0
50	-18	-13	-8	-15	-10	-5	-10	-5	0
45	-19	-14	-9	-17	-12	-7	-13	-8	-3
40	-19	-14	-9	-18	-13	-8	-15	-10	-5

1. **Obtain V1, VR and V2 for the actual weight using the 20K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (20K Derate)

No Reverse Thrust

Weight Adjustments (1000 KG)

20K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-18.6	-21.3	-24.1	-22.4	-25.1	-27.8	-31.3	-34.1	-36.8
85	-16.0	-18.7	-21.4	-19.1	-21.9	-24.6	-26.4	-29.1	-31.9
80	-13.6	-16.3	-19.0	-16.1	-18.9	-21.6	-21.9	-24.6	-27.4
75	-11.5	-14.2	-16.9	-13.5	-16.2	-18.9	-18.0	-20.7	-23.4
70	-9.7	-12.4	-15.1	-11.2	-14.0	-16.7	-14.7	-17.4	-20.1
65	-8.2	-10.9	-13.6	-9.4	-12.1	-14.8	-12.0	-14.7	-17.4
60	-7.0	-9.7	-12.4	-7.9	-10.6	-13.3	-9.8	-12.6	-15.3
55	-6.0	-8.8	-11.5	-6.7	-9.5	-12.2	-8.3	-11.0	-13.8
50	-5.4	-8.1	-10.8	-5.9	-8.6	-11.4	-7.3	-10.0	-12.7
45	-4.7	-7.5	-10.2	-5.1	-7.8	-10.6	-6.3	-9.0	-11.7
40	-4.1	-6.8	-9.5	-4.3	-7.0	-9.8	-5.3	-8.0	-10.8

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1600				32.2			41.7		
1800	42.9			48.8			57.5	35.5	
2000	60.9	34.9		66.1	41.3		77.5	50.1	
2200	79.3	52.8		84.3	58.2	33.9		67.8	43.3
2400	98.0	71.0	44.7		76.0	50.6		92.0	59.4
2600		89.6	62.8		94.7	68.0			80.1
2800			81.2			86.3			
3000			99.9						

1. **Enter Weight Adjustment table with slush/standing water depth and 20K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -40 m/+35 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (20K Derate)

No Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-10	-7	-5	0	0	0	0	0	0
85	-12	-9	-7	0	0	0	0	0	0
80	-14	-11	-9	0	0	0	0	0	0
75	-16	-13	-11	-5	-2	0	0	0	0
70	-18	-15	-13	-9	-7	-4	0	0	0
65	-19	-17	-14	-13	-10	-8	0	0	0
60	-21	-18	-16	-16	-13	-11	-4	-2	0
55	-22	-20	-17	-19	-16	-14	-9	-7	-4
50	-23	-21	-18	-21	-18	-16	-14	-11	-9
45	-24	-22	-19	-22	-20	-17	-17	-15	-12
40	-25	-23	-20	-23	-21	-18	-20	-17	-15

1. **Obtain V1, VR and V2 for the actual weight using the 20K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (20K Derate)

Maximum Reverse Thrust

Weight Adjustment (1000 KG)

20K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-2.7	-2.7	-2.7	-7.8	-7.8	-7.8	-12.5	-12.5	-12.5
85	-2.3	-2.3	-2.3	-6.9	-6.9	-6.9	-11.3	-11.3	-11.3
80	-1.9	-1.9	-1.9	-6.2	-6.2	-6.2	-10.1	-10.1	-10.1
75	-1.5	-1.5	-1.5	-5.6	-5.6	-5.6	-9.1	-9.1	-9.1
70	-1.3	-1.3	-1.3	-5.0	-5.0	-5.0	-8.3	-8.3	-8.3
65	-1.0	-1.0	-1.0	-4.5	-4.5	-4.5	-7.5	-7.5	-7.5
60	-0.8	-0.8	-0.8	-4.1	-4.1	-4.1	-6.8	-6.8	-6.8
55	-0.8	-0.8	-0.8	-3.7	-3.7	-3.7	-6.2	-6.2	-6.2
50	-0.8	-0.8	-0.8	-3.5	-3.5	-3.5	-5.8	-5.8	-5.8
45	-0.9	-0.9	-0.9	-3.4	-3.4	-3.4	-5.5	-5.5	-5.5
40	-1.0	-1.0	-1.0	-3.3	-3.3	-3.3	-5.3	-5.3	-5.3

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1000	34.4								
1200	56.6	34.6							
1400	78.9	56.9	34.8	41.2					
1600		79.1	57.1	58.3	36.4				
1800			79.4	76.4	53.1	31.6	39.4		
2000				95.3	70.9	48.1	51.0	30.2	
2200					89.7	65.5	63.3	41.4	
2400						84.1	76.5	53.1	32.1
2600							90.3	65.5	43.3
2800								78.8	55.2
3000								92.7	67.7
3200									81.2
3400									95.1

1. **Enter Weight Adjustment table with reported braking action and 20K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -25 m/+20 m for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -25 m/+20 m for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -40 m/+35 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (20K Derate)

Maximum Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-4	-3	-2	-12	-10	-9	-21	-20	-18
85	-4	-3	-2	-12	-10	-9	-21	-20	-18
80	-4	-3	-2	-12	-10	-9	-21	-20	-19
75	-5	-4	-2	-12	-11	-10	-22	-21	-19
70	-5	-4	-3	-13	-12	-11	-23	-22	-21
65	-6	-5	-4	-14	-13	-12	-25	-24	-22
60	-7	-6	-5	-16	-15	-13	-27	-26	-24
55	-8	-7	-6	-17	-16	-15	-29	-28	-26
50	-9	-8	-7	-19	-18	-17	-31	-30	-29
45	-10	-9	-8	-21	-19	-18	-33	-32	-31
40	-12	-10	-9	-22	-21	-20	-35	-34	-32

1. **Obtain V1, VR and V2 for the actual weight using the 20K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (20K Derate)

No Reverse Thrust

Weight Adjustments (1000 KG)

20K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-4.3	-4.3	-4.3	-10.5	-10.5	-10.5	-16.4	-16.4	-16.4
85	-3.6	-3.6	-3.6	-9.3	-9.3	-9.3	-14.7	-14.7	-14.7
80	-2.9	-2.9	-2.9	-8.3	-8.3	-8.3	-13.1	-13.1	-13.1
75	-2.4	-2.4	-2.4	-7.4	-7.4	-7.4	-11.7	-11.7	-11.7
70	-2.0	-2.0	-2.0	-6.6	-6.6	-6.6	-10.5	-10.5	-10.5
65	-1.7	-1.7	-1.7	-6.0	-6.0	-6.0	-9.4	-9.4	-9.4
60	-1.6	-1.6	-1.6	-5.5	-5.5	-5.5	-8.5	-8.5	-8.5
55	-1.6	-1.6	-1.6	-5.1	-5.1	-5.1	-7.8	-7.8	-7.8
50	-1.7	-1.7	-1.7	-4.9	-4.9	-4.9	-7.3	-7.3	-7.3
45	-1.9	-1.9	-1.9	-4.9	-4.9	-4.9	-7.0	-7.0	-7.0
40	-2.3	-2.3	-2.3	-5.0	-5.0	-5.0	-6.8	-6.8	-6.8

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1200	48.8								
1400	72.9	52.8	32.2						
1600	96.2	76.7	56.7	35.3					
1800		100.0	80.5	56.5	32.3				
2000				78.1	53.4				
2200					75.0	50.4			
2400					97.0	71.9	35.0		
2600						93.9	50.2		
2800							66.0	38.7	
3000							82.6	54.0	
3200							99.7	70.0	42.4
3400								86.8	57.9
3600									74.1
3800									91.1

1. **Enter Weight Adjustment table with reported braking action and 20K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust “Good” field length available by -25 m/+20 m for every 5°C above/below 4°C.**
   Adjust “Medium” field length available by -25 m/+20 m for every 5°C above/below 4°C.
   Adjust “Poor” field length available by -45 m/+40 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (20K Derate)
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-15	-12	-10	-26	-23	-21	-41	-38	-36
85	-11	-9	-6	-22	-19	-17	-36	-34	-31
80	-9	-6	-4	-18	-16	-13	-33	-31	-28
75	-7	-5	-2	-17	-15	-12	-32	-30	-27
70	-7	-5	-2	-17	-15	-12	-33	-30	-28
65	-8	-5	-3	-18	-16	-13	-34	-32	-29
60	-9	-6	-4	-20	-18	-15	-37	-34	-32
55	-10	-7	-5	-23	-20	-18	-40	-37	-35
50	-11	-9	-6	-25	-22	-20	-42	-40	-37
45	-13	-10	-8	-27	-24	-22	-44	-42	-39
40	-14	-11	-9	-28	-25	-23	-46	-43	-41

1. **Obtain V1, VR and V2 for the actual weight using the 20K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Takeoff %N1 (20K Derate)

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

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
60	84.0	84.4	84.7	86.1	87.3	88.1	89.1	89.3	89.5	88.8	88.2	87.9	87.5
55	84.8	85.3	85.8	87.0	88.1	89.0	90.0	90.1	90.3	89.6	88.8	87.9	86.9
50	85.8	86.3	86.8	87.9	88.9	89.8	90.8	90.9	91.0	90.3	89.6	88.7	87.7
45	86.8	87.2	87.7	88.7	89.7	90.7	91.7	91.7	91.7	91.1	90.4	89.5	88.6
40	87.7	88.2	88.6	89.7	90.6	91.6	92.5	92.4	92.4	91.8	91.2	90.3	89.4
35	88.6	89.0	89.5	90.6	91.5	92.4	93.4	93.3	93.2	92.5	91.9	91.0	90.1
30	88.2	89.3	90.5	91.4	92.5	93.3	94.3	94.1	94.0	93.4	92.7	91.8	90.9
25	87.5	88.6	89.7	90.7	91.8	92.7	93.8	94.2	94.7	94.2	93.5	92.6	91.7
20	86.8	87.9	89.0	90.0	91.1	91.9	93.0	93.4	93.9	94.5	94.3	93.4	92.5
15	86.0	87.2	88.3	89.3	90.3	91.2	92.2	92.6	93.1	93.7	94.2	94.2	93.4
10	85.3	86.4	87.5	88.5	89.6	90.4	91.5	91.9	92.3	92.9	93.4	93.7	94.3
5	84.6	85.7	86.8	87.7	88.8	89.6	90.7	91.1	91.6	92.1	92.6	92.9	93.5
0	83.8	84.9	86.0	87.0	88.0	88.9	89.9	90.3	90.8	91.4	91.8	92.1	92.7
-5	83.1	84.2	85.2	86.2	87.2	88.1	89.1	89.5	90.0	90.5	91.0	91.3	91.9
-10	82.3	83.4	84.5	85.4	86.4	87.3	88.3	88.7	89.2	89.7	90.2	90.5	91.0
-15	81.6	82.6	83.7	84.6	85.6	86.5	87.5	87.9	88.3	88.9	89.3	89.7	90.2
-20	80.8	81.8	82.9	83.8	84.8	85.7	86.7	87.0	87.5	88.1	88.5	88.8	89.4
-25	80.0	81.1	82.1	83.0	84.0	84.8	85.8	86.2	86.7	87.3	87.7	88.0	88.5
-30	79.2	80.3	81.3	82.2	83.2	84.0	85.0	85.4	85.8	86.4	86.8	87.2	87.7
-35	78.4	79.5	80.5	81.4	82.4	83.2	84.1	84.5	85.0	85.6	86.0	86.3	86.8
-40	77.6	78.6	79.6	80.6	81.5	82.3	83.3	83.7	84.1	84.7	85.1	85.4	86.0
-45	76.8	77.8	78.8	79.7	80.7	81.5	82.4	82.8	83.3	83.8	84.2	84.5	85.1
-50	76.0	77.0	78.0	78.9	79.8	80.6	81.6	81.9	82.4	82.9	83.3	83.7	84.2

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.9	0.9	0.9

Assumed Temperature Reduced Thrust (20K Derate)

Maximum Assumed Temperature (Table 1 of 3)

Based on 25% Takeoff Thrust Reduction

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
55	73	71	69	67								
50	73	71	69	67	65	63						
45	73	71	69	67	65	63	61	59	57			
40	69	68	69	67	65	63	61	59	57	55		
35	64	63	65	66	65	63	61	59	57	55	53	
30	61	59	60	61	61	61	61	59	57	55	53	51
25	61	59	60	60	60	60	59	58	57	55	53	51
20	61	59	60	60	60	60	59	58	53	51	52	51
15	61	59	60	60	60	60	59	58	53	49	46	46
10 & BELOW	61	59	60	60	60	60	59	58	53	49	45	40

Takeoff %N1 (Table 2 of 3)

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

ASSUMED TEMP (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
75	81.4	81.5	84.0	85.8	87.2	88.8	89.7	90.6	90.4	90.1	89.8	89.4
70	82.5	82.6	84.3	85.5	86.6	88.2	89.1	89.9	89.7	89.5	89.2	88.8
65	83.4	83.7	85.2	86.4	87.2	88.2	88.5	89.3	89.1	88.9	88.6	88.1
60	84.4	84.7	86.1	87.3	88.1	89.1	89.3	89.5	88.8	88.2	87.9	87.5
55	85.3	85.8	87.0	88.1	89.0	90.0	90.1	90.3	89.6	88.8	87.9	86.9
50	86.3	86.8	87.9	88.9	89.8	90.8	90.9	91.0	90.3	89.6	88.7	87.7
45	87.2	87.7	88.7	89.7	90.7	91.7	91.7	91.7	91.1	90.4	89.5	88.6
40	88.2	88.6	89.7	90.6	91.6	92.5	92.4	92.4	91.8	91.2	90.3	89.4
35	89.0	89.5	90.6	91.5	92.4	93.4	93.3	93.2	92.5	91.9	91.0	90.1
30	89.3	90.5	91.4	92.5	93.3	94.3	94.1	94.0	93.4	92.7	91.8	90.9
25	88.6	89.7	90.7	91.8	92.7	93.8	94.2	94.7	94.2	93.5	92.6	91.7
20	87.9	89.0	90.0	91.1	91.9	93.0	93.4	93.9	94.5	94.3	93.4	92.5
15	87.2	88.3	89.3	90.3	91.2	92.2	92.6	93.1	93.7	94.2	94.2	93.4
10	86.4	87.5	88.5	89.6	90.4	91.5	91.9	92.3	92.9	93.4	93.7	94.3
MINIMUM ASSUMED TEMP (°C)	32	30	30	30	29	29	27	25	21	18	14	10

With engine bleed for packs off, increase %N1 by 0.9.

Assumed Temperature Reduced Thrust (20K Derate)

%N1 Adjustment for Temperature Difference (Table 3 of 3)

ASSUMED TEMP MINUS OAT (°C)	OUTSIDE AIR TEMPERATURE (°C)													
	-40	-20	0	5	10	15	20	25	30	35	40	45	50	55
110	11.2													
100	10.3	6.0												
90	10.5	8.2												
80	11.8	7.1	3.2											
70	10.7	7.4	5.3	3.6	1.8									
60	9.2	8.7	4.1	4.0	3.9	2.2	0.5							
50	7.8	7.5	4.3	2.7	2.6	3.7	2.7	0.9	0.5					
40		6.0	5.7	4.4	2.8	2.9	3.3	3.1	1.4	1.1	0.8			
30		4.6	4.4	4.3	4.2	4.1	4.0	3.9	3.5	3.3	3.0	2.8	3.4	
20			3.0	2.9	2.9	2.9	2.8	2.7	2.6	2.6	2.5	2.5	2.4	2.3
10			1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.3	1.3	1.3	1.2	1.2
0			0	0	0	0	0	0	0	0	0	0	0	0

1. **Determine Maximum Assumed Temperature allowed from Table 1.**
2. **Find Maximum %N1 from Table 2 using the desired assumed temperature (no greater than temperature from Table 1).**
3. **Use the difference between assumed temperature and OAT to determine the %N1 adjustment from Table 3.**
4. **Subtract %N1 adjustment from Maximum %N1 in Table 2.**

Takeoff Speeds - Dry Runway (18K Derate)

Flaps 1 and 5

V1, VR, V2

WEIGHT (1000 KG)	FLAPS1			FLAPS5		
	V1	VR	V2	V1	VR	V2
68	143	143	146			
64	139	139	142	136	136	139
60	133	134	138	130	131	135
56	128	128	133	125	126	130
52	122	122	128	119	120	125
48	116	116	123	114	114	120
44	110	110	117	107	108	115
40	103	103	112	101	102	110

Check V1(MCG).

V1, VR, V2 Adjustment*

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

Slope and Wind V1 Adjustment*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
68	-1	0	0	0	0	0	0	0	0	0	0	0	0
64	-1	0	0	0	0	-1	0	0	0	0	0	0	0
60	-2	-1	0	0	0	-1	0	0	0	0	0	0	0
56	-2	-1	0	0	0	-1	0	0	0	0	0	0	0
52	-1	-1	0	0	0	-1	0	0	0	0	0	0	0
48	-1	0	0	0	0	-1	-1	0	0	0	0	0	0
44	-1	0	0	0	0	-1	-1	0	0	0	0	0	0
40	-1	0	0	0	0	-1	0	0	0	0	0	0	0

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	90	88					
60	140	90	88	89	90			
50	122	92	90	89	90	88	85	81
40	104	97	95	94	92	89	85	81
30	86	100	100	99	97	93	88	83
20	68	100	100	99	98	95	92	87
-60	-76	102	101	100	99	96	94	92

Takeoff Speeds - Dry Runway (18K Derate)
Flaps 10, 15 and 25
V1, VR, V2

WEIGHT (1000 KG)	FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2
60	124	125	129	122	122	126			
56	120	120	124	117	118	122	116	116	121
52	115	115	120	113	113	118	111	111	117
48	109	110	116	108	108	114	106	106	113
44	104	104	111	102	103	109	101	101	108
40	98	98	107	96	96	105	95	96	104

Check V1(MCG).

V1, VR, V2 Adjustments*

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

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
60	-1	0	0	0	0	-1	0	0	0	0	0	0	0
56	-1	0	0	0	0	-1	0	0	0	0	0	0	0
52	-1	0	0	0	0	-1	0	0	0	0	0	0	0
48	-1	0	0	0	0	-1	-1	0	0	0	0	0	0
44	-1	0	0	0	0	-1	-1	0	0	0	0	0	0
40	-1	0	0	1	1	-2	-1	0	0	0	1	1	1

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	90	88					
60	140	90	88	89	90			
50	122	92	90	89	90	88	85	81
40	104	97	95	94	92	89	85	81
30	86	100	100	99	97	93	88	83
20	68	100	100	99	98	95	92	87
-60	-76	102	101	100	99	96	94	92

Takeoff Speeds - Wet Runway (18K Derate)

Flaps 1 and 5

V1, VR, V2

WEIGHT (1000 KG)	FLAPS 1			FLAPS 5		
	V1	VR	V2	V1	VR	V2
68	139	143	146			
64	133	139	142	130	136	139
60	128	134	138	125	131	135
56	122	128	133	119	126	130
52	115	122	128	113	120	125
48	109	116	123	106	114	120
44	102	110	117	99	108	115
40	95	103	112	92	102	110

Check V1(MCG).

V1, VR, V2 Adjustment*

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

Slope and Wind V1 Adjustment*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
68	-3	-1	0	3	5	-2	-1	0	0	1	2	2	3
64	-3	-1	0	2	5	-2	-1	0	0	1	1	2	3
60	-3	-1	0	2	4	-3	-2	-1	0	1	1	2	2
56	-3	-1	0	2	4	-3	-2	-1	0	1	1	2	3
52	-3	-1	0	2	4	-3	-2	-1	0	1	2	2	3
48	-2	-1	0	2	3	-3	-2	-1	0	1	2	2	3
44	-2	-1	0	2	3	-3	-2	-1	0	1	2	3	3
40	-1	0	0	2	3	-3	-2	-1	0	1	2	3	4

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	90	88					
60	140	90	88	89	90			
50	122	92	90	89	90	88	85	81
40	104	97	95	94	92	89	85	81
30	86	100	100	99	97	93	88	83
20	68	100	100	99	98	95	92	87
-60	-76	102	101	100	99	96	94	92

Takeoff Speeds - Wet Runway (18K Derate)
Flaps 10, 15 and 25
V1, VR, V2

WEIGHT (1000 KG)	FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2
60	120	125	129	121	122	126			
56	114	120	124	114	118	122	113	116	121
52	108	115	120	108	113	118	107	111	117
48	103	110	116	102	108	114	101	106	113
44	97	104	111	96	103	109	95	101	108
40	89	98	107	90	96	105	89	96	104

Check V1(MCG).

V1, VR, V2 Adjustments*

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

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
60	-2	-1	0	2	4	-3	-1	0	0	1	2	2	3
56	-3	-1	0	2	3	-3	-2	-1	0	1	1	2	3
52	-3	-1	0	1	3	-3	-2	-1	0	1	1	2	3
48	-3	-1	0	1	3	-3	-2	-1	0	1	1	2	3
44	-2	-1	0	2	3	-3	-2	-1	0	1	2	2	3
40	-1	0	0	2	3	-3	-2	-1	0	1	2	3	4

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	90	88					
60	140	90	88	89	90			
50	122	92	90	89	90	88	85	81
40	104	97	95	94	92	89	85	81
30	86	100	100	99	97	93	88	83
20	68	100	100	99	98	95	92	87
-60	-76	102	101	100	99	96	94	92

Maximum Allowable Clearway (18K Derate)

FIELD LENGTH (M)	MAX ALLOWABLE CLEARWAY FOR V1 REDUCTION (M)
1200	140
1800	200
2400	250
3000	310
3600	430
4200	470

Clearway and Stopway V1 Adjustments (18K Derate)

CLEARWAY MINUS STOPWAY (M)	NORMAL V1 (KIAS)					
	DRY RUNWAY			WET RUNWAY		
	100	120	140	100	120	140
300	-4	-3	-3			
200	-4	-3	-3			
100	-2	-1	-1			
0	0	0	0	0	0	0
-100	1	0	0	3	2	1
-200	1	0	0	3	2	1
-300	1	0	0	3	2	1

Use of clearway not allowed on wet runways.
V1 not to exceed VR.

Stab Trim Setting (18K Derate)

Flaps 1 and 5

WEIGHT	C.G. (%MAC)								
(1000 KG)	9	12	13	15	16	20	24	28	33
70-80	8 1/2	8 1/2	8 1/2	8 1/2	8 1/4	7 1/2	6 3/4	6	5
60	8 1/2	8 1/2	8 1/4	7 3/4	7 1/2	6 3/4	6	5 1/2	4 1/2
50	8 1/4	7 3/4	7 1/2	7 1/4	7	6 1/4	5 1/2	4 3/4	4
35-45	8	7 1/2	7 1/4	6 3/4	6 3/4	6	5 1/4	4 1/2	3 3/4

Flaps 10, 15 and 25

WEIGHT	C.G. (%MAC)								
(1000 KG)	9	10	12	13	16	20	24	28	33
70-80	8 1/2	8 1/2	8 1/2	8 1/4	7 1/2	6 1/2	5 3/4	5	3 3/4
60	8 1/2	8 1/2	8	8	7	6 1/4	5 1/4	4 1/2	3 1/2
50	8 1/4	8	7 1/2	7 1/4	6 1/2	5 3/4	4 3/4	4	3
35-45	7 1/4	7	6 1/2	6 1/2	6	5 1/4	4 1/2	3 1/2	2 3/4

ADVISORY INFORMATION

Slush/Standing Water Takeoff (18K Derate)
Maximum Reverse Thrust
Weight Adjustments (1000 KG)

18K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-15.7	-17.7	-19.8	-19.5	-21.5	-23.6	-32.1	-34.1	-36.1
85	-13.7	-15.7	-17.8	-17.0	-19.0	-21.0	-27.2	-29.2	-31.3
80	-11.7	-13.8	-15.8	-14.4	-16.5	-18.5	-22.3	-24.3	-26.4
75	-9.9	-11.9	-14.0	-12.1	-14.1	-16.2	-18.0	-20.0	-22.0
70	-8.3	-10.3	-12.4	-10.0	-12.1	-14.1	-14.2	-16.3	-18.3
65	-6.9	-8.9	-11.0	-8.2	-10.3	-12.3	-11.2	-13.2	-15.3
60	-5.7	-7.7	-9.8	-6.7	-8.7	-10.8	-8.7	-10.8	-12.8
55	-4.8	-6.8	-8.8	-5.5	-7.6	-9.6	-7.2	-9.2	-11.3
50	-4.1	-6.1	-8.2	-4.6	-6.7	-8.7	-6.1	-8.1	-10.2
45	-3.6	-5.7	-7.7	-4.0	-6.1	-8.1	-5.0	-7.0	-9.1
40	-3.4	-5.4	-7.5	-3.7	-5.8	-7.8	-3.9	-5.9	-7.9

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1200				30.0			33.3		
1400	42.4			44.4			47.7		
1600	57.7	34.7		59.6	36.8		62.3	40.1	
1800	74.2	49.5		75.9	51.5		77.1	54.6	32.6
2000	91.9	65.4	41.6	93.3	67.2	43.7	92.3	69.3	47.0
2200		82.5	56.9		84.1	58.9		84.3	61.5
2400			73.3			75.1		99.5	76.4
2600			91.0			92.4			91.5

1. **Enter Weight Adjustment table with slush/standing water depth and 18K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -35 m/+30 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (18K Derate)
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	0	0	0	0	0	0	0	0	0
85	-1	0	0	0	0	0	0	0	0
80	-4	-2	0	0	0	0	0	0	0
75	-8	-5	-3	0	0	0	0	0	0
70	-10	-8	-5	-3	0	0	0	0	0
65	-13	-10	-8	-7	-4	-2	0	0	0
60	-14	-12	-9	-10	-8	-5	0	0	0
55	-16	-13	-11	-13	-10	-8	-4	-2	0
50	-17	-15	-12	-15	-12	-10	-8	-5	-3
45	-18	-16	-13	-16	-14	-11	-11	-9	-6
40	-19	-16	-14	-17	-15	-12	-13	-11	-8

1. **Obtain V1, VR and V2 for the actual weight using the 18K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG).If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (18K Derate)

No Reverse Thrust

Weight Adjustments (1000 KG)

18K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-21.5	-23.5	-25.6	-26.2	-28.2	-30.3	-35.3	-37.4	-39.4
85	-18.2	-20.2	-22.2	-22.0	-24.0	-26.1	-29.6	-31.7	-33.7
80	-15.1	-17.1	-19.2	-18.2	-20.2	-22.3	-24.4	-26.4	-28.5
75	-12.5	-14.5	-16.5	-14.9	-16.9	-18.9	-19.8	-21.9	-23.9
70	-10.2	-12.3	-14.3	-12.1	-14.1	-16.1	-15.9	-18.0	-20.0
65	-8.4	-10.4	-12.5	-9.8	-11.8	-13.9	-12.8	-14.8	-16.8
60	-7.0	-9.0	-11.1	-8.0	-10.1	-12.1	-10.3	-12.3	-14.4
55	-6.0	-8.0	-10.1	-6.8	-8.8	-10.8	-8.5	-10.5	-12.5
50	-5.4	-7.5	-9.5	-6.0	-8.1	-10.1	-7.3	-9.4	-11.4
45	-5.3	-7.3	-9.3	-5.8	-7.8	-9.9	-6.9	-9.0	-11.0
40	-5.5	-7.6	-9.6	-6.1	-8.1	-10.2	-7.2	-9.2	-11.3

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1400							30.5		
1600	32.6			38.5			47.0		
1800	51.3			56.2	30.7		62.4	39.7	
2000	70.0	42.9		73.9	48.3		77.1	55.6	32.3
2200	88.7	61.6	34.6	91.6	66.0	40.4	91.0	70.6	48.6
2400		80.3	53.2		83.6	58.0		84.9	64.0
2600		99.1	71.9			75.7		98.7	78.6
2800			90.7			93.4			92.5

1. **Enter Weight Adjustment table with slush/standing water depth and 18K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -40 m/+35 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (18K Derate)

No Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-7	-5	-2	0	0	0	0	0	0
85	-9	-7	-4	0	0	0	0	0	0
80	-12	-9	-7	0	0	0	0	0	0
75	-14	-11	-9	-2	0	0	0	0	0
70	-15	-13	-10	-6	-3	-1	0	0	0
65	-17	-15	-12	-10	-7	-5	0	0	0
60	-19	-16	-14	-13	-11	-8	0	0	0
55	-20	-18	-15	-16	-14	-11	-6	-3	-1
50	-22	-19	-17	-19	-16	-14	-11	-9	-6
45	-23	-21	-18	-21	-18	-16	-15	-12	-10
40	-24	-22	-19	-22	-20	-17	-18	-15	-13

1. **Obtain V1, VR and V2 for the actual weight using the 18K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG).If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (18K Derate)

Maximum Reverse Thrust

Weight Adjustment (1000 KG)

18K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-2.1	-2.1	-2.1	-7.8	-7.8	-7.8	-11.8	-11.8	-11.8
85	-2.0	-2.0	-2.0	-7.0	-7.0	-7.0	-10.9	-10.9	-10.9
80	-1.9	-1.9	-1.9	-6.1	-6.1	-6.1	-10.0	-10.0	-10.0
75	-1.5	-1.5	-1.5	-5.5	-5.5	-5.5	-9.1	-9.1	-9.1
70	-1.1	-1.1	-1.1	-5.0	-5.0	-5.0	-8.2	-8.2	-8.2
65	-1.0	-1.0	-1.0	-4.5	-4.5	-4.5	-7.4	-7.4	-7.4
60	-0.8	-0.8	-0.8	-3.9	-3.9	-3.9	-6.7	-6.7	-6.7
55	-0.7	-0.7	-0.7	-3.7	-3.7	-3.7	-6.1	-6.1	-6.1
50	-0.8	-0.8	-0.8	-3.6	-3.6	-3.6	-5.8	-5.8	-5.8
45	-1.1	-1.1	-1.1	-3.7	-3.7	-3.7	-5.7	-5.7	-5.7
40	-1.6	-1.6	-1.6	-4.0	-4.0	-4.0	-5.8	-5.8	-5.8

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1000	37.8								
1200	60.3	39.7							
1400	82.5	62.2	41.7	45.0					
1600		84.3	64.1	62.6	41.3		31.2		
1800			86.2	81.1	58.6	37.5	42.7		
2000					77.0	54.7	54.8	34.9	
2200					96.2	72.8	67.7	46.5	
2400						91.9	81.4	58.9	38.6
2600							96.1	72.0	50.4
2800								86.1	63.0
3000									76.4
3200									90.9

1. **Enter Weight Adjustment table with reported braking action and 18K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -25 m/+20 m for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -25 m/+20 m for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -35 m/+30 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (18K Derate)

Maximum Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-2	-1	0	-10	-9	-8	-19	-18	-17
85	-3	-2	0	-10	-9	-8	-19	-18	-17
80	-4	-2	-1	-10	-9	-8	-19	-18	-17
75	-4	-3	-2	-11	-10	-9	-20	-19	-18
70	-5	-4	-2	-12	-11	-9	-21	-20	-19
65	-6	-4	-3	-13	-12	-11	-23	-22	-20
60	-6	-5	-4	-15	-13	-12	-25	-23	-22
55	-7	-6	-5	-16	-15	-14	-27	-25	-24
50	-8	-7	-6	-18	-16	-15	-29	-28	-26
45	-9	-8	-7	-19	-18	-17	-31	-30	-29
40	-11	-10	-8	-21	-20	-18	-33	-32	-31

1. **Obtain V1, VR and V2 for the actual weight using the 18K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG).If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (18K Derate)

No Reverse Thrust

Weight Adjustments (1000 KG)

18K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-6.4	-6.4	-6.4	-11.2	-11.2	-11.2	-17.7	-17.7	-17.7
85	-5.0	-5.0	-5.0	-9.8	-9.8	-9.8	-15.6	-15.6	-15.6
80	-3.8	-3.8	-3.8	-8.5	-8.5	-8.5	-13.7	-13.7	-13.7
75	-2.9	-2.9	-2.9	-7.4	-7.4	-7.4	-12.1	-12.1	-12.1
70	-2.1	-2.1	-2.1	-6.5	-6.5	-6.5	-10.6	-10.6	-10.6
65	-1.6	-1.6	-1.6	-5.8	-5.8	-5.8	-9.4	-9.4	-9.4
60	-1.4	-1.4	-1.4	-5.3	-5.3	-5.3	-8.5	-8.5	-8.5
55	-1.3	-1.3	-1.3	-4.9	-4.9	-4.9	-7.7	-7.7	-7.7
50	-1.5	-1.5	-1.5	-4.8	-4.8	-4.8	-7.2	-7.2	-7.2
45	-1.9	-1.9	-1.9	-4.8	-4.8	-4.8	-6.9	-6.9	-6.9
40	-2.6	-2.6	-2.6	-5.0	-5.0	-5.0	-6.9	-6.9	-6.9

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1200	53.5	34.4							
1400	77.2	59.3	40.5						
1600	99.9	82.7	64.9	41.6					
1800			88.0	63.4	36.8				
2000				85.0	58.6	32.0			
2200					80.3	53.8			
2400						75.5	42.2		
2600						97.0	58.0		
2800							74.4	43.6	
3000							91.4	59.6	
3200								76.0	45.1
3400								93.0	61.1
3600									77.6
3800									94.6

1. **Enter Weight Adjustment table with reported braking action and 18K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust “Good” field length available by -25 m/+20 m for every 5°C above/below 4°C.**
   Adjust “Medium” field length available by -25 m/+20 m for every 5°C above/below 4°C.
   Adjust “Poor” field length available by -40 m/+35 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (18K Derate)
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-18	-15	-13	-30	-28	-25	-45	-42	-40
85	-13	-11	-8	-24	-22	-19	-39	-36	-34
80	-10	-8	-5	-20	-17	-15	-34	-31	-29
75	-8	-6	-3	-17	-15	-12	-32	-29	-27
70	-7	-5	-2	-17	-14	-12	-31	-29	-26
65	-7	-5	-2	-17	-15	-12	-32	-30	-27
60	-8	-5	-3	-19	-16	-14	-34	-32	-29
55	-9	-6	-4	-21	-18	-16	-37	-34	-32
50	-10	-8	-5	-23	-20	-18	-40	-37	-35
45	-12	-9	-7	-25	-23	-20	-42	-40	-37
40	-13	-11	-8	-27	-24	-22	-44	-42	-39

1. **Obtain V1, VR and V2 for the actual weight using the 18K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG).If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG).V1 not to exceed VR.**

Takeoff %N1 (18K Derate)

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

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
60	82.0	82.4	82.8	83.6	84.5	85.5	86.5	86.4	86.4	85.6	85.2	84.7	84.3
55	82.8	83.3	83.7	84.5	85.5	86.4	87.3	87.3	87.2	86.5	85.8	84.8	83.8
50	83.7	84.1	84.5	85.5	86.5	87.3	88.2	88.1	88.1	87.4	86.7	85.7	84.7
45	84.6	85.1	85.5	86.4	87.4	88.2	89.0	88.9	88.9	88.2	87.5	86.6	85.6
40	85.7	86.1	86.6	87.4	88.2	89.0	89.8	89.7	89.6	89.0	88.4	87.4	86.5
35	86.6	87.1	87.5	88.3	89.1	89.9	90.7	90.5	90.4	89.8	89.2	88.3	87.4
30	86.2	87.3	88.4	89.2	90.1	90.8	91.6	91.4	91.3	90.6	90.0	89.1	88.2
25	85.5	86.6	87.7	88.5	89.4	90.2	91.0	91.6	92.0	91.5	90.9	90.0	89.0
20	84.8	85.9	87.0	87.8	88.7	89.5	90.3	90.8	91.3	91.8	91.7	90.8	90.0
15	84.1	85.2	86.3	87.1	88.0	88.8	89.5	90.1	90.5	91.1	91.6	91.7	90.8
10	83.4	84.5	85.5	86.3	87.2	88.0	88.8	89.3	89.8	90.3	90.8	91.3	91.9
5	82.7	83.7	84.8	85.6	86.5	87.3	88.0	88.5	89.0	89.5	90.1	90.5	91.1
0	82.0	83.0	84.1	84.9	85.7	86.5	87.3	87.8	88.2	88.8	89.3	89.7	90.3
-5	81.2	82.3	83.3	84.1	85.0	85.7	86.5	87.0	87.4	88.0	88.5	88.9	89.5
-10	80.5	81.5	82.5	83.3	84.2	84.9	85.7	86.2	86.6	87.2	87.7	88.1	88.7
-15	79.7	80.8	81.8	82.6	83.4	84.2	84.9	85.4	85.8	86.4	86.9	87.3	87.9
-20	79.0	80.0	81.0	81.8	82.6	83.4	84.1	84.6	85.0	85.6	86.1	86.5	87.1
-25	78.2	79.2	80.2	81.0	81.8	82.6	83.3	83.8	84.2	84.7	85.2	85.7	86.2
-30	77.5	78.4	79.4	80.2	81.0	81.8	82.5	82.9	83.4	83.9	84.4	84.8	85.4
-35	76.7	77.7	78.6	79.4	80.2	80.9	81.7	82.1	82.6	83.1	83.6	84.0	84.6
-40	75.9	76.9	77.8	78.6	79.4	80.1	80.8	81.3	81.7	82.2	82.7	83.1	83.7
-45	75.1	76.1	77.0	77.8	78.6	79.3	80.0	80.4	80.9	81.4	81.9	82.3	82.8
-50	74.3	75.2	76.2	76.9	77.7	78.4	79.1	79.6	80.0	80.5	81.0	81.4	81.9

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.9	0.9	0.9

Assumed Temperature Reduced Thrust (18K Derate)

Maximum Assumed Temperature (Table 1 of 3)

Based on 25% Takeoff Thrust Reduction

OAT (°C)	PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
54	73	71	69	67								
50	73	71	69	67	65	63						
45	73	71	69	67	65	63	61	59	57			
40	69	69	68	67	65	63	61	59	57	55		
35	64	64	63	64	65	63	61	59	57	55	53	
30	61	59	59	59	60	61	61	59	57	55	53	51
25	61	59	58	59	59	60	58	57	56	55	53	51
20	61	59	58	59	59	60	58	57	52	51	50	50
15	61	59	58	59	59	60	58	57	52	48	45	44
10 & BELOW	61	59	58	59	59	60	58	57	52	48	44	39

Takeoff %N1 (Table 2 of 3)

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

ASSUMED TEMP (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
75	79.8	80.1	81.1	82.7	84.5	86.2	86.7	87.3	87.1	87.0	86.6	86.2
70	80.7	81.1	81.5	82.5	83.9	85.6	86.1	86.7	86.5	86.4	86.0	85.6
65	81.6	82.0	82.6	83.5	84.5	85.6	85.5	86.1	85.9	85.8	85.4	84.9
60	82.4	82.8	83.6	84.5	85.5	86.5	86.4	86.4	85.6	85.2	84.7	84.3
55	83.3	83.7	84.5	85.5	86.4	87.3	87.3	87.2	86.5	85.8	84.8	83.8
50	84.1	84.5	85.5	86.5	87.3	88.2	88.1	88.1	87.4	86.7	85.7	84.7
45	85.1	85.5	86.4	87.4	88.2	89.0	88.9	88.9	88.2	87.5	86.6	85.6
40	86.1	86.6	87.4	88.2	89.0	89.8	89.7	89.6	89.0	88.4	87.4	86.5
35	87.1	87.5	88.3	89.1	89.9	90.7	90.5	90.4	89.8	89.2	88.3	87.4
30	87.3	88.4	89.2	90.1	90.8	91.6	91.4	91.3	90.6	90.0	89.1	88.2
25	86.6	87.7	88.5	89.4	90.2	91.0	91.6	92.0	91.5	90.9	90.0	89.0
20	85.9	87.0	87.8	88.7	89.5	90.3	90.8	91.3	91.8	91.7	90.8	90.0
15	85.2	86.3	87.1	88.0	88.8	89.5	90.1	90.5	91.1	91.6	91.7	90.8
10	84.5	85.5	86.3	87.2	88.0	88.8	89.3	89.8	90.3	90.8	91.3	91.9
MINIMUM ASSUMED TEMP (°C)	32	30	30	30	29	29	27	25	21	18	14	10

With engine bleed for packs off, increase %N1 by 0.9.

Assumed Temperature Reduced Thrust (18K Derate)

%N1 Adjustment for Temperature Difference (Table 3 of 3)

ASSUMED TEMP MINUS OAT (°C)	OUTSIDE AIR TEMPERATURE (°C)													
	-40	-20	0	5	10	15	20	25	30	35	40	45	50	55
110	10.4													
100	9.2	6.5												
90	9.6	7.3												
80	11.3	6.1	3.7											
70	10.5	6.5	4.4	4.0	2.4									
60	9.0	8.2	3.1	3.0	2.9	2.7	1.1							
50	7.6	7.3	3.5	1.9	1.7	2.9	2.7	1.4	1.2					
40		5.9	5.3	3.7	2.1	2.2	2.8	3.1	1.5	1.6	1.5			
30		4.5	4.3	4.2	3.9	4.0	3.9	3.8	3.5	3.3	3.2	3.4	3.4	
20			2.9	2.9	2.8	2.8	2.7	2.7	2.6	2.5	2.5	2.4	2.3	2.3
10			1.5	1.4	1.4	1.4	1.4	1.4	1.3	1.3	1.3	1.2	1.2	1.2
0			0	0	0	0	0	0	0	0	0	0	0	0

1. **Determine Maximum Assumed Temperature allowed from Table 1.**
2. **Find Maximum %N1 from Table 2 using the desired assumed temperature (no greater than temperature from Table 1).**
3. **Use the difference between assumed temperature and OAT to determine the %N1 adjustment from Table 3.**
4. **Subtract %N1 adjustment from Maximum %N1 in Table 2.**

Max Climb %N1

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

TAT (°C)	PRESSURE ALTITUDE (FT)/SPEED (KIAS/MACH)									
	0	5000	10000	15000	20000	25000	30000	35000	37000	41000
	280	280	280	280	280	280	280	.78	.78	.78
60	88.4	88.6	88.5	88.2	88.9	91.3	92.9	94.3	94.4	92.7
55	89.2	89.4	89.3	89.1	89.3	90.6	92.3	93.6	93.7	92.0
50	90.0	90.1	90.1	89.9	90.2	90.7	91.6	92.9	93.0	91.3
45	90.7	90.8	90.9	90.7	91.1	91.6	91.6	92.2	92.3	90.6
40	91.5	91.6	91.6	91.4	92.0	92.4	92.4	91.5	91.6	89.9
35	92.0	92.3	92.3	92.2	92.8	93.2	93.2	92.3	91.6	90.0
30	91.3	93.0	93.0	92.9	93.6	94.0	93.9	93.1	92.5	91.0
25	90.5	93.0	93.8	93.6	94.3	94.8	94.6	93.9	93.3	92.0
20	89.8	92.3	94.5	94.3	95.1	95.5	95.3	94.6	94.1	92.9
15	89.1	91.5	93.9	95.1	95.8	96.2	96.0	95.4	94.9	93.9
10	88.3	90.8	93.1	95.3	96.7	96.9	96.6	96.1	95.7	94.8
5	87.5	90.0	92.4	94.5	97.7	97.8	97.3	96.9	96.5	95.7
0	86.8	89.2	91.6	93.7	97.1	98.9	98.3	97.8	97.4	96.6
-5	86.0	88.4	90.8	92.9	96.3	98.8	99.3	98.5	98.2	97.7
-10	85.2	87.6	89.9	92.1	95.5	98.0	99.6	99.4	99.1	98.6
-15	84.4	86.8	89.1	91.2	94.7	97.3	98.8	100.4	100.1	99.6
-20	83.6	86.0	88.3	90.4	93.9	96.5	98.0	100.1	100.6	100.2
-25	82.8	85.2	87.5	89.6	93.1	95.7	97.2	99.2	99.8	99.4
-30	82.0	84.3	86.6	88.7	92.3	94.9	96.4	98.4	98.9	98.6
-35	81.2	83.5	85.8	87.9	91.4	94.0	95.5	97.6	98.1	97.7
-40	80.4	82.6	84.9	87.0	90.6	93.2	94.7	96.7	97.2	96.9

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)					
	0	10	20	30	35	41
ENGINE ANTI-ICE	-0.6	-0.8	-0.9	-0.9	-0.8	-0.8
ENGINE & WING ANTI-ICE*	-1.8	-2.1	-2.5	-2.7	-3.0	-3.0

***Dual bleed sources**

Go-around %N1

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

AIRPORT OAT		TAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
°C	°F		-2000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
57	134	60	88.5	89.3	89.4									
52	125	55	89.2	90.1	90.3	90.4	90.5							
47	116	50	90.0	90.9	91.0	91.2	91.3	91.4	91.4	91.3				
42	108	45	90.9	91.7	91.9	92.0	92.1	92.2	92.2	92.1	91.8	91.4		
37	99	40	91.8	92.6	92.7	92.8	92.9	93.0	93.0	92.9	92.6	92.2	92.1	92.0
32	90	35	91.9	93.5	93.6	93.7	93.7	93.8	93.7	93.7	93.4	93.0	93.0	92.9
27	81	30	91.2	93.4	94.1	94.5	94.6	94.6	94.6	94.5	94.1	93.8	93.8	93.7
22	72	25	90.5	92.6	93.3	94.0	94.7	95.5	95.4	95.3	95.0	94.6	94.5	94.5
17	63	20	89.7	91.9	92.6	93.3	94.0	94.7	95.2	95.8	96.0	95.7	95.3	95.3
12	54	15	89.0	91.1	91.8	92.5	93.2	93.9	94.5	95.0	95.6	96.2	96.8	96.5
7	45	10	88.3	90.4	91.0	91.7	92.4	93.2	93.7	94.2	94.8	95.4	96.1	96.7
2	36	5	87.5	89.6	90.3	90.9	91.6	92.4	92.9	93.4	94.0	94.6	95.3	95.9
-3	27	0	86.7	88.8	89.5	90.1	90.9	91.6	92.1	92.6	93.2	93.8	94.5	95.1
-8	18	-5	86.0	88.0	88.7	89.4	90.1	90.8	91.3	91.8	92.4	93.0	93.7	94.3
-13	9	-10	85.2	87.2	87.9	88.5	89.2	89.9	90.5	91.0	91.6	92.2	92.9	93.5
-17	1	-15	84.4	86.4	87.1	87.7	88.4	89.1	89.7	90.2	90.8	91.4	92.0	92.7
-22	-8	-20	83.6	85.6	86.3	86.9	87.6	88.3	88.8	89.3	90.0	90.5	91.2	91.9
-27	-17	-25	82.8	84.8	85.4	86.1	86.8	87.5	88.0	88.5	89.1	89.7	90.4	91.1
-32	-26	-30	82.0	84.0	84.6	85.2	85.9	86.6	87.1	87.6	88.3	88.9	89.5	90.2
-37	-35	-35	81.2	83.1	83.8	84.4	85.1	85.8	86.3	86.8	87.4	88.0	88.7	89.4
-42	-44	-40	80.3	82.3	82.9	83.5	84.2	84.9	85.4	85.9	86.5	87.1	87.8	88.5
-47	-53	-45	79.5	81.4	82.1	82.7	83.4	84.0	84.5	85.0	85.7	86.3	87.0	87.6
-52	-62	-50	78.6	80.6	81.2	81.8	82.5	83.1	83.6	84.1	84.8	85.4	86.1	86.8

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (FT)											
	-2000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.8	0.8	0.8
A/C HIGH	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Climb (280/.76)

Flaps Up, Set Max Climb Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		40	50	60	70	80
40000	**PITCH ATT**	**4.0**	**4.0**	**4.0**		
	V/S (FT/MIN)	1800	1100	400		
30000	**PITCH ATT**	**4.0**	**4.0**	**4.0**	**4.0**	**4.0**
	V/S (FT/MIN)	2600	2000	1500	1100	800
20000	**PITCH ATT**	**7.0**	**6.5**	**6.0**	**6.0**	**6.0**
	V/S (FT/MIN)	4100	3200	2500	2100	1600
10000	**PITCH ATT**	**10.5**	**9.0**	**8.0**	**8.0**	**7.5**
	V/S (FT/MIN)	5400	4200	3400	2800	2300
SEA LEVEL	**PITCH ATT**	**14.0**	**12.0**	**11.0**	**10.0**	**9.5**
	V/S (FT/MIN)	6600	5200	4200	3500	3000

Cruise (.76/280)

Flaps Up, %N1 for Level Flight

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		40	50	60	70	80
40000	**PITCH ATT**	**2.0**	**2.5**	**3.5**		
	%N1	83	87	92		
35000	**PITCH ATT**	**1.0**	**2.0**	**2.5**	**3.0**	**3.5**
	%N1	81	83	85	89	94
30000	**PITCH ATT**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**
	%N1	80	81	83	85	87
25000	**PITCH ATT**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**
	%N1	77	78	79	81	83
20000	**PITCH ATT**	**1.0**	**1.5**	**2.0**	**3.0**	**3.5**
	%N1	73	74	75	77	79
15000	**PITCH ATT**	**1.0**	**1.5**	**2.5**	**3.0**	**3.5**
	%N1	69	70	71	73	75

Descent (.76/280)

Flaps Up, Set Idle Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		40	50	60	70	80
40000	**PITCH ATT**	**-2.0**	**-0.5**	**0.0**	**0.5**	**1.0**
	V/S (FT/MIN)	-2800	-2600	-2600	-2800	-3100
30000	**PITCH ATT**	**-3.5**	**-2.0**	**-1.0**	**-0.5**	**0.5**
	V/S (FT/MIN)	-3200	-2700	-2400	-2200	-2100
20000	**PITCH ATT**	**-3.5**	**-2.0**	**-1.0**	**0.0**	**0.5**
	V/S (FT/MIN)	-2900	-2400	-2100	-2000	-1900
10000	**PITCH ATT**	**-3.5**	**-2.5**	**-1.0**	**-0.5**	**0.5**
	V/S (FT/MIN	-2700	-2300	-2000	-1800	-1700
SEA LEVEL	**PITCH ATT**	**-4.0**	**-2.5**	**-1.5**	**-0.5**	**0.5**
	V/S (FT/MIN)	-2600	-2200	-1900	-1700	-1600

Flight With Unreliable Airspeed / Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Holding (VREF40 + 70)

Flaps Up, %N1 for Level Flight

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		40	50	60	70	80
15000	**PITCH ATT**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
	%N1	56	62	66	70	74
	KIAS	177	196	215	233	250
10000	**PITCH ATT**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
	%N1	53	58	63	66	70
	KIAS	177	196	214	232	248
5000	**PITCH ATT**	**5.5**	**5.5**	**5.0**	**5.0**	**5.0**
	%N1	49	54	58	63	66
	KIAS	177	194	214	231	247

Terminal Area (5000 FT)

%N1 for Level Flight

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS UP (GEAR UP) (VREF40 + 70)	**PITCH ATT.**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	49	54	58	62	66
FLAPS 1 (GEAR UP) (VREF40 + 50)	**PITCH ATT.**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
	%N1	51	56	61	65	69
FLAPS 5 (GEAR UP) (VREF40 + 30)	**PITCH ATT.**	**5.5**	**6.0**	**6.5**	**6.5**	**7.0**
	%N1	52	57	62	66	70
FLAPS 15 (GEAR DOWN) (VREF40 + 20)	**PITCH ATT.**	**6.0**	**6.0**	**6.5**	**6.5**	**7.0**
	%N1	60	65	70	75	79

Final Approach (1500 FT)

Gear Down, %N1 for 3° Glideslope

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS 15 (VREF 15 + 10)	**PITCH ATT**	**3.5**	**3.5**	**3.5**	**4.0**	**4.0**
	%N1	42	46	51	54	57
FLAPS 30 (VREF 30 + 10)	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.5**
	%N1	46	51	56	59	63
FLAPS 40 (VREF 40 + 10)	**PITCH ATT**	**0.0**	**0.0**	**0.5**	**0.5**	**0.5**
	%N1	53	58	63	67	70

Go-Around

Flaps 15, Gear Up, Set Go-Around Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		40	50	60	70	80
10000	**PITCH ATT**	**19.5**	**16.0**	**13.5**	**11.5**	**10.0**
	V/S (FT/MIN)	3400	2700	2100	1600	1300
	KIAS	126	139	151	163	174
5000	**PITCH ATT**	**22.0**	**18.0**	**15.0**	**13.0**	**11.5**
	V/S (FT/MIN)	3800	3000	2400	1900	1600
	KIAS	126	138	150	161	172
SEA LEVEL	**PITCH ATT**	**24.5**	**19.5**	**16.5**	**14.5**	**13.0**
	V/S (FT/MIN)	4000	3200	2600	2100	1700
	KIAS	126	138	149	160	170

Intentionally
Blank

Performance Inflight — Chapter PI

All Engine — Section 11

Long Range Cruise Maximum Operating Altitude

Max Cruise Thrust

ISA + 10°C and Below

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
80	31000	-8	34400*	34400*	34400*	33500	32100
75	32400	-11	35900*	35900*	35900*	34800	33500
70	33900	-14	37300*	37300*	37300*	36300	34900
65	35500	-18	38700*	38700*	38700*	37800	36500
60	37100	-19	40200*	40200*	40200*	39500	38100
55	39000	-19	41000	41000	41000	41000	39900
50	40900	-19	41000	41000	41000	41000	41000
45	41000	-19	41000	41000	41000	41000	41000
40	41000	-19	41000	41000	41000	41000	41000
35	41000	-19	41000	41000	41000	41000	41000

ISA + 15°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
80	31000	-2	33100*	33100*	33100*	33100*	32100
75	32400	-5	34900*	34900*	34900*	34800	33500
70	33900	-8	36400*	36400*	36400*	36300	34900
65	35500	-12	37900*	37900*	37900*	37800	36500
60	37100	-13	39400*	39400*	39400*	39400*	38100
55	39000	-13	40900*	40900*	40900*	40900*	39900
50	40900	-13	41000	41000	41000	41000	41000
45	41000	-13	41000	41000	41000	41000	41000
40	41000	-13	41000	41000	41000	41000	41000
35	41000	-13	41000	41000	41000	41000	41000

ISA + 20°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
80	31000	4	30800*	30800*	30800*	30800*	30800*
75	32400	0	33300*	33300*	33300*	33300*	33300*
70	33900	-3	35200*	35200*	35200*	35200*	34900
65	35500	-6	36800*	36800*	36800*	36800*	36500
60	37100	-8	38300*	38300*	38300*	38300*	38100
55	39000	-8	39800*	39800*	39800*	39800*	39800*
50	40900	-8	41000	41000	41000	41000	41000
45	41000	-8	41000	41000	41000	41000	41000
40	41000	-8	41000	41000	41000	41000	41000
35	41000	-8	41000	41000	41000	41000	41000

***Denotes altitude thrust limited in level flight, 100 fpm residual rate of climb.**

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)									
		23	25	27	29	31	33	35	37	39	41
80	%N1	83.1	84.5	85.7	86.9	88.3	90.3	94.3			
	MACH	.712	.736	.753	.767	.780	.790	.787			
	KIAS	310	309	303	296	289	280	267			
	FF/ENG	1515	1503	1488	1473	1468	1492	1560			
75	%N1	81.6	83.1	84.4	85.6	86.9	88.4	90.8			
	MACH	.691	.719	.742	.757	.771	.784	.791			
	KIAS	301	301	298	292	285	278	268			
	FF/ENG	1418	1415	1409	1392	1378	1378	1410			
70	%N1	80.0	81.5	83.0	84.3	85.4	86.8	88.5	91.9		
	MACH	.671	.697	.724	.746	.760	.774	.787	.790		
	KIAS	292	291	291	288	281	274	267	256		
	FF/ENG	1324	1321	1323	1316	1296	1283	1291	1341		
65	%N1	78.5	79.8	81.3	82.7	84.0	85.3	86.6	88.9	93.5	
	MACH	.652	.675	.702	.728	.749	.763	.777	.789	.789	
	KIAS	283	281	281	280	277	270	263	256	244	
	FF/ENG	1235	1226	1230	1230	1220	1200	1190	1214	1279	
60	%N1	76.8	78.1	79.5	81.0	82.4	83.7	85.0	86.8	89.7	
	MACH	.633	.654	.677	.705	.731	.751	.765	.779	.790	
	KIAS	274	272	270	271	270	265	259	252	244	
	FF/ENG	1149	1137	1134	1139	1137	1124	1105	1109	1141	
55	%N1	75.1	76.4	77.7	79.0	80.6	82.0	83.3	84.9	87.2	90.3
	MACH	.612	.633	.654	.677	.706	.733	.752	.767	.781	.790
	KIAS	265	263	261	259	260	258	254	248	241	233
	FF/ENG	1070	1051	1045	1043	1046	1042	1029	1021	1031	1063
50	%N1	73.0	74.5	75.7	77.0	78.4	80.0	81.4	83.1	85.2	87.4
	MACH	.586	.610	.631	.653	.676	.705	.732	.752	.767	.781
	KIAS	253	253	251	249	248	248	247	243	237	230
	FF/ENG	984	971	959	954	951	952	948	942	941	950
45	%N1	70.5	72.1	73.6	74.9	76.2	77.6	79.2	81.0	83.1	85.2
	MACH	.557	.581	.605	.627	.649	.673	.702	.730	.751	.765
	KIAS	240	240	240	239	237	236	236	235	231	225
	FF/ENG	894	885	879	870	863	859	859	860	861	868
40	%N1	67.6	69.4	71.0	72.5	73.9	75.2	76.6	78.5	80.8	82.9
	MACH	.525	.549	.573	.598	.621	.643	.667	.694	.724	.747
	KIAS	225	226	227	227	226	224	223	222	222	219
	FF/ENG	804	797	794	802	793	783	777	778	786	789
35	%N1	64.4	66.0	67.8	69.5	71.1	72.6	73.9	75.6	77.8	80.2
	MACH	.491	.513	.536	.561	.586	.611	.634	.657	.682	.713
	KIAS	210	211	212	212	213	213	211	209	208	208
	FF/ENG	727	721	718	716	711	703	693	690	692	700

Shaded area approximates optimum altitude.

Long Range Cruise Enroute Fuel and Time - Low Altitudes

Ground to Air Miles Conversions

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
303	276	252	232	215	200	190	181	173	165	158
457	415	379	349	323	300	285	271	259	248	238
612	556	506	465	431	400	380	362	345	330	317
768	696	633	582	538	500	475	452	431	412	395
924	837	761	699	646	600	570	543	518	495	474
1081	978	889	816	754	700	665	633	604	577	553
1238	1120	1017	933	862	800	760	723	690	659	632
1396	1262	1145	1050	970	900	855	813	776	742	711
1554	1404	1274	1168	1079	1000	950	904	862	824	790
1713	1547	1403	1285	1187	1100	1045	994	947	906	869
1873	1691	1532	1403	1295	1200	1139	1084	1033	988	947
2034	1835	1662	1521	1404	1300	1234	1174	1119	1070	1026
2195	1979	1792	1640	1512	1400	1329	1264	1205	1152	1104
2357	2124	1922	1758	1621	1500	1424	1355	1291	1234	1182
2519	2270	2053	1877	1729	1600	1519	1445	1377	1315	1260
2683	2415	2184	1995	1838	1700	1614	1535	1462	1397	1338
2847	2562	2314	2114	1947	1800	1708	1624	1548	1478	1416
3012	2708	2446	2233	2056	1900	1803	1714	1633	1560	1494
3177	2856	2577	2352	2165	2000	1898	1804	1718	1641	1572

Reference Fuel And Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		20		24		28	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	1.3	0:44	1.2	0:42	1.0	0:39	0.9	0:37	0.8	0:36
300	2.0	1:05	1.9	1:02	1.6	0:57	1.4	0:54	1.3	0:52
400	2.8	1:27	2.5	1:22	2.2	1:15	2.0	1:11	1.8	1:08
500	3.5	1:48	3.2	1:42	2.8	1:33	2.5	1:28	2.3	1:24
600	4.2	2:10	3.8	2:02	3.3	1:51	3.0	1:45	2.8	1:40
700	4.8	2:31	4.5	2:23	3.9	2:10	3.6	2:02	3.3	1:56
800	5.5	2:53	5.1	2:43	4.5	2:28	4.1	2:19	3.8	2:12
900	6.2	3:15	5.7	3:04	5.1	2:47	4.6	2:36	4.2	2:28
1000	6.9	3:37	6.4	3:24	5.6	3:05	5.1	2:54	4.7	2:44
1100	7.6	4:00	7.0	3:45	6.2	3:24	5.6	3:11	5.2	3:01
1200	8.3	4:22	7.6	4:06	6.7	3:43	6.2	3:29	5.7	3:17
1300	8.9	4:45	8.3	4:28	7.3	4:02	6.7	3:46	6.2	3:34
1400	9.6	5:08	8.9	4:49	7.8	4:21	7.2	4:04	6.6	3:50
1500	10.3	5:31	9.5	5:11	8.4	4:41	7.7	4:22	7.1	4:07
1600	10.9	5:54	10.1	5:32	8.9	5:00	8.2	4:40	7.6	4:23
1700	11.6	6:17	10.7	5:54	9.5	5:20	8.7	4:58	8.0	4:40
1800	12.2	6:40	11.3	6:16	10.0	5:40	9.2	5:16	8.5	4:57
1900	12.9	7:04	11.9	6:38	10.6	6:00	9.7	5:35	9.0	5:14
2000	13.5	7:28	12.5	7:01	11.1	6:19	10.2	5:53	9.4	5:31

Long Range Cruise Enroute Fuel and Time - Low Altitudes

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	30	40	50	60	70
2	-0.2	-0.1	0.0	0.2	0.3
4	-0.4	-0.3	0.0	0.4	0.7
6	-0.7	-0.4	0.0	0.6	1.1
8	-0.9	-0.6	0.0	0.8	1.5
10	-1.2	-0.7	0.0	0.9	1.9
12	-1.6	-0.8	0.0	1.1	2.3
14	-1.9	-0.9	0.0	1.3	2.7

Based on .78/280/250 descent.

Long Range Cruise Enroute Fuel and Time - High Altitudes

Ground to Air Miles Conversions

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
547	509	476	447	422	400	382	365	349	335	323
817	762	713	671	634	600	573	548	526	505	486
1088	1016	951	895	845	800	765	732	702	674	649
1360	1270	1189	1119	1056	1000	956	915	878	843	812
1633	1525	1428	1343	1268	1200	1147	1098	1053	1012	975
1907	1781	1667	1568	1480	1400	1339	1282	1229	1181	1137
2182	2037	1906	1792	1692	1600	1530	1465	1405	1349	1299
2459	2294	2146	2018	1903	1800	1721	1648	1580	1518	1461
2736	2552	2387	2243	2116	2000	1912	1830	1755	1686	1623
3014	2810	2627	2468	2328	2200	2103	2013	1930	1854	1785
3293	3070	2868	2694	2540	2400	2294	2196	2105	2022	1946
3574	3330	3110	2920	2752	2600	2485	2379	2280	2190	2107
3856	3591	3353	3146	2965	2800	2676	2561	2455	2357	2268
4139	3853	3596	3373	3177	3000	2867	2743	2629	2524	2429
4423	4115	3839	3600	3390	3200	3057	2925	2803	2691	2590
4708	4379	4084	3828	3603	3400	3248	3107	2977	2858	2750
4996	4644	4329	4056	3817	3600	3438	3289	3151	3024	2910
5284	4910	4574	4285	4030	3800	3629	3470	3324	3191	3070
5575	5177	4821	4513	4244	4000	3819	3652	3498	3357	3229
5867	5445	5068	4743	4457	4200	4010	3833	3671	3522	3388
6161	5715	5316	4972	4671	4400	4200	4015	3844	3688	3547
6457	5985	5564	5202	4886	4600	4390	4196	4017	3853	3706
6754	6257	5813	5433	5100	4800	4580	4377	4190	4019	3864
7053	6530	6063	5664	5314	5000	4770	4558	4362	4184	4022

Long Range Cruise Enroute Fuel and Time - High Altitudes

Reference Fuel And Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	29		31		33		35		37	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
400	1.9	1:04	1.8	1:03	1.7	1:01	1.7	1:00	1.6	0:59
600	2.8	1:37	2.7	1:35	2.6	1:32	2.5	1:30	2.4	1:28
800	3.7	2:10	3.6	2:06	3.5	2:03	3.3	2:00	3.2	1:57
1000	4.6	2:42	4.5	2:38	4.3	2:34	4.2	2:30	4.1	2:26
1200	5.6	3:15	5.4	3:10	5.2	3:05	5.0	3:00	4.9	2:55
1400	6.5	3:48	6.3	3:42	6.1	3:36	5.9	3:30	5.7	3:24
1600	7.4	4:21	7.2	4:14	6.9	4:07	6.7	4:00	6.5	3:53
1800	8.3	4:54	8.1	4:46	7.8	4:38	7.6	4:30	7.3	4:21
2000	9.3	5:26	9.0	5:18	8.7	5:09	8.4	5:00	8.1	4:50
2200	10.2	6:01	9.8	5:51	9.5	5:41	9.2	5:31	8.9	5:20
2400	11.0	6:35	10.7	6:24	10.3	6:14	10.0	6:02	9.7	5:51
2600	11.9	7:10	11.5	6:58	11.2	6:46	10.8	6:34	10.5	6:21
2800	12.8	7:44	12.4	7:31	12.0	7:18	11.6	7:05	11.3	6:51
3000	13.7	8:19	13.3	8:04	12.8	7:50	12.4	7:36	12.1	7:21
3200	14.6	8:55	14.1	8:39	13.6	8:24	13.2	8:09	12.8	7:52
3400	15.4	9:32	14.9	9:14	14.4	8:58	14.0	8:41	13.6	8:24
3600	16.3	10:08	15.8	9:49	15.2	9:31	14.8	9:14	14.3	8:55
3800	17.2	10:45	16.6	10:24	16.0	10:05	15.5	9:46	15.1	9:26
4000	18.0	11:22	17.4	10:59	16.8	10:39	16.3	10:19	15.8	9:58
4200	18.8	12:01	18.2	11:36	17.6	11:14	17.0	10:53	16.5	10:31
4400	19.6	12:40	19.0	12:14	18.4	11:50	17.8	11:27	17.2	11:03
4600	20.5	13:19	19.8	12:51	19.1	12:25	18.5	12:01	17.9	11:36
4800	21.3	13:58	20.6	13:28	19.9	13:01	19.2	12:35	18.6	12:09
5000	22.1	14:37	21.4	14:05	20.6	13:36	20.0	13:09	19.4	12:41

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)					
	30	40	50	60	70	80
2	-0.3	-0.1	0.0	0.3	1.0	2.0
4	-0.6	-0.3	0.0	0.6	1.6	3.2
6	-1.0	-0.4	0.0	0.8	2.3	4.3
8	-1.4	-0.6	0.0	1.1	2.9	5.4
10	-1.8	-0.8	0.0	1.3	3.4	6.3
12	-2.2	-0.9	0.0	1.5	3.9	7.2
14	-2.6	-1.1	0.0	1.8	4.4	7.9
16	-3.0	-1.3	0.0	2.0	4.8	8.5
18	-3.5	-1.6	0.0	2.2	5.2	9.1
20	-4.0	-1.8	0.0	2.4	5.6	9.5
22	-4.5	-2.0	0.0	2.6	5.9	9.8
24	-5.0	-2.2	0.0	2.8	6.2	10.1

Based on .78/280/250 descent.

Long Range Cruise Wind-Altitude Trade

PRESSURE ALTITUDE (1000 FT)	CRUISE WEIGHT (1000 KG)										
	80	75	70	65	60	55	50	45	40	35	30
41					23	7	0	3	15	35	62
39			42	19	6	0	3	13	29	52	80
37		32	14	4	0	3	11	26	45	69	98
35	23	10	2	0	3	11	24	41	62	87	115
33	6	1	0	4	12	24	39	58	80	104	131
31	0	1	6	14	25	39	56	75	97	121	147
29	3	8	16	27	40	55	72	92	113	136	161
27	11	19	29	41	55	71	89	108	129	151	174
25	22	32	44	57	71	87	105	124	143	164	186

The above wind factor table is for calculation of wind required to maintain present range capability at new pressure altitude, i.e., break-even wind.

Method:

1. **Read wind factors for present and new altitudes from table.**
2. **Determine difference (new altitude wind factor minus present altitude wind factor); This difference may be negative or positive.**
3. **Break-even wind at new altitude is present altitude wind plus difference from step 2.**

Descent

.78/280/250

PRESSURE ALTITUDE (FT)	TIME (MIN)	FUEL (KG)	DISTANCE (NM)			
			LANDING WEIGHT (1000 KG)			
			40	50	60	70
41000	26	340	104	120	132	139
39000	25	330	99	115	127	134
37000	25	330	94	110	121	129
35000	24	320	90	105	116	123
33000	23	320	86	101	111	118
31000	22	310	82	95	105	112
29000	21	310	77	89	99	105
27000	20	300	72	84	92	98
25000	19	290	68	78	86	91
23000	18	280	63	73	80	84
21000	17	270	58	67	74	78
19000	16	260	54	62	67	71
17000	15	250	49	56	61	64
15000	14	240	45	51	55	58
10000	10	200	31	35	37	38
5000	7	150	18	19	21	21
1500	4	110	9	9	9	9

Allowances for a straight-in approach are included.

Holding

Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)								
		1500	5000	10000	15000	20000	25000	30000	35000	41000
80	%N1	63.2	66.1	69.8	74.0	78.2	82.5	86.6	93.7	
	KIAS	247	247	248	250	251	253	256	259	
	FF/ENG	1440	1420	1410	1410	1380	1390	1420	1580	
75	%N1	61.4	64.5	68.2	72.4	76.5	80.9	85.0	90.2	
	KIAS	239	240	240	242	243	245	248	251	
	FF/ENG	1360	1340	1330	1320	1290	1290	1320	1400	
70	%N1	59.6	62.6	66.5	70.5	74.7	79.1	83.2	87.9	
	KIAS	231	231	232	233	235	236	239	242	
	FF/ENG	1280	1260	1240	1230	1210	1200	1230	1270	
65	%N1	57.9	60.5	64.8	68.5	72.8	77.2	81.4	85.8	
	KIAS	223	223	223	224	226	227	229	232	
	FF/ENG	1200	1180	1160	1150	1130	1110	1130	1160	
60	%N1	56.0	58.5	62.8	66.5	70.9	75.1	79.4	83.7	94.2
	KIAS	214	214	215	215	217	218	220	222	226
	FF/ENG	1120	1090	1080	1060	1050	1020	1040	1060	1230
55	%N1	53.9	56.5	60.3	64.5	68.6	72.9	77.3	81.6	89.6
	KIAS	204	205	206	206	207	208	210	212	215
	FF/ENG	1040	1010	1000	980	960	940	950	960	1050
50	%N1	51.7	54.2	57.9	62.3	66.1	70.6	74.9	79.3	86.6
	KIAS	195	195	196	197	197	198	200	201	204
	FF/ENG	960	930	910	900	880	860	860	880	930
45	%N1	49.3	51.8	55.4	59.4	63.6	67.9	72.1	76.7	83.8
	KIAS	185	185	186	186	187	188	189	191	193
	FF/ENG	880	850	830	830	810	800	790	790	830
40	%N1	46.7	49.1	52.8	56.5	60.9	64.8	69.3	73.8	80.9
	KIAS	177	177	177	177	177	177	178	179	181
	FF/ENG	820	790	770	750	730	720	710	700	730
35	%N1	44.1	46.4	49.9	53.6	57.5	61.8	66.1	70.4	77.6
	KIAS	171	171	171	171	171	171	171	171	171
	FF/ENG	740	720	690	670	650	640	630	620	640

This table includes 5% additional fuel for holding in a racetrack pattern.

Intentionally
Blank

Performance Inflight — Chapter PI

Advisory Information — Section 12

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF15	ONE REV	NO REV

Dry Runway

MAX MANUAL	890	65/-50	20/25	-30/110	10/-10	20/-20	30	15	35
AUTOBRAKE MAX	1125	60/-60	25/35	-40/140	0/0	25/-25	55	0	0
AUTOBRAKE 3	1570	95/-100	40/60	-70/230	0/0	40/-40	90	0	0
AUTOBRAKE 2	2020	135/-150	60/85	-95/325	15/-30	55/-55	100	25	25
AUTOBRAKE 1	2255	170/-180	75/105	-110/385	50/-65	65/-65	95	185	205

Good Reported Braking Action

MAX MANUAL	1220	70/-75	30/45	-55/190	30/-25	30/-30	45	65	145
AUTOBRAKE MAX	1290	75/-80	35/45	-55/195	25/-20	30/-30	55	70	160
AUTOBRAKE 3	1575	95/-100	40/60	-70/235	5/0	40/-40	90	5	15
AUTOBRAKE 2	2020	135/-150	60/85	-95/325	15/-30	55/-55	100	25	25
AUTOBRAKE 1	2255	170/-180	75/105	-110/385	50/-65	65/-65	95	185	205

Medium Reported Braking Action

MAX MANUAL	1680	115/-115	50/70	-85/320	75/-60	40/-45	60	185	455
AUTOBRAKE MAX	1690	115/-115	50/75	-90/320	70/-55	45/-45	70	180	450
AUTOBRAKE 3	1750	115/-120	50/75	-90/325	60/-35	45/-45	90	150	425
AUTOBRAKE 2	2070	140/-150	60/85	-105/365	45/-45	55/-60	100	65	195
AUTOBRAKE 1	2270	170/-180	75/105	-115/400	70/-70	65/-65	95	200	265

Poor Reported Braking Action

MAX MANUAL	2210	165/-165	70/105	-135/505	185/-120	55/-60	75	405	1120
AUTOBRAKE MAX	2210	165/-165	75/105	-135/505	185/-120	55/-60	75	405	1120
AUTOBRAKE 3	2210	165/-165	75/105	-135/505	185/-115	55/-60	80	405	1120
AUTOBRAKE 2	2340	170/-175	75/110	-140/520	165/-105	60/-65	95	310	1005
AUTOBRAKE 1	2460	185/-195	80/115	-145/540	170/-120	65/-70	95	365	920

Reference distance is based on sea level, standard day, no wind or slope, VREF15 approach speed, two-engine detent No. 2 reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 55 m.
For autobrake and manual speedbrakes, increase reference landing distance by 45 m.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF30	ONE REV	NO REV

Dry Runway

MAX MANUAL	860	55/-45	20/25	-30/110	10/-10	15/-15	30	15	35
AUTOBRAKE MAX	1070	55/-60	25/30	-40/135	0/0	25/-25	50	0	0
AUTOBRAKE 3	1490	85/-95	40/55	-65/225	0/0	40/-40	85	0	0
AUTOBRAKE 2	1900	125/-135	55/80	-90/315	15/-30	55/-55	90	30	30
AUTOBRAKE 1	2110	155/-160	70/95	-110/370	50/-60	60/-60	85	165	195

Good Reported Braking Action

MAX MANUAL	1180	65/-70	30/40	-55/190	30/-25	25/-30	45	60	135
AUTOBRAKE MAX	1250	70/-75	30/45	-55/195	25/-20	30/-30	55	65	145
AUTOBRAKE 3	1490	90/-95	40/55	-65/230	5/0	40/-40	85	5	15
AUTOBRAKE 2	1900	125/-135	55/80	-90/315	15/-30	55/-55	90	30	30
AUTOBRAKE 1	2110	155/-160	70/95	-110/370	50/-60	60/-60	85	165	195

Medium Reported Braking Action

MAX MANUAL	1610	105/-110	45/65	-85/310	70/-55	40/-40	60	165	400
AUTOBRAKE MAX	1620	110/-110	50/70	-85/315	70/-50	40/-40	70	165	400
AUTOBRAKE 3	1670	110/-110	50/70	-90/320	60/-35	45/-45	85	140	385
AUTOBRAKE 2	1955	130/-140	55/80	-100/355	45/-45	55/-55	90	65	180
AUTOBRAKE 1	2125	155/-165	70/95	-110/385	70/-65	60/-60	85	180	255

Poor Reported Braking Action

MAX MANUAL	2090	155/-155	65/100	-130/495	175/-115	55/-60	70	355	955
AUTOBRAKE MAX	2095	155/-155	65/100	-130/495	180/-115	55/-60	70	355	960
AUTOBRAKE 3	2095	155/-155	65/100	-130/495	175/-110	55/-60	80	355	960
AUTOBRAKE 2	2210	160/-160	70/100	-135/510	160/-105	55/-60	90	280	860
AUTOBRAKE 1	2310	170/-175	75/105	-140/525	165/-115	60/-65	85	330	805

Reference distance is based on sea level, standard day, no wind or slope, VREF30 approach speed, two-engine detent No. 2 reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 50 m.
For autobrake and manual speedbrakes, increase reference landing distance by 45 m.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 40

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF40	ONE REV	NO REV
Dry Runway									
MAX MANUAL	845	55/-45	15/25	-30/105	10/-10	15/-15	35	15	30
AUTOBRAKE MAX	1045	50/-55	25/35	-40/130	0/0	20/-25	50	0	0
AUTOBRAKE 3	1440	85/-90	40/55	-65/220	0/0	35/-35	85	0	0
AUTOBRAKE 2	1835	120/-130	55/80	-90/305	10/-30	50/-50	90	20	20
AUTOBRAKE 1	2045	150/-155	65/90	-105/365	45/-55	60/-55	85	145	175
Good Reported Braking Action									
MAX MANUAL	1165	65/-70	30/45	-55/190	30/-25	25/-25	45	55	130
AUTOBRAKE MAX	1235	70/-75	30/45	-55/195	25/-20	30/-30	55	60	140
AUTOBRAKE 3	1445	85/-90	40/55	-65/225	10/-5	35/-35	85	5	15
AUTOBRAKE 2	1835	120/-130	55/80	-90/305	10/-30	50/-50	90	20	20
AUTOBRAKE 1	2045	150/-155	65/90	-105/365	45/-55	60/-55	85	145	175
Medium Reported Braking Action									
MAX MANUAL	1575	105/-105	45/65	-85/310	70/-55	40/-40	60	155	375
AUTOBRAKE MAX	1590	105/-110	45/70	-85/310	70/-50	40/-40	70	155	370
AUTOBRAKE 3	1630	105/-110	50/70	-85/315	60/-40	40/-45	85	140	370
AUTOBRAKE 2	1895	125/-135	55/80	-100/350	45/-45	50/-50	90	60	175
AUTOBRAKE 1	2055	150/-155	65/95	-110/380	70/-65	55/-60	85	160	235
Poor Reported Braking Action									
MAX MANUAL	2040	150/-150	65/95	-130/490	175/-110	50/-55	70	330	875
AUTOBRAKE MAX	2045	150/-150	65/100	-130/490	175/-115	50/-55	70	330	875
AUTOBRAKE 3	2050	155/-150	65/100	-130/490	175/-110	50/-55	80	330	875
AUTOBRAKE 2	2150	155/-155	70/100	-130/500	155/-105	55/-60	85	260	795
AUTOBRAKE 1	2240	165/-170	70/105	-135/515	165/-115	60/-65	85	305	745

Reference distance is based on sea level, standard day, no wind or slope, VREF40 approach speed, two-engine detent No. 2 reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 50 m.
For autobrake and manual speedbrakes, increase reference landing distance by 45 m.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Airspeed Unreliable (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	950	75/-55	20/30	-35/115	10/-10	20/-20	N/A	20	45
AUTOBRAKE MAX	1230	65/-65	30/40	-45/150	0/0	30/-30	N/A	0	5
AUTOBRAKE 2	2195	150/-160	70/95	-100/340	30/-45	60/-60	N/A	105	105

Good Reported Braking Action

MAX MANUAL	1300	75/-75	35/45	-55/195	30/-25	30/-30	N/A	75	175
AUTOBRAKE MAX	1385	80/-80	35/50	-60/205	25/-20	35/-35	N/A	85	190
AUTOBRAKE 2	2195	150/-160	70/95	-100/340	30/-45	60/-60	N/A	105	105

Medium Reported Braking Action

MAX MANUAL	1775	120/-120	55/75	-90/325	75/-60	45/-45	N/A	210	525
AUTOBRAKE MAX	1800	120/-120	55/75	-90/325	70/-55	45/-50	N/A	210	525
AUTOBRAKE 3	1915	120/-125	55/80	-95/340	50/-35	50/-50	N/A	135	445

Poor Reported Braking Action

MAX MANUAL	2305	170/-170	75/110	-135/510	180/-120	60/-65	N/A	445	1250
AUTOBRAKE MAX	2305	170/-170	75/110	-135/510	180/-120	60/-65	N/A	440	1250
AUTOBRAKE 3	2320	170/-170	75/110	-135/510	175/-105	60/-65	N/A	440	1250

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Airspeed Unreliable (Flaps 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	920	65/-50	20/25	-35/115	10/-10	20/-20	N/A	20	40
AUTOBRAKE MAX	1175	60/-60	25/35	-45/145	0/0	25/-25	N/A	0	0
AUTOBRAKE 2	2065	135/-145	65/85	-95/325	35/-40	60/-60	N/A	100	100

Good Reported Braking Action

MAX MANUAL	1265	70/-75	35/45	-55/195	30/-25	30/-30	N/A	70	165
AUTOBRAKE MAX	1350	75/-80	35/50	-60/200	25/-25	30/-30	N/A	80	180
AUTOBRAKE 2	2065	135/-145	65/85	-95/325	35/-40	60/-60	N/A	100	100

Medium Reported Braking Action

MAX MANUAL	1705	110/-115	50/70	-85/320	70/-55	45/-45	N/A	190	465
AUTOBRAKE MAX	1735	115/-115	50/70	-90/320	65/-55	45/-45	N/A	190	470
AUTOBRAKE 3	1830	115/-115	55/75	-90/330	50/-35	50/-50	N/A	125	405

Poor Reported Braking Action

MAX MANUAL	2185	160/-155	70/100	-130/500	170/-115	55/-60	N/A	390	1070
AUTOBRAKE MAX	2190	160/-160	70/100	-130/500	175/-115	55/-60	N/A	390	1070
AUTOBRAKE 3	2210	160/-160	70/100	-130/500	165/-100	55/-60	N/A	390	1075

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Airspeed Unreliable (Flaps 40)

VREF40

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	910	60/-45	20/25	-35/110	10/-10	20/-20	N/A	20	40
AUTOBRAKE MAX	1145	55/-60	25/35	-40/140	0/0	25/-25	N/A	0	0
AUTOBRAKE 2	1995	135/-140	60/85	-95/320	30/-40	55/-55	N/A	90	90

Good Reported Braking Action

MAX MANUAL	1250	70/-70	35/45	-55/195	30/-25	30/-30	N/A	70	155
AUTOBRAKE MAX	1335	75/-80	35/50	-60/200	25/-25	30/-30	N/A	75	170
AUTOBRAKE 2	1995	135/-140	60/85	-95/320	35/-40	55/-55	N/A	90	90

Medium Reported Braking Action

MAX MANUAL	1675	110/-110	50/70	-85/315	70/-60	40/-45	N/A	180	435
AUTOBRAKE MAX	1705	115/-115	50/75	-90/320	65/-55	45/-45	N/A	180	440
AUTOBRAKE 3	1785	110/-115	50/75	-90/330	50/-40	45/-50	N/A	125	390

Poor Reported Braking Action

MAX MANUAL	2140	155/-155	70/100	-130/495	170/-110	55/-60	N/A	365	975
AUTOBRAKE MAX	2145	155/-155	70/100	-130/495	170/-110	55/-60	N/A	360	975
AUTOBRAKE 3	2165	160/-155	70/100	-130/495	165/-105	55/-60	N/A	365	985

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

All Flaps Up Landing

VREF40 + 55

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1240	170/-80	30/80	-40/145	15/-15	30/-30	40	40	85
AUTOBRAKE MAX	1730	95/-80	45/60	-55/185	5/-5	45/-45	70	5	15
AUTOBRAKE 2	3090	195/-215	105/145	-120/405	70/-75	95/-95	95	275	320

Good Reported Braking Action

MAX MANUAL	1635	85/-90	45/65	-65/220	35/-30	40/-45	45	105	240
AUTOBRAKE MAX	1860	90/-95	50/70	-70/235	25/-20	50/-50	65	80	215
AUTOBRAKE 2	3090	195/-215	105/145	-120/405	70/-75	95/-95	95	275	320

Medium Reported Braking Action

MAX MANUAL	2305	145/-150	75/105	-100/360	90/-75	65/-65	60	295	735
AUTOBRAKE MAX	2380	145/-150	75/110	-105/365	85/-70	65/-65	70	300	760
AUTOBRAKE 3	2720	140/-160	85/120	-115/395	55/-50	80/-80	105	150	485

Poor Reported Braking Action

MAX MANUAL	3050	215/-215	110/155	-155/570	215/-150	85/-90	75	640	1825
AUTOBRAKE MAX	3050	215/-215	110/155	-155/570	215/-140	85/-90	85	635	1810
AUTOBRAKE 3	3165	205/-210	110/155	-155/580	190/-130	90/-95	105	555	1750

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

ANTISKID INOPERATIVE (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1570	95/-100	40/60	-75/265	45/-40	35/-40	60	125	295
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1760	115/-115	50/70	-90/325	70/-55	40/-45	65	185	460
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2250	165/-160	70/105	-135/505	170/-110	55/-60	75	400	1135
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	3015	240/-235	100/150	-220/935	1360/-260	65/-90	90	985	3725
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

ANTISKID INOPERATIVE (Flaps 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1510	90/-95	40/55	-75/260	45/-40	35/-35	60	110	265
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1685	105/-110	45/65	-85/320	65/-55	40/-40	65	165	405
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2140	150/-150	65/95	-130/495	165/-105	50/-55	75	350	970
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	2845	225/-215	90/140	-215/915	1265/-245	60/-85	85	865	3105
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

ANTISKID INOPERATIVE (Flaps 40)

VREF40

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1480	90/-90	40/55	-75/260	45/-40	35/-35	60	105	250
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1650	105/-105	45/65	-85/315	65/-55	40/-40	65	155	375
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2090	150/-145	65/95	-130/490	165/-105	50/-55	75	325	885
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	2765	215/-210	90/135	-210/905	1220/-240	60/-80	80	805	2815
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Jammed or Restricted Flight Controls (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	885	70/-50	20/25	-30/110	10/-10	20/-20	30	20	40
AUTOBRAKE MAX	1125	60/-60	25/35	-40/140	0/0	25/-25	55	0	0
AUTOBRAKE 2	2000	140/-150	60/85	-95/320	20/-30	55/-55	100	45	45

Good Reported Braking Action

MAX MANUAL	1210	70/-70	30/45	-55/190	25/-25	30/-30	45	70	155
AUTOBRAKE MAX	1280	75/-80	35/45	-55/195	25/-20	30/-30	50	75	170
AUTOBRAKE 2	2000	140/-150	60/85	-95/320	20/-30	55/-55	100	45	45

Medium Reported Braking Action

MAX MANUAL	1655	110/-110	50/70	-85/315	70/-55	40/-45	60	190	480
AUTOBRAKE MAX	1665	115/-115	50/70	-85/315	65/-50	40/-45	70	190	475
AUTOBRAKE 3	1735	115/-115	50/70	-90/325	55/-35	45/-45	90	145	440

Poor Reported Braking Action

MAX MANUAL	2155	165/-160	70/105	-130/500	175/-115	55/-60	75	415	1170
AUTOBRAKE MAX	2155	165/-160	70/105	-130/500	175/-115	55/-60	75	415	1170
AUTOBRAKE 3	2155	165/-160	70/105	-130/500	175/-110	55/-60	75	415	1170

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

LEADING EDGE FLAPS TRANSIT (Flaps 15)

VREF15 + 15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1000	80/-60	20/30	-35/120	10/-10	20/-20	35	25	55
AUTOBRAKE MAX	1290	65/-70	30/40	-45/150	0/0	30/-30	60	0	5
AUTOBRAKE 2	2345	155/-170	75/100	-105/350	30/-45	70/-65	100	95	95

Good Reported Braking Action

MAX MANUAL	1385	80/-80	35/50	-60/205	30/-30	35/-35	50	90	205
AUTOBRAKE MAX	1465	85/-85	40/55	-60/210	30/-25	35/-35	55	95	220
AUTOBRAKE 2	2345	155/-170	75/100	-105/350	30/-45	70/-65	100	95	95

Medium Reported Braking Action

MAX MANUAL	1900	125/-130	60/85	-95/335	80/-65	50/-50	65	240	610
AUTOBRAKE MAX	1915	130/-130	60/85	-95/335	75/-60	50/-50	70	240	610
AUTOBRAKE 3	2025	125/-130	60/85	-95/350	55/-35	55/-55	95	165	540

Poor Reported Braking Action

MAX MANUAL	2470	185/-180	85/120	-140/525	195/-130	65/-70	75	510	1460
AUTOBRAKE MAX	2470	185/-180	85/120	-140/525	195/-130	65/-70	75	510	1460
AUTOBRAKE 3	2475	185/-180	85/125	-140/525	195/-115	65/-70	90	505	1460

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
LOSS OF SYSTEM A (Flaps 15)
VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	965	65/-50	20/30	-35/120	15/-10	20/-20	40	25	40
AUTOBRAKE MAX	1125	60/-60	25/35	-40/140	0/0	25/-25	55	0	0
AUTOBRAKE 2	2050	135/-145	60/80	-95/325	0/-5	60/-60	125	0	0

Good Reported Braking Action

MAX MANUAL	1395	85/-85	40/55	-60/210	40/-35	35/-35	60	110	220
AUTOBRAKE MAX	1395	85/-90	40/55	-60/210	35/-25	35/-35	65	105	215
AUTOBRAKE 2	2050	135/-145	60/80	-95/325	0/-5	60/-60	125	0	0

Medium Reported Braking Action

MAX MANUAL	1920	135/-135	60/85	-95/345	95/-75	50/-50	80	295	705
AUTOBRAKE MAX	1905	135/-135	60/85	-95/345	100/-75	50/-50	80	290	695
AUTOBRAKE 3	1905	135/-135	60/85	-95/345	100/-75	50/-50	80	290	695

Poor Reported Braking Action

MAX MANUAL	2495	195/-190	85/125	-145/540	220/-145	65/-70	95	605	1765
AUTOBRAKE MAX	2490	195/-190	85/125	-145/540	225/-150	65/-70	95	605	1765
AUTOBRAKE 3	2490	195/-190	85/125	-145/540	225/-150	65/-70	95	605	1765

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

LOSS OF SYSTEM A (Flaps 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	935	60/-45	20/30	-35/115	15/-10	20/-20	45	25	35
AUTOBRAKE MAX	1070	55/-60	25/30	-40/135	0/0	25/-25	50	5	5
AUTOBRAKE 2	1930	125/-135	55/75	-95/315	0/0	55/-55	120	0	0

Good Reported Braking Action

MAX MANUAL	1350	80/-80	35/50	-60/210	40/-35	30/-35	65	100	200
AUTOBRAKE MAX	1350	80/-85	35/50	-60/210	30/-30	30/-35	65	100	195
AUTOBRAKE 2	1930	125/-135	55/75	-95/315	0/0	55/-55	120	0	0

Medium Reported Braking Action

MAX MANUAL	1830	125/-125	55/80	-95/340	90/-70	45/-50	80	260	615
AUTOBRAKE MAX	1820	125/-125	55/80	-95/340	95/-75	45/-50	80	260	610
AUTOBRAKE 3	1820	125/-125	55/80	-95/340	95/-75	45/-50	80	260	610

Poor Reported Braking Action

MAX MANUAL	2360	180/-175	80/115	-140/530	210/-135	60/-65	90	530	1475
AUTOBRAKE MAX	2355	180/-175	80/115	-140/530	215/-140	60/-65	90	530	1475
AUTOBRAKE 3	2360	180/-175	80/115	-140/530	215/-140	60/-65	90	530	1475

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

LOSS OF SYSTEM A (Flaps 40)

VREF40

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	930	60/-45	20/30	-35/115	15/-10	20/-20	45	25	35
AUTOBRAKE MAX	1045	55/-55	25/35	-40/135	5/0	25/-25	50	10	20
AUTOBRAKE 2	1860	120/-130	55/75	-90/310	0/0	50/-50	115	0	0

Good Reported Braking Action

MAX MANUAL	1330	80/-80	35/50	-60/210	40/-35	30/-30	65	95	190
AUTOBRAKE MAX	1335	80/-85	35/55	-60/210	35/-30	30/-30	70	95	185
AUTOBRAKE 2	1860	120/-130	55/75	-90/310	0/0	50/-50	115	0	0

Medium Reported Braking Action

MAX MANUAL	1790	125/-120	55/80	-95/335	90/-70	45/-45	80	240	560
AUTOBRAKE MAX	1785	125/-120	55/80	-95/335	95/-75	45/-45	80	240	560
AUTOBRAKE 3	1785	125/-120	55/80	-95/335	95/-75	45/-45	80	240	560

Poor Reported Braking Action

MAX MANUAL	2285	175/-170	75/115	-140/525	205/-135	60/-65	90	480	1305
AUTOBRAKE MAX	2290	175/-170	75/115	-140/525	210/-140	60/-65	90	480	1305
AUTOBRAKE 3	2290	175/-170	75/115	-140/525	210/-140	60/-65	90	480	1305

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

LOSS OF SYSTEM A AND SYSTEM B (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1375	75/-75	35/50	-55/190	35/-30	30/-35	70	-10	60
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1605	90/-95	40/60	-70/235	55/-45	40/-40	80	10	150
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2230	145/-145	65/95	-110/380	120/-95	55/-60	100	150	670
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	2890	215/-205	95/140	-160/585	265/-175	70/-80	115	455	1925
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

LOSS OF SYSTEM B (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1015	50/-55	25/30	-40/135	15/-15	20/-20	40	35	55
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1280	75/-75	35/45	-55/195	30/-25	30/-30	50	80	155
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	1755	120/-120	50/75	-90/325	80/-60	45/-45	65	225	510
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	2285	175/-170	75/110	-135/515	190/-125	55/-65	80	475	1290
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

MANUAL REVERSION (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1375	75/-75	35/50	-55/190	35/-30	30/-35	70	-10	60
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1605	90/-95	40/60	-70/235	55/-45	40/-40	80	10	150
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2230	145/-145	65/95	-110/380	120/-95	55/-60	100	150	670
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	2890	215/-205	95/140	-160/585	265/-175	70/-80	115	455	1925
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

One Engine Inoperative Landing (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	885	75/-55	20/30	-35/115	10/-10	20/-20	35	0	20
AUTOBRAKE MAX	1125	65/-60	30/40	-40/140	0/0	25/-25	55	0	0
AUTOBRAKE 2	2045	135/-145	65/90	-95/325	0/-10	60/-60	120	0	0

Good Reported Braking Action

MAX MANUAL	1260	75/-75	35/50	-55/200	30/-30	30/-30	50	0	85
AUTOBRAKE MAX	1340	80/-85	40/50	-60/205	30/-25	30/-30	55	0	90
AUTOBRAKE 2	2045	135/-145	65/90	-95/325	0/-10	60/-60	120	0	0

Medium Reported Braking Action

MAX MANUAL	1800	120/-125	60/80	-95/340	90/-70	45/-50	70	0	270
AUTOBRAKE MAX	1815	125/-125	60/85	-95/345	85/-65	50/-50	80	0	270
AUTOBRAKE 3	1845	125/-130	60/85	-95/345	85/-55	50/-50	85	0	275

Poor Reported Braking Action

MAX MANUAL	2470	185/-185	90/125	-150/560	245/-155	65/-70	85	0	685
AUTOBRAKE MAX	2470	185/-185	90/125	-150/560	250/-160	70/-70	85	0	685
AUTOBRAKE 3	2475	190/-190	90/125	-150/560	250/-150	70/-70	95	0	685

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

One Engine Inoperative Landing (Flaps 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	855	60/-50	20/25	-30/110	10/-10	15/-20	35	0	20
AUTOBRAKE MAX	1070	55/-60	25/35	-40/135	0/0	25/-25	50	0	0
AUTOBRAKE 2	1920	125/-130	60/85	-95/315	5/-10	55/-55	115	0	0

Good Reported Braking Action

MAX MANUAL	1215	70/-75	35/45	-55/195	30/-25	30/-30	50	0	75
AUTOBRAKE MAX	1295	75/-80	35/50	-60/205	30/-25	30/-30	60	0	85
AUTOBRAKE 2	1920	125/-130	60/85	-95/315	5/-10	55/-55	115	0	0

Medium Reported Braking Action

MAX MANUAL	1710	115/-115	55/75	-90/335	90/-70	45/-45	65	0	235
AUTOBRAKE MAX	1730	115/-120	55/75	-95/335	80/-60	45/-45	75	0	235
AUTOBRAKE 3	1755	115/-120	55/80	-95/335	85/-55	45/-45	85	0	245

Poor Reported Braking Action

MAX MANUAL	2315	170/-170	80/115	-145/545	230/-145	65/-65	80	0	575
AUTOBRAKE MAX	2315	170/-170	80/115	-145/545	235/-150	65/-65	85	0	575
AUTOBRAKE 3	2330	175/-175	80/115	-145/545	230/-140	65/-65	90	0	580

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Stabilizer Trim Inoperative (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	885	70/-50	20/25	-30/110	10/-10	20/-20	30	20	40
AUTOBRAKE MAX	1125	60/-60	25/35	-40/140	0/0	25/-25	55	0	0
AUTOBRAKE 2	2000	140/-150	60/85	-95/320	20/-30	55/-55	100	45	45

Good Reported Braking Action

MAX MANUAL	1210	70/-70	30/45	-55/190	25/-25	30/-30	45	70	155
AUTOBRAKE MAX	1280	75/-80	35/45	-55/195	25/-20	30/-30	50	75	170
AUTOBRAKE 2	2000	140/-150	60/85	-95/320	20/-30	55/-55	100	45	45

Medium Reported Braking Action

MAX MANUAL	1655	110/-110	50/70	-85/315	70/-55	40/-45	60	190	480
AUTOBRAKE MAX	1665	115/-115	50/70	-85/315	65/-50	40/-45	70	190	475
AUTOBRAKE 3	1735	115/-115	50/70	-90/325	55/-35	45/-45	90	145	440

Poor Reported Braking Action

MAX MANUAL	2155	165/-160	70/105	-130/500	175/-115	55/-60	75	415	1170
AUTOBRAKE MAX	2155	165/-160	70/105	-130/500	175/-115	55/-60	75	415	1170
AUTOBRAKE 3	2155	165/-160	70/105	-130/500	175/-110	55/-60	75	415	1170

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Asymmetry (1 ≤ Flap Lever <15)

VREF40 + 30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1020	95/-65	25/35	-35/125	10/-10	25/-25	35	25	55
AUTOBRAKE MAX	1400	70/-70	35/50	-50/160	5/-5	35/-35	65	0	5
AUTOBRAKE 2	2495	160/-175	90/125	-110/360	45/-55	75/-70	95	155	160

Good Reported Braking Action

MAX MANUAL	1410	75/-80	40/60	-60/205	30/-25	35/-35	45	85	195
AUTOBRAKE MAX	1540	80/-85	45/65	-60/215	25/-20	40/-40	60	90	215
AUTOBRAKE 2	2500	160/-175	90/125	-110/360	45/-55	75/-70	95	155	160

Medium Reported Braking Action

MAX MANUAL	1955	125/-125	65/95	-95/335	80/-65	50/-55	60	235	590
AUTOBRAKE MAX	2000	125/-130	70/100	-95/340	75/-60	50/-55	70	240	600
AUTOBRAKE 3	2180	125/-130	70/105	-100/360	50/-35	60/-60	100	135	450

Poor Reported Braking Action

MAX MANUAL	2555	185/-185	95/140	-140/530	195/-130	70/-75	75	505	1425
AUTOBRAKE MAX	2555	185/-180	95/140	-140/530	195/-130	70/-75	75	500	1420
AUTOBRAKE 3	2595	180/-180	95/140	-140/535	180/-110	70/-75	95	485	1410

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Asymmetry (Flap Lever 15 or 25)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	875	70/-50	20/30	-30/110	10/-10	20/-20	30	20	40
AUTOBRAKE MAX	1125	60/-60	30/40	-40/140	0/0	25/-25	55	0	0
AUTOBRAKE 2	2000	140/-150	70/90	-95/320	20/-30	55/-55	100	45	45

Good Reported Braking Action

MAX MANUAL	1210	70/-70	35/50	-55/190	25/-25	30/-30	45	70	155
AUTOBRAKE MAX	1280	75/-80	35/50	-55/195	25/-20	30/-30	50	75	170
AUTOBRAKE 2	2000	140/-150	70/90	-95/320	20/-30	55/-55	100	45	45

Medium Reported Braking Action

MAX MANUAL	1655	110/-110	55/75	-85/315	70/-55	40/-45	60	190	480
AUTOBRAKE MAX	1665	115/-115	55/80	-85/315	65/-50	40/-45	70	190	475
AUTOBRAKE 3	1735	115/-115	55/80	-90/325	55/-35	45/-45	90	145	440

Poor Reported Braking Action

MAX MANUAL	2155	165/-160	80/115	-130/500	175/-115	55/-60	75	415	1170
AUTOBRAKE MAX	2155	165/-160	80/115	-130/500	175/-115	55/-60	75	415	1170
AUTOBRAKE 3	2155	165/-160	80/115	-130/500	175/-110	55/-60	75	415	1170

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Asymmetry (Flap Lever 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	845	60/-45	20/25	-30/110	10/-10	15/-15	30	15	35
AUTOBRAKE MAX	1070	55/-60	25/35	-40/135	0/0	25/-25	50	0	0
AUTOBRAKE 2	1885	125/-135	60/85	-90/310	20/-30	50/-50	90	45	45

Good Reported Braking Action

MAX MANUAL	1175	65/-70	30/45	-55/185	25/-25	25/-25	45	65	145
AUTOBRAKE MAX	1240	70/-75	35/50	-55/195	25/-20	30/-30	55	70	155
AUTOBRAKE 2	1885	125/-135	60/85	-90/310	20/-30	50/-50	90	45	45

Medium Reported Braking Action

MAX MANUAL	1585	105/-105	50/70	-85/310	70/-55	40/-40	60	170	425
AUTOBRAKE MAX	1600	110/-110	50/75	-85/310	65/-50	40/-40	65	170	420
AUTOBRAKE 3	1655	105/-110	50/75	-85/315	55/-35	40/-45	85	135	400

Poor Reported Braking Action

MAX MANUAL	2045	150/-150	70/105	-125/485	165/-110	50/-55	70	365	1000
AUTOBRAKE MAX	2050	150/-150	70/105	-125/485	170/-110	50/-55	70	365	1000
AUTOBRAKE 3	2050	155/-150	75/105	-125/485	170/-100	50/-55	80	365	1005

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Disagree (1 ≤ Indicated Flaps <15)

VREF40 + 30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1020	95/-65	25/35	-35/125	10/-10	25/-25	35	25	55
AUTOBRAKE MAX	1400	70/-70	35/50	-50/160	5/-5	35/-35	65	0	5
AUTOBRAKE 2	2495	160/-175	90/125	-110/360	45/-55	75/-70	95	155	160

Good Reported Braking Action

MAX MANUAL	1410	75/-80	40/60	-60/205	30/-25	35/-35	45	85	195
AUTOBRAKE MAX	1540	80/-85	45/65	-60/215	25/-20	40/-40	60	90	215
AUTOBRAKE 2	2500	160/-175	90/125	-110/360	45/-55	75/-70	95	155	160

Medium Reported Braking Action

MAX MANUAL	1955	125/-125	65/95	-95/335	80/-65	50/-55	60	235	590
AUTOBRAKE MAX	2000	125/-130	70/100	-95/340	75/-60	50/-55	70	240	600
AUTOBRAKE 3	2180	125/-130	70/105	-100/360	50/-35	60/-60	100	135	450

Poor Reported Braking Action

MAX MANUAL	2555	185/-185	95/140	-140/530	195/-130	70/-75	75	505	1425
AUTOBRAKE MAX	2555	185/-180	95/140	-140/530	195/-130	70/-75	75	500	1420
AUTOBRAKE 3	2595	180/-180	95/140	-140/535	180/-110	70/-75	95	485	1410

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Disagree (15 ≤ Indicated Flaps <30)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	875	70/-50	20/30	-30/110	10/-10	20/-20	30	20	40
AUTOBRAKE MAX	1125	60/-60	30/40	-40/140	0/0	25/-25	55	0	0
AUTOBRAKE 2	2000	140/-150	70/90	-95/320	20/-30	55/-55	100	45	45

Good Reported Braking Action

MAX MANUAL	1210	70/-70	35/50	-55/190	25/-25	30/-30	45	70	155
AUTOBRAKE MAX	1280	75/-80	35/50	-55/195	25/-20	30/-30	50	75	170
AUTOBRAKE 2	2000	140/-150	70/90	-95/320	20/-30	55/-55	100	45	45

Medium Reported Braking Action

MAX MANUAL	1655	110/-110	55/75	-85/315	70/-55	40/-45	60	190	480
AUTOBRAKE MAX	1665	115/-115	55/80	-85/315	65/-50	40/-45	70	190	475
AUTOBRAKE 3	1735	115/-115	55/80	-90/325	55/-35	45/-45	90	145	440

Poor Reported Braking Action

MAX MANUAL	2155	165/-160	80/115	-130/500	175/-115	55/-60	75	415	1170
AUTOBRAKE MAX	2155	165/-160	80/115	-130/500	175/-115	55/-60	75	415	1170
AUTOBRAKE 3	2155	165/-160	80/115	-130/500	175/-110	55/-60	75	415	1170

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Disagree (30 ≤ Indicated Flaps <40)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	845	60/-45	20/25	-30/110	10/-10	15/-15	30	15	35
AUTOBRAKE MAX	1070	55/-60	25/35	-40/135	0/0	25/-25	50	0	0
AUTOBRAKE 2	1885	125/-135	60/85	-90/310	20/-30	50/-50	90	45	45

Good Reported Braking Action

MAX MANUAL	1175	65/-70	30/45	-55/185	25/-25	25/-25	45	65	145
AUTOBRAKE MAX	1240	70/-75	35/50	-55/195	25/-20	30/-30	55	70	155
AUTOBRAKE 2	1885	125/-135	60/85	-90/310	20/-30	50/-50	90	45	45

Medium Reported Braking Action

MAX MANUAL	1585	105/-105	50/70	-85/310	70/-55	40/-40	60	170	425
AUTOBRAKE MAX	1600	110/-110	50/75	-85/310	65/-50	40/-40	65	170	420
AUTOBRAKE 3	1655	105/-110	50/75	-85/315	55/-35	40/-45	85	135	400

Poor Reported Braking Action

MAX MANUAL	2045	150/-150	70/105	-125/485	165/-110	50/-55	70	365	1000
AUTOBRAKE MAX	2050	150/-150	70/105	-125/485	170/-110	50/-55	70	365	1000
AUTOBRAKE 3	2050	155/-150	75/105	-125/485	170/-100	50/-55	80	365	1005

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flaps Up Landing

VREF40 + 40

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1085	115/-65	30/45	-40/130	10/-10	25/-25	40	30	60
AUTOBRAKE MAX	1530	80/-75	40/55	-50/170	5/-5	40/-40	65	0	5
AUTOBRAKE 2	2695	175/-190	100/135	-110/375	60/-65	80/-80	90	215	250

Good Reported Braking Action

MAX MANUAL	1480	80/-85	45/60	-60/205	30/-30	35/-35	45	90	200
AUTOBRAKE MAX	1655	80/-85	50/70	-65/220	25/-20	40/-40	65	75	195
AUTOBRAKE 2	2695	175/-190	100/135	-110/375	60/-65	80/-80	90	215	250

Medium Reported Braking Action

MAX MANUAL	2055	130/-135	70/100	-95/345	80/-65	55/-55	60	245	615
AUTOBRAKE MAX	2125	130/-135	75/105	-100/350	75/-60	55/-60	65	255	630
AUTOBRAKE 3	2385	130/-145	80/110	-105/375	50/-45	65/-70	100	130	420

Poor Reported Braking Action

MAX MANUAL	2700	190/-190	105/150	-145/540	195/-135	75/-80	75	530	1490
AUTOBRAKE MAX	2705	190/-190	105/150	-145/540	195/-125	75/-80	80	525	1480
AUTOBRAKE 3	2790	185/-190	105/150	-145/550	175/-115	75/-80	100	475	1445

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Recommended Brake Cooling Schedule

Reference Brake Energy Per Brake (Millions of Foot Pounds)

		WIND CORRECTED BRAKES ON SPEED (KIAS)*																	
		80			100			120			140			160			180		
WEIGHT (1000 KG)	OAT (°C)	PRESSURE ALTITUDE (1000 FT)																	
		0	5	10	0	5	10	0	5	10	0	5	10	0	5	10	0	5	10
80	0	15.3	17.2	19.4	22.9	25.8	29.3	31.7	35.8	40.9	41.5	47.1	54.2	52.2	59.6	69.0	62.4	71.4	83.3
	10	15.8	17.7	20.0	23.6	26.6	30.2	32.7	37.0	42.2	42.8	48.7	55.9	53.9	61.5	71.2	64.4	73.7	86.0
	15	16.0	18.0	20.3	24.0	27.1	30.7	33.2	37.6	42.9	43.5	49.4	56.8	54.7	62.4	72.3	65.3	74.8	87.3
	20	16.3	18.3	20.6	24.4	27.5	31.1	33.7	38.1	43.5	44.1	50.1	57.6	55.6	63.4	73.4	66.3	75.9	88.6
	30	16.7	18.8	21.2	25.0	28.2	32.0	34.6	39.2	44.7	45.4	51.5	59.3	57.1	65.1	75.4	68.2	78.0	91.0
	40	16.8	18.9	21.3	25.2	28.5	32.3	35.0	39.6	45.3	46.0	52.3	60.2	58.0	66.3	77.0	69.5	79.7	93.3
	50	16.8	19.0	21.4	25.3	28.6	32.5	35.2	40.0	45.8	46.4	52.9	61.1	58.8	67.4	78.5	70.7	81.3	95.6
70	0	13.9	15.6	17.6	20.6	23.3	26.3	28.4	32.1	36.5	37.1	42.1	48.2	46.6	53.0	61.2	56.4	64.4	74.8
	10	14.4	16.2	18.2	21.3	24.0	27.2	29.3	33.1	37.7	38.3	43.4	49.7	48.1	54.7	63.1	58.2	66.5	77.2
	15	14.6	16.4	18.5	21.6	24.4	27.6	29.8	33.6	38.3	38.9	44.1	50.5	48.8	55.6	64.1	59.1	67.5	78.4
	20	14.8	16.7	18.8	22.0	24.8	28.0	30.2	34.2	38.9	39.5	44.7	51.3	49.5	56.4	65.1	60.0	68.5	79.6
	30	15.2	17.1	19.3	22.6	25.5	28.8	31.1	35.1	40.0	40.6	46.0	52.7	50.9	58.0	66.9	61.6	70.4	81.8
	40	15.3	17.2	19.4	22.7	25.6	29.1	31.3	35.5	40.4	41.0	46.6	53.5	51.7	58.9	68.1	62.7	71.8	83.6
	50	15.3	17.2	19.4	22.8	25.8	29.2	31.5	35.7	40.8	41.4	47.1	54.2	52.3	59.7	69.3	63.7	73.1	85.4
60	0	12.6	14.1	15.9	18.4	20.7	23.4	25.1	28.3	32.2	32.5	36.9	42.1	40.7	46.3	53.1	49.6	56.5	65.3
	10	13.0	14.6	16.4	19.0	21.4	24.2	25.9	29.2	33.2	33.6	38.0	43.4	42.0	47.7	54.9	51.2	58.3	67.4
	15	13.2	14.8	16.6	19.3	21.7	24.6	26.3	29.7	33.7	34.1	38.6	44.1	42.7	48.5	55.7	51.9	59.2	68.4
	20	13.4	15.0	16.9	19.6	22.1	24.9	26.7	30.1	34.2	34.6	39.2	44.8	43.3	49.2	56.5	52.7	60.1	69.5
	30	13.7	15.4	17.4	20.1	22.7	25.6	27.4	31.0	35.2	35.6	40.3	46.0	44.5	50.6	58.1	54.2	61.7	71.4
	40	13.8	15.5	17.5	20.3	22.8	25.8	27.7	31.3	35.6	36.0	40.8	46.6	45.1	51.3	59.0	55.0	62.8	72.8
	50	13.8	15.5	17.5	20.3	22.9	25.9	27.8	31.5	35.8	36.2	41.1	47.1	45.6	51.9	59.9	55.7	63.8	74.2
50	0	11.2	12.6	14.1	16.2	18.2	20.5	21.8	24.6	27.9	28.0	31.7	36.1	34.8	39.5	45.1	42.1	47.9	55.1
	10	11.6	13.0	14.6	16.7	18.8	21.2	22.5	25.4	28.8	28.9	32.7	37.2	35.9	40.7	46.6	43.5	49.4	56.8
	15	11.7	13.2	14.8	16.9	19.1	21.5	22.8	25.8	29.2	29.4	33.2	37.8	36.5	41.4	47.3	44.2	50.2	57.7
	20	11.9	13.4	15.1	17.2	19.4	21.9	23.2	26.2	29.6	29.8	33.7	38.4	37.0	42.0	48.0	44.8	50.9	58.6
	30	12.3	13.8	15.5	17.7	19.9	22.5	23.8	26.9	30.5	30.7	34.7	39.4	38.1	43.2	49.4	46.1	52.4	60.2
	40	12.3	13.8	15.6	17.8	20.0	22.6	24.0	27.1	30.7	30.9	35.0	39.9	38.5	43.7	50.0	46.7	53.1	61.2
	50	12.3	13.8	15.6	17.8	20.1	22.7	24.1	27.2	30.9	31.1	35.2	40.2	38.8	44.1	50.6	47.2	53.8	62.1
40	0	9.9	11.1	12.5	14.0	15.7	17.7	18.5	20.8	23.5	23.5	26.5	30.1	28.9	32.7	37.3	34.8	39.4	45.1
	10	10.2	11.5	12.9	14.4	16.2	18.2	19.1	21.5	24.3	24.3	27.4	31.1	29.9	33.8	38.5	35.9	40.7	46.5
	15	10.4	11.7	13.1	14.6	16.5	18.5	19.4	21.8	24.7	24.6	27.8	31.5	30.3	34.3	39.1	36.4	41.3	47.2
	20	10.6	11.9	13.3	14.9	16.7	18.8	19.7	22.2	25.1	25.0	28.2	32.0	30.8	34.8	39.7	37.0	41.9	47.9
	30	10.9	12.2	13.7	15.3	17.2	19.3	20.2	22.8	25.8	25.7	29.0	32.9	31.7	35.8	40.8	38.0	43.1	49.3
	40	10.9	12.2	13.7	15.3	17.3	19.5	20.4	22.9	26.0	25.9	29.3	33.2	31.9	36.2	41.2	38.4	43.6	50.0
	50	10.9	12.2	13.8	15.4	17.3	19.5	20.4	23.0	26.1	26.0	29.4	33.4	32.1	36.4	41.6	38.7	44.0	50.5

***To correct for wind, enter table with the brakes on speed minus one half the headwind or plus 1.5 times the tailwind. If ground speed is used for brakes on speed, ignore wind and enter table with sea level, 15°C.**

Adjusted Brake Energy Per Brake (Millions of Foot Pounds)
No Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)								
EVENT		10	20	30	40	50	60	70	80	90
RTO MAX MAN		10	20	30	40	50	60	70	80	90
LANDING	MAX MAN	7.5	15.8	24.6	33.8	43.5	53.5	63.6	73.9	84.2
	MAX AUTO	7.3	15.0	23.2	31.9	41.2	51.0	61.3	72.2	83.7
	AUTOBRAKE 3	7.0	14.2	21.8	29.7	38.1	47.1	56.7	67.1	78.3
	AUTOBRAKE 2	6.6	13.3	20.2	27.3	34.7	42.6	51.0	59.9	69.6
	AUTOBRAKE 1	6.3	12.4	18.6	24.9	31.6	38.6	46.2	54.4	63.5

ADVISORY INFORMATION

Recommended Brake Cooling Schedule

Adjusted Brake Energy Per Brake (Millions of Foot Pounds)

Two Engine Detent Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)								
EVENT		10	20	30	40	50	60	70	80	90
RTO MAX MAN		10	20	30	40	50	60	70	80	90
LANDING	MAX MAN	6.9	14.5	22.7	31.4	40.4	49.7	59.3	68.9	78.5
	MAX AUTO	6.0	12.6	19.8	27.6	36.0	45.1	54.8	65.3	76.5
	AUTOBRAKE 3	4.5	9.5	15.1	21.3	28.1	35.6	43.7	52.5	62.0
	AUTOBRAKE 2	2.6	5.9	9.7	14.1	19.1	24.7	31.0	37.9	45.4
	AUTOBRAKE 1	1.8	3.8	6.3	9.1	12.5	16.4	21.0	26.3	32.5

Cooling Time (Minutes) - Category A Steel and Carbon Brakes

	EVENT ADJUSTED BRAKE ENERGY (MILLIONS OF FOOT POUNDS)								
	16 & BELOW	17	19	20.9	23.5	26.9	29.4	30 TO 41	41 & ABOVE
	BRAKE TEMPERATURE MONITOR SYSTEM INDICATION ON CDS								
	UP TO 2.5	2.6	3	3.3	3.8	4.5	4.9	5.0 TO 7.1	7.1 & ABOVE
INFLIGHT GEAR DOWN	NO SPECIAL PROCEDURE REQUIRED	1	4	5	6	7	7.6	CAUTION	FUSE PLUG MELT ZONE
GROUND		6.7	16.0	24.1	34.2	45.9	53.3		

Observe maximum quick turnaround limit.
Table shows energy per brake added by a single stop with all brakes operating. Energy is assumed to be equally distributed among the operating brakes. Total energy is the sum of residual energy plus energy added.
Add 1.0 million foot pounds per brake for each taxi mile.

When in caution zone, wheel fuse plugs may melt. Delay takeoff and inspect after one hour. If overheat occurs after takeoff, extend gear soon for at least 7 minutes.

When in fuse plug melt zone, clear runway immediately. Unless required, do not set parking brake. Do not approach gear or attempt to taxi for one hour. Tire, wheel and brake replacement may be required. If overheat occurs after takeoff, extend gear soon for at least 12 minutes.

Brake temperature monitor system (BTMS) indication on CDS systems page may be used 10 to 15 minutes after airplane has come to a complete stop or inflight with gear retracted to determine recommended cooling schedule.

Performance Inflight — Chapter PI

Engine Inoperative — Section 13

ENGINE INOP

Initial Max Continuous %N1

Based on .79M, A/C high and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT)								
	25	27	29	31	33	35	37	39	41
20	96.0	95.8	95.6	95.4	95.1	94.7	94.2	93.9	93.1
15	96.6	96.4	96.1	96.0	95.9	95.4	95.0	94.7	94.0
10	97.2	97.1	96.7	96.6	96.6	96.2	95.7	95.5	94.9
5	97.4	97.8	97.5	97.3	97.3	96.9	96.5	96.3	95.8
0	96.7	98.0	98.4	98.2	98.1	97.7	97.4	97.1	96.7
-5	95.9	97.2	98.4	99.1	99.0	98.5	98.2	98.0	97.7
-10	95.1	96.4	97.6	98.9	99.8	99.4	99.1	98.9	98.6
-15	94.3	95.7	96.9	98.1	99.4	100.3	100.0	99.8	99.6
-20	93.5	94.9	96.1	97.3	98.6	99.8	100.3	100.1	99.9
-25	92.7	94.1	95.3	96.5	97.8	98.9	99.5	99.3	99.1
-30	91.8	93.3	94.5	95.7	96.9	98.1	98.6	98.4	98.2
-35	91.0	92.5	93.6	94.8	96.1	97.2	97.8	97.6	97.4
-40	90.1	91.7	92.8	94.0	95.3	96.4	96.9	96.7	96.5

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)								
	25	27	29	31	33	35	37	39	41
ENGINE ANTI-ICE	-1.2	-1.1	-1.0	-0.9	-0.8	-0.8	-0.8	-0.8	-0.8
ENGINE & WING ANTI-ICE	-4.2	-4.4	-4.5	-4.7	-5.0	-4.8	-4.8	-4.8	-4.8

ENGINE INOP

Max Continuous %N1

37000 FT to 29000 FT Pressure Altitudes

37000 FT PRESS ALT		TAT (°C)											
KIAS	M	-55	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0
160	.51	96.0	96.9	97.8	98.7	99.5	98.9	98.0	96.8	95.5	93.9	92.4	91.1
200	.63	95.3	96.2	97.1	98.0	98.8	99.7	99.4	98.6	97.7	96.7	95.5	94.4
240	.74	94.4	95.3	96.1	97.0	97.9	98.7	99.6	100.0	99.2	98.4	97.6	96.6
280	.86	93.6	94.5	95.4	96.3	97.1	98.0	98.8	99.6	100.4	100.1	99.2	98.4

35000 FT PRESS ALT		TAT (°C)											
KIAS	M	-55	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0
160	.49	95.8	96.7	97.6	98.5	99.4	99.1	98.3	97.2	96.0	94.6	93.2	92.0
200	.60	95.4	96.4	97.2	98.1	99.0	99.9	99.8	98.8	97.9	96.9	95.7	94.6
240	.71	94.3	95.2	96.1	97.0	97.9	98.7	99.6	100.1	99.4	98.8	97.9	96.9
280	.82	93.1	94.0	94.8	95.7	96.5	97.4	98.2	99.0	99.8	99.6	98.8	98.0

33000 FT PRESS ALT		TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
160	.47	96.7	97.6	98.4	99.3	100.1	99.3	98.4	97.2	95.9	94.5	93.1	91.9
200	.58	96.3	97.2	98.1	99.0	99.8	100.7	99.8	98.9	97.9	96.7	95.5	94.4
240	.68	95.2	96.1	97.0	97.8	98.7	99.5	100.4	100.1	99.5	98.6	97.6	96.6
280	.79	93.6	94.4	95.3	96.1	97.0	97.8	98.6	99.4	99.8	99.0	98.1	97.3
320	.89	92.9	93.8	94.7	95.5	96.3	97.2	98.0	98.8	99.6	100.3	100.0	99.1

31000 FT PRESS ALT		TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
160	.45	96.7	97.5	98.4	99.3	100.2	100.3	99.5	98.4	97.2	95.8	94.4	93.1
200	.55	96.4	97.3	98.1	99.0	99.9	100.7	100.9	100.0	99.0	97.9	96.6	95.4
240	.66	94.9	95.8	96.7	97.5	98.4	99.2	100.1	100.6	99.8	99.0	98.0	97.0
280	.76	93.1	94.0	94.8	95.6	96.5	97.3	98.1	98.9	99.7	99.0	98.1	97.2
320	.85	91.7	92.5	93.4	94.2	95.0	95.8	96.6	97.4	98.2	99.0	99.2	98.3

29000 FT PRESS ALT		TAT (°C)											
KIAS	M	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
160	.43	97.4	98.3	99.2	100.0	100.9	100.5	99.5	98.4	97.1	95.6	94.3	93.0
200	.53	96.8	97.7	98.6	99.4	100.3	101.1	100.6	99.6	98.6	97.4	96.2	95.0
240	.63	95.6	96.4	97.3	98.1	99.0	99.8	100.6	100.3	99.4	98.5	97.4	96.5
280	.73	93.5	94.3	95.2	96.0	96.8	97.6	98.4	99.2	99.3	98.4	97.4	96.7
320	.82	91.3	92.2	93.0	93.8	94.6	95.4	96.2	97.0	97.7	98.5	97.7	96.9
360	.91	91.3	92.2	93.0	93.8	94.6	95.4	96.2	97.0	97.7	98.5	99.2	99.3

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)				
	29	31	33	35	37
ENGINE ANTI-ICE ON	-0.9	-0.9	-0.8	-0.8	-0.8
ENGINE & WING ANTI-ICE ON	-4.1	-4.3	-4.5	-4.7	-4.7

ENGINE INOP

Max Continuous %N1
27000 FT to 20000 FT Pressure Altitudes

27000 FT PRESS ALT		TAT (°C)											
KIAS	M	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
160	.41	97.3	98.1	99.0	99.9	100.7	101.5	100.5	99.5	98.3	96.9	95.6	94.3
200	.51	96.2	97.1	98.0	98.8	99.7	100.5	101.0	100.1	99.1	98.0	96.8	95.6
240	.60	94.9	95.8	96.7	97.5	98.3	99.2	100.0	100.6	99.6	98.6	97.6	96.7
280	.70	92.9	93.7	94.6	95.4	96.2	97.0	97.8	98.6	99.4	98.6	97.6	96.8
320	.79	90.8	91.6	92.5	93.3	94.1	94.9	95.6	96.4	97.2	97.9	97.8	97.1
360	.88	90.0	90.9	91.7	92.5	93.4	94.2	95.0	95.7	96.5	97.3	98.0	98.6

25000 FT PRESS ALT		TAT (°C)											
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
160	.39	98.1	98.9	99.8	100.7	101.5	101.6	100.6	99.5	98.3	96.9	95.7	94.4
200	.49	96.7	97.6	98.5	99.3	100.1	100.9	100.8	99.8	98.8	97.6	96.5	95.4
240	.58	95.0	95.8	96.7	97.5	98.3	99.1	99.9	99.7	98.8	97.8	96.8	95.9
280	.67	93.1	94.0	94.8	95.6	96.4	97.2	98.0	98.7	98.8	97.8	96.8	96.1
320	.76	90.8	91.7	92.5	93.3	94.1	94.9	95.7	96.5	97.2	97.8	97.1	96.4
360	.85	89.5	90.3	91.2	92.0	92.9	93.7	94.5	95.3	96.1	96.9	97.6	97.4

24000 FT PRESS ALT		TAT (°C)											
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
160	.38	97.3	98.2	99.1	99.9	100.7	101.5	100.4	99.3	98.1	96.8	95.6	94.4
200	.48	96.1	96.9	97.8	98.6	99.4	100.2	100.6	99.6	98.6	97.4	96.3	95.3
240	.57	94.5	95.3	96.1	96.9	97.8	98.6	99.3	99.7	98.7	97.6	96.7	95.8
280	.66	92.7	93.5	94.3	95.1	95.9	96.7	97.5	98.3	98.8	97.7	96.7	96.0
320	.75	90.2	91.1	91.9	92.7	93.5	94.4	95.2	95.9	96.7	97.5	96.9	96.2
360	.83	88.7	89.6	90.4	91.2	92.1	92.9	93.7	94.5	95.3	96.1	96.9	96.9

22000 FT PRESS ALT		TAT (°C)											
KIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
160	.37	96.7	97.6	98.4	99.2	100.1	100.2	99.0	97.8	96.6	95.5	94.4	93.3
200	.46	95.5	96.4	97.2	98.0	98.8	99.6	99.3	98.1	97.0	96.0	95.0	94.0
240	.55	94.1	94.9	95.8	96.5	97.3	98.1	98.9	98.5	97.3	96.4	95.5	94.7
280	.63	92.5	93.3	94.1	94.9	95.7	96.4	97.2	97.9	97.6	96.7	95.8	95.1
320	.72	90.1	91.0	91.8	92.7	93.5	94.3	95.1	95.9	96.7	96.8	96.0	95.3
360	.80	88.4	89.2	90.1	90.9	91.7	92.6	93.4	94.2	95.0	95.8	96.3	95.8

20000 FT PRESS ALT		TAT (°C)											
KIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
160	.35	95.3	96.1	97.0	97.8	98.6	99.4	98.8	97.4	96.2	95.2	94.2	93.2
200	.44	94.2	95.0	95.8	96.6	97.4	98.2	98.9	97.8	96.4	95.5	94.6	93.7
240	.53	92.8	93.6	94.4	95.2	96.0	96.8	97.5	98.2	97.0	95.9	95.1	94.3
280	.61	91.1	92.0	92.8	93.6	94.4	95.2	96.0	96.8	97.4	96.5	95.6	94.9
320	.69	89.1	90.0	90.8	91.6	92.5	93.3	94.1	94.9	95.7	96.5	95.8	95.1
360	.77	87.4	88.3	89.1	90.0	90.8	91.6	92.4	93.2	94.0	94.8	95.6	95.4

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)				
	20	22	24	25	27
ENGINE ANTI-ICE ON	-0.9	-0.9	-1.0	-1.0	-1.0
ENGINE & WING ANTI-ICE ON	-3.6	-3.8	-3.8	-3.9	-4.0

ENGINE INOP

Max Continuous %N1
18000 FT to 12000 FT Pressure Altitudes

18000 FT PRESS ALT		TAT (°C)											
KIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
160	.34	94.5	95.3	96.1	96.9	97.7	98.4	97.3	95.9	94.9	94.0	93.0	92.1
200	.42	93.4	94.2	95.0	95.8	96.6	97.3	97.6	96.3	95.2	94.4	93.5	92.6
240	.51	91.9	92.7	93.5	94.3	95.1	95.9	96.7	96.7	95.6	94.7	94.0	93.2
280	.59	90.4	91.3	92.1	92.9	93.8	94.6	95.4	96.1	96.1	95.2	94.4	93.7
320	.67	88.9	89.7	90.5	91.4	92.2	93.0	93.8	94.6	95.4	95.5	94.8	94.1
360	.75	87.3	88.2	89.0	89.8	90.7	91.5	92.3	93.1	93.9	94.7	95.1	94.5

16000 FT PRESS ALT		TAT (°C)											
KIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
160	.33	93.0	93.8	94.6	95.4	96.1	96.9	97.2	96.0	94.8	94.0	93.1	92.2
200	.41	91.6	92.4	93.2	94.0	94.8	95.6	96.4	96.1	95.0	94.1	93.3	92.5
240	.49	90.3	91.1	92.0	92.8	93.6	94.4	95.2	96.0	95.4	94.5	93.7	92.9
280	.57	89.0	89.9	90.7	91.5	92.4	93.2	94.0	94.8	95.6	94.9	94.1	93.4
320	.64	87.8	88.6	89.5	90.3	91.1	91.9	92.7	93.5	94.3	95.1	94.5	93.8
360	.72	86.5	87.3	88.2	89.0	89.8	90.6	91.4	92.2	93.0	93.8	94.6	94.2

14000 FT PRESS ALT		TAT (°C)											
KIAS	M	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
160	.31	92.4	93.2	94.1	94.9	95.7	96.4	96.4	95.5	94.6	93.8	92.9	92.0
200	.39	91.0	91.9	92.7	93.5	94.3	95.1	95.9	95.1	94.2	93.4	92.6	91.8
240	.47	90.0	90.9	91.7	92.5	93.3	94.1	94.9	95.4	94.6	93.7	93.0	92.3
280	.54	88.9	89.8	90.6	91.4	92.3	93.1	93.9	94.7	94.9	94.1	93.4	92.7
320	.62	87.8	88.7	89.5	90.3	91.2	92.0	92.8	93.5	94.3	94.5	93.8	93.1
360	.69	86.7	87.5	88.3	89.1	90.0	90.8	91.5	92.3	93.1	93.9	94.2	93.6

12000 FT PRESS ALT		TAT (°C)											
KIAS	M	-20	-15	-10	-5	0	5	10	15	20	25	30	35
160	.30	91.8	92.6	93.4	94.2	95.0	95.8	95.5	94.8	94.0	93.2	92.4	91.5
200	.38	90.7	91.5	92.3	93.1	93.9	94.7	95.2	94.3	93.5	92.7	92.0	91.2
240	.45	89.8	90.7	91.5	92.3	93.1	93.9	94.7	94.7	93.8	93.1	92.4	91.6
280	.52	88.9	89.8	90.6	91.4	92.2	93.0	93.8	94.6	94.2	93.5	92.8	92.1
320	.60	87.9	88.8	89.6	90.4	91.2	92.0	92.8	93.6	94.3	93.9	93.2	92.5
360	.67	86.8	87.7	88.5	89.3	90.1	90.9	91.6	92.4	93.2	93.9	93.5	92.9

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)			
	12	14	16	18
ENGINE ANTI-ICE ON	-0.9	-0.9	-0.9	-0.9
ENGINE & WING ANTI-ICE ON	-3.2	-3.4	-3.4	-3.5

ENGINE INOP

Max Continuous %N1
10000 FT to 1000 FT Pressure Altitudes

10000 FT PRESS ALT		TAT (°C)											
KIAS	M	-20	-15	-10	-5	0	5	10	15	20	25	30	35
160	.29	90.5	91.4	92.2	93.0	93.8	94.6	95.4	94.7	94.1	93.3	92.5	91.7
200	.36	89.6	90.4	91.3	92.1	92.9	93.7	94.5	94.5	93.7	92.9	92.2	91.4
240	.43	88.9	89.7	90.6	91.4	92.2	93.0	93.8	94.5	94.0	93.1	92.4	91.7
280	.51	88.1	89.0	89.8	90.6	91.4	92.2	93.0	93.8	94.4	93.6	92.8	92.2
320	.58	87.2	88.0	88.8	89.6	90.4	91.2	92.0	92.8	93.5	93.9	93.2	92.5
360	.65	86.2	87.0	87.8	88.6	89.4	90.2	91.0	91.7	92.5	93.2	93.6	92.9

5000 FT PRESS ALT		TAT (°C)											
KIAS	M	-10	-5	0	5	10	15	20	25	30	35	40	45
160	.26	89.1	89.9	90.7	91.5	92.3	93.1	93.7	93.5	93.2	92.5	91.8	91.0
200	.33	88.7	89.5	90.3	91.1	91.8	92.6	93.4	93.3	92.9	92.3	91.6	90.8
240	.40	88.1	88.9	89.7	90.5	91.3	92.0	92.8	93.3	92.5	91.8	91.1	90.3
280	.46	87.5	88.3	89.1	89.8	90.6	91.4	92.2	92.9	92.9	92.1	91.4	90.7
320	.53	86.8	87.6	88.3	89.1	89.9	90.7	91.4	92.2	92.9	92.5	91.8	91.1
360	.59	86.0	86.7	87.5	88.3	89.1	89.8	90.6	91.3	92.0	92.8	92.2	91.5

3000 FT PRESS ALT		TAT (°C)											
KIAS	M	-5	0	5	10	15	20	25	30	35	40	45	50
160	.26	88.8	89.6	90.4	91.2	91.9	92.7	93.1	92.9	92.6	91.8	91.1	90.3
200	.32	88.5	89.3	90.0	90.8	91.6	92.3	93.1	92.8	92.5	91.8	91.1	90.3
240	.38	87.9	88.7	89.5	90.3	91.0	91.8	92.5	92.6	91.8	91.0	90.3	89.6
280	.45	87.4	88.1	88.9	89.7	90.5	91.2	92.0	92.7	92.2	91.4	90.7	90.0
320	.51	86.7	87.5	88.3	89.0	89.8	90.5	91.3	92.0	92.5	91.8	91.1	90.4
360	.57	85.9	86.7	87.5	88.2	89.0	89.7	90.5	91.2	91.9	92.2	91.5	90.7

1000 FT PRESS ALT		TAT (°C)											
KIAS	M	-5	0	5	10	15	20	25	30	35	40	45	50
160	.25	87.7	88.5	89.3	90.0	90.8	91.6	92.3	92.3	91.8	91.2	90.5	89.7
200	.31	87.4	88.2	89.0	89.7	90.5	91.3	92.0	92.4	92.0	91.5	90.8	90.0
240	.37	86.9	87.7	88.5	89.3	90.0	90.8	91.5	92.3	91.9	91.2	90.4	89.7
280	.43	86.4	87.2	87.9	88.7	89.5	90.2	90.9	91.7	92.1	91.4	90.7	89.9
320	.49	85.8	86.6	87.4	88.1	88.9	89.6	90.4	91.1	91.8	91.8	91.1	90.3
360	.55	85.1	85.9	86.7	87.4	88.1	88.9	89.6	90.3	91.1	91.8	91.4	90.7

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)			
	1	3	5	10
ENGINE ANTI-ICE ON	-0.6	-0.8	-0.8	-0.8
ENGINE & WING ANTI-ICE ON	-2.9	-3.0	-3.1	-3.2

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

WEIGHT (1000 KG)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFTDOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
80	76	261	16000	13800	11500
75	71	253	18600	16600	14100
70	67	245	21100	19500	17200
65	62	237	23600	22200	20400
60	57	228	26000	24900	23500
55	53	219	28300	27300	26200
50	48	209	30500	29700	28600
45	43	198	32700	31900	31000
40	38	187	35000	34300	33400
35	33	175	37600	36900	36100
30	29	162	40700	39900	39100

Includes APU fuel burn.

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown/LRC Cruise Range Capability

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
140	129	120	113	106	100	95	90	85	82	78
279	259	241	226	212	200	189	180	171	163	156
418	388	361	338	318	300	284	270	256	245	234
558	517	482	451	424	400	379	359	342	326	312
697	646	602	564	530	500	473	449	428	408	390
836	775	722	676	636	600	568	539	513	490	468
975	904	843	789	742	700	663	629	599	571	546
1114	1033	963	902	848	800	757	719	684	653	624
1253	1162	1083	1014	954	900	852	809	770	734	702
1392	1291	1204	1127	1060	1000	947	899	855	816	780
1532	1420	1324	1240	1166	1100	1041	989	941	898	858
1671	1550	1444	1353	1272	1200	1136	1078	1026	979	936
1811	1679	1565	1465	1378	1300	1231	1168	1112	1061	1014
1951	1809	1686	1578	1484	1400	1325	1258	1197	1142	1092
2091	1938	1806	1691	1590	1500	1420	1348	1283	1223	1169
2231	2068	1927	1804	1696	1600	1514	1437	1368	1305	1247
2372	2198	2048	1917	1802	1700	1609	1527	1453	1386	1325
2513	2329	2169	2030	1908	1800	1703	1617	1538	1467	1402

Driftdown/Cruise Fuel and Time

AIR DIST (NM)	FUEL REQUIRED (1000 KG)								TIME (HR:MIN)
	WEIGHT AT START OF DRIFTDOWN (1000 KG)								
	35	40	45	50	55	60	65	70	
100	0.3	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0:17
200	0.7	0.8	0.8	0.9	0.9	1.0	1.1	1.1	0:34
300	1.2	1.2	1.3	1.4	1.5	1.6	1.7	1.8	0:51
400	1.5	1.7	1.8	2.0	2.1	2.3	2.4	2.5	1:08
500	1.9	2.1	2.3	2.5	2.7	2.9	3.1	3.2	1:24
600	2.3	2.5	2.7	3.0	3.2	3.4	3.7	3.9	1:41
700	2.6	2.9	3.2	3.4	3.7	4.0	4.3	4.6	1:58
800	3.0	3.3	3.6	3.9	4.2	4.6	4.9	5.2	2:15
900	3.3	3.7	4.0	4.4	4.8	5.1	5.5	5.9	2:32
1000	3.7	4.1	4.5	4.9	5.3	5.7	6.1	6.5	2:49
1100	4.0	4.5	4.9	5.4	5.8	6.2	6.7	7.1	3:06
1200	4.4	4.8	5.3	5.8	6.3	6.8	7.3	7.8	3:23
1300	4.7	5.2	5.8	6.3	6.8	7.3	7.9	8.4	3:40
1400	5.0	5.6	6.2	6.7	7.3	7.9	8.4	9.0	3:57
1500	5.4	6.0	6.6	7.2	7.8	8.4	9.0	9.7	4:14
1600	5.7	6.3	7.0	7.6	8.3	8.9	9.6	10.3	4:31
1700	6.0	6.7	7.4	8.1	8.8	9.4	10.1	10.9	4:48
1800	6.4	7.1	7.8	8.5	9.2	10.0	10.7	11.5	5:05

Includes APU fuel burn.
Driftdown at optimum driftdown speed and cruise at LRC speed.

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Altitude Capability

100 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
80	10000	7400	4800
75	12800	10300	7800
70	15800	13300	10800
65	19900	16600	13800
60	23200	20500	17600
55	26100	24500	21700
50	28900	27600	25800
45	31300	30400	29100
40	33700	32900	31800
35	36300	35600	34500
30	39400	38500	37500

With engine anti-ice on, decrease altitude capability by 2000 ft.
With engine and wing anti-ice on, decrease altitude capability by 7000 ft.

ENGINE INOP

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)									
		10	15	17	19	21	23	25	27	29	31
75	%N1	88.5	92.6								
	MACH	.528	.579								
	KIAS	293	293								
	FF/ENG	2693	2723								
70	%N1	86.6	90.8	92.5	94.2						
	MACH	.510	.562	.582	.595						
	KIAS	282	284	283	278						
	FF/ENG	2499	2529	2532	2500						
65	%N1	84.5	88.8	90.5	92.3	94.2					
	MACH	.491	.542	.563	.584	.596					
	KIAS	271	274	274	273	268					
	FF/ENG	2306	2334	2339	2341	2313					
60	%N1	82.3	86.6	88.4	90.1	92.0	94.0	96.8			
	MACH	.471	.521	.543	.564	.585	.597	.614			
	KIAS	261	263	263	263	263	258	254			
	FF/ENG	2120	2141	2145	2148	2152	2131	2175			
55	%N1	80.0	84.2	86.0	87.8	89.6	91.5	93.6	96.6		
	MACH	.453	.498	.520	.541	.563	.585	.597	.614		
	KIAS	250	251	252	252	253	252	247	244		
	FF/ENG	1945	1948	1952	1954	1959	1966	1953	1997		
50	%N1	77.6	81.6	83.4	85.2	87.0	88.8	90.8	92.9	96.1	
	MACH	.434	.475	.495	.516	.538	.561	.583	.596	.613	
	KIAS	240	239	239	240	241	241	241	236	233	
	FF/ENG	1777	1759	1760	1763	1767	1771	1783	1776	1815	
45	%N1	75.2	78.9	80.5	82.3	84.1	86.0	87.8	89.8	92.0	95.2
	MACH	.415	.452	.469	.489	.511	.533	.556	.578	.593	.610
	KIAS	229	227	227	227	228	229	229	229	225	222
	FF/ENG	1617	1585	1576	1573	1577	1581	1588	1604	1601	1630
40	%N1	72.5	76.0	77.6	79.2	80.9	82.8	84.6	86.5	88.4	90.8
	MACH	.395	.429	.445	.462	.480	.502	.525	.548	.571	.589
	KIAS	218	215	215	214	214	215	216	216	216	214
	FF/ENG	1462	1421	1406	1395	1388	1393	1400	1411	1424	1428
35	%N1	69.4	73.0	74.4	75.9	77.6	79.2	81.0	82.8	84.7	86.6
	MACH	.375	.406	.420	.435	.452	.469	.490	.513	.536	.560
	KIAS	207	203	202	202	201	201	201	202	203	203
	FF/ENG	1314	1266	1247	1230	1217	1209	1212	1224	1233	1243
30	%N1	66.2	69.5	71.0	72.4	73.8	75.4	77.1	78.7	80.6	82.5
	MACH	.355	.382	.394	.407	.422	.438	.455	.474	.496	.520
	KIAS	196	191	190	189	188	187	186	186	187	187
	FF/ENG	1173	1117	1097	1078	1059	1042	1037	1040	1048	1055

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
314	283	256	234	216	200	190	180	172	164	157
634	570	514	470	433	400	379	360	343	327	313
957	859	775	706	650	600	569	540	513	489	468
1283	1150	1036	943	867	800	758	719	684	652	623
1611	1443	1298	1181	1085	1000	947	898	853	814	778
1942	1737	1561	1419	1302	1200	1135	1076	1023	975	933
2276	2034	1825	1658	1520	1400	1324	1255	1193	1136	1087
2612	2332	2090	1897	1739	1600	1513	1434	1362	1297	1240
2951	2631	2356	2137	1957	1800	1702	1613	1531	1459	1394

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		18		22		26	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	1.3	0:46	1.1	0:43	1.0	0:41	0.9	0:39	0.8	0:38
400	2.6	1:30	2.4	1:25	2.2	1:20	2.0	1:15	1.8	1:12
600	3.9	2:14	3.6	2:07	3.3	2:00	3.0	1:52	2.9	1:46
800	5.2	2:59	4.8	2:50	4.4	2:39	4.1	2:29	3.9	2:21
1000	6.5	3:45	6.0	3:33	5.5	3:20	5.2	3:07	4.8	2:56
1200	7.8	4:31	7.2	4:16	6.7	4:01	6.2	3:45	5.8	3:31
1400	9.0	5:18	8.3	5:00	7.7	4:42	7.2	4:23	6.8	4:07
1600	10.2	6:05	9.5	5:45	8.8	5:24	8.2	5:02	7.7	4:43
1800	11.5	6:53	10.7	6:30	9.9	6:06	9.2	5:41	8.7	5:19

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	30	40	50	60	70
1	-0.1	-0.1	0.0	0.1	0.3
2	-0.3	-0.2	0.0	0.3	0.7
3	-0.5	-0.2	0.0	0.4	1.0
4	-0.6	-0.3	0.0	0.6	1.4
5	-0.8	-0.4	0.0	0.7	1.7
6	-1.0	-0.5	0.0	0.8	2.0
7	-1.1	-0.6	0.0	1.0	2.3
8	-1.3	-0.6	0.0	1.1	2.6
9	-1.4	-0.7	0.0	1.2	2.9
10	-1.6	-0.8	0.0	1.3	3.2
11	-1.8	-0.9	0.0	1.4	3.4
12	-1.9	-1.0	0.0	1.5	3.6
13	-2.1	-1.0	0.0	1.6	3.8
14	-2.3	-1.1	0.0	1.7	4.0

Includes APU fuel burn.

ENGINE INOP

MAX CONTINUOUS THRUST

Holding

Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)								
		1500	5000	10000	15000	20000	25000	30000	35000	40000
80	%N1	80.1	83.1	87.4	91.9					
	KIAS	247	247	248	250					
	FF/ENG	2640	2640	2650	2700					
75	%N1	78.3	81.2	85.5	90.0					
	KIAS	239	240	240	242					
	FF/ENG	2470	2460	2470	2510					
70	%N1	76.5	79.2	83.6	88.0	93.4				
	KIAS	231	231	232	233	235				
	FF/ENG	2310	2300	2300	2320	2370				
65	%N1	74.4	77.2	81.5	85.8	90.6				
	KIAS	223	223	223	224	226				
	FF/ENG	2140	2130	2120	2140	2160				
60	%N1	72.1	75.1	79.2	83.6	88.2	95.3			
	KIAS	214	214	215	215	217	218			
	FF/ENG	1980	1960	1950	1960	1970	2070			
55	%N1	69.7	72.7	76.8	81.1	85.7	91.2			
	KIAS	204	205	206	206	207	208			
	FF/ENG	1820	1800	1790	1790	1790	1830			
50	%N1	67.2	70.0	74.3	78.5	83.0	87.8	96.4		
	KIAS	195	195	196	197	197	198	200		
	FF/ENG	1670	1640	1630	1620	1610	1630	1770		
45	%N1	64.5	67.2	71.4	75.6	80.1	84.8	91.0		
	KIAS	185	185	186	186	187	188	189		
	FF/ENG	1510	1490	1470	1460	1440	1450	1510		
40	%N1	61.3	64.2	68.2	72.6	76.9	81.5	86.4	96.0	
	KIAS	177	177	177	177	177	177	178	179	
	FF/ENG	1360	1340	1310	1300	1280	1280	1300	1430	
35	%N1	58.0	60.8	64.9	69.0	73.4	77.9	82.6	88.8	
	KIAS	171	171	171	171	171	171	171	171	
	FF/ENG	1210	1190	1170	1150	1130	1110	1130	1170	
30	%N1	54.8	57.3	61.4	65.4	70.0	74.1	78.7	83.5	93.6
	KIAS	164	164	164	164	164	164	164	164	164
	FF/ENG	1070	1050	1030	1010	990	970	980	990	1090

This table includes 5% additional fuel for holding in a racetrack pattern.

ENGINE INOP

ADVISORY INFORMATION

Gear Down Landing Rate of Climb Available

Flaps 15

TAT (°C)	RATE OF CLIMB (FT/MIN)						
	PRESSURE ALTITUDE (FT)						
	-2000	0	2000	4000	6000	8000	10000
52	-290	-350					
50	-270	-330	-420				
48	-250	-310	-390				
46	-220	-280	-370	-460			
44	-200	-260	-350	-440			
42	-170	-230	-330	-420	-520		
40	-140	-210	-300	-390	-500		
38	-120	-180	-270	-370	-470	-600	
36	-100	-150	-250	-350	-450	-580	
34	-100	-130	-220	-320	-430	-560	-660
32	-100	-110	-200	-300	-410	-540	-640
30	-100	-110	-170	-280	-390	-520	-620
20	-90	-100	-160	-210	-290	-390	-520
10	-90	-100	-160	-210	-290	-360	-440
0	-80	-100	-150	-210	-290	-360	-440
-20	-80	-100	-160	-210	-290	-370	-460
-40	-80	-100	-160	-220	-300	-380	-470

Rate of climb capability shown is valid for 60000 kg, gear down at VREF15+5.
Decrease rate of climb 110 ft/min per 5000 kg greater than 60000 kg.
Increase rate of climb 150 ft/min per 5000 kg less than 60000 kg.

Flaps 30

TAT (°C)	RATE OF CLIMB (FT/MIN)						
	PRESSURE ALTITUDE (FT)						
	-2000	0	2000	4000	6000	8000	10000
52	-450	-510					
50	-430	-490	-580				
48	-410	-470	-560				
46	-380	-450	-540	-630			
44	-360	-430	-520	-610			
42	-330	-400	-490	-590	-690		
40	-310	-380	-470	-560	-670		
38	-290	-350	-450	-540	-650	-770	
36	-270	-330	-420	-520	-630	-760	
34	-270	-300	-400	-500	-610	-740	-840
32	-270	-280	-370	-480	-590	-720	-820
30	-270	-280	-350	-450	-570	-700	-810
20	-260	-280	-340	-390	-470	-580	-710
10	-260	-280	-340	-400	-470	-550	-630
0	-260	-280	-340	-400	-480	-560	-640
-20	-270	-290	-350	-410	-490	-570	-660
-40	-280	-300	-360	-420	-500	-590	-680

Rate of climb capability shown is valid for 60000 kg, gear down at VREF30+5.
Decrease rate of climb 110 ft/min per 5000 kg greater than 60000 kg.
Increase rate of climb 150 ft/min per 5000 kg less than 60000 kg.

GEAR DOWN

Long Range Cruise Altitude Capability

Max Cruise Thrust, 100 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
80	14800	12300	9600
75	19000	15100	12600
70	22500	19300	15700
65	25400	23300	19600
60	27900	26400	24400
55	30200	29100	27400
50	32400	31400	30200
45	34600	33600	32500
40	37000	36100	35000
35	39700	38800	37800

GEAR DOWN

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)									
		10	21	23	25	27	29	31	33	35	37
80	%N1	84.7									
	MACH	.468									
	KIAS	259									
	FF/ENG	2307									
75	%N1	82.9	92.5								
	MACH	.454	.554								
	KIAS	251	248								
	FF/ENG	2154	2148								
70	%N1	81.0	90.4	92.5							
	MACH	.440	.541	.557							
	KIAS	243	242	240							
	FF/ENG	2003	1998	1995							
65	%N1	79.0	88.4	90.1	92.5						
	MACH	.425	.524	.543	.560						
	KIAS	235	234	233	231						
	FF/ENG	1856	1845	1841	1846						
60	%N1	76.8	86.2	88.0	89.8	92.2	95.6				
	MACH	.409	.504	.525	.544	.562	.580				
	KIAS	226	225	225	224	222	220				
	FF/ENG	1712	1689	1690	1691	1701	1746				
55	%N1	74.6	83.8	85.5	87.3	89.2	91.8	95.2			
	MACH	.393	.484	.504	.525	.545	.562	.581			
	KIAS	217	216	216	216	215	213	211			
	FF/ENG	1570	1537	1536	1540	1546	1556	1600			
50	%N1	72.1	81.2	82.9	84.7	86.5	88.4	91.0	94.5		
	MACH	.376	.463	.482	.502	.523	.544	.561	.580		
	KIAS	207	206	206	206	206	205	203	201		
	FF/ENG	1431	1388	1386	1389	1397	1402	1409	1451		
45	%N1	69.3	78.3	80.1	81.8	83.6	85.4	87.4	90.0	93.5	
	MACH	.358	.441	.458	.477	.498	.520	.541	.559	.578	
	KIAS	197	196	196	196	196	196	195	193	191	
	FF/ENG	1297	1244	1238	1240	1247	1253	1258	1263	1299	
40	%N1	66.3	75.2	76.9	78.7	80.4	82.2	84.1	86.0	88.5	92.3
	MACH	.340	.417	.434	.452	.471	.491	.513	.535	.554	.573
	KIAS	187	185	185	185	185	185	185	185	183	181
	FF/ENG	1169	1106	1095	1095	1102	1106	1109	1113	1118	1151
35	%N1	63.2	71.9	73.5	75.2	77.0	78.7	80.5	82.3	84.3	86.9
	MACH	.321	.392	.408	.425	.442	.461	.481	.503	.526	.547
	KIAS	177	174	174	173	173	173	173	173	173	172
	FF/ENG	1044	974	959	955	961	962	965	966	969	978

GEAR DOWN

Long Range Cruise Enroute Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
324	290	260	236	217	200	188	178	168	160	153
655	584	523	474	435	400	377	357	338	321	307
990	881	787	713	653	600	566	535	507	483	461
1330	1181	1054	953	871	800	755	713	676	642	613
1676	1486	1323	1195	1091	1000	943	891	844	803	766
2027	1793	1594	1437	1310	1200	1131	1069	1013	962	918
2385	2106	1868	1681	1531	1400	1319	1246	1180	1121	1069
2749	2422	2143	1926	1751	1600	1507	1423	1347	1279	1220
3120	2742	2421	2172	1973	1800	1695	1600	1514	1437	1370

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		20		24		28	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	2.4	0:49	2.2	0:47	1.9	0:44	1.8	0:42	1.6	0:41
400	5.0	1:36	4.6	1:31	4.1	1:25	3.8	1:20	3.6	1:17
600	7.4	2:25	6.9	2:17	6.2	2:06	5.8	1:59	5.5	1:54
800	9.9	3:14	9.2	3:03	8.3	2:48	7.7	2:38	7.3	2:31
1000	12.2	4:05	11.4	3:51	10.3	3:31	9.6	3:18	9.2	3:08
1200	14.5	4:56	13.6	4:39	12.2	4:14	11.5	3:59	10.9	3:46
1400	16.8	5:49	15.7	5:28	14.2	4:59	13.3	4:40	12.7	4:24
1600	19.0	6:43	17.8	6:19	16.1	5:44	15.1	5:22	14.3	5:04
1800	21.2	7:39	19.8	7:10	17.9	6:30	16.8	6:05	16.0	5:43

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	40	50	60	70	80
2	-0.3	-0.2	0.0	0.3	0.7
4	-0.7	-0.3	0.0	0.7	1.5
6	-1.0	-0.5	0.0	1.0	2.2
8	-1.4	-0.7	0.0	1.2	2.8
10	-1.8	-0.9	0.0	1.5	3.4
12	-2.1	-1.1	0.0	1.8	4.0
14	-2.5	-1.2	0.0	2.0	4.5
16	-2.8	-1.4	0.0	2.2	4.9
18	-3.2	-1.6	0.0	2.3	5.3
20	-3.6	-1.8	0.0	2.5	5.7
22	-3.9	-1.9	0.0	2.6	6.0

GEAR DOWN

Descent

VREF40 + 70 KIAS

PRESSURE ALTITUDE (FT)	TIME (MIN)	FUEL (KG)	DISTANCE (NM)
41000	21	270	88
39000	20	260	84
37000	20	260	79
35000	19	260	75
33000	18	250	71
31000	18	250	67
29000	17	240	63
27000	16	230	59
25000	15	230	55
23000	14	220	51
21000	14	210	47
19000	13	210	43
17000	12	200	39
15000	11	190	35
10000	9	160	25
5000	6	130	16
1500	4	100	9

Allowances for a straight-in approach are included.

GEAR DOWN

Holding

Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)								
		1500	5000	10000	15000	20000	25000	30000	35000	40000
80	%N1	74.5	77.3	81.5	85.8	90.5				
	KIAS	224	224	224	224	224				
	FF/ENG	2140	2130	2120	2130	2150				
75	%N1	72.8	75.7	79.8	84.1	88.7				
	KIAS	219	219	219	219	219				
	FF/ENG	2010	2000	1990	2000	2000				
70	%N1	71.0	74.0	78.0	82.3	86.9	92.7			
	KIAS	214	214	214	214	214	214			
	FF/ENG	1890	1880	1870	1870	1870	1920			
65	%N1	69.1	72.1	76.2	80.5	84.9	89.9			
	KIAS	209	209	209	209	209	209			
	FF/ENG	1780	1760	1740	1740	1730	1760			
60	%N1	67.2	70.0	74.2	78.3	82.8	87.5	95.4		
	KIAS	203	203	203	203	203	203	203		
	FF/ENG	1660	1630	1620	1610	1600	1610	1720		
55	%N1	65.1	67.9	72.1	76.2	80.6	85.2	91.2		
	KIAS	197	197	197	197	197	197	197		
	FF/ENG	1540	1520	1500	1480	1470	1480	1530		
50	%N1	62.8	65.6	69.7	73.9	78.2	82.8	87.7		
	KIAS	190	190	190	190	190	190	190		
	FF/ENG	1420	1400	1380	1360	1340	1340	1370		
45	%N1	60.3	63.3	67.2	71.5	75.7	80.2	84.9	92.3	
	KIAS	184	184	184	184	184	184	184	184	
	FF/ENG	1310	1290	1270	1250	1220	1220	1240	1300	
40	%N1	57.9	60.6	64.7	68.8	73.1	77.5	82.0	87.4	
	KIAS	177	177	177	177	177	177	177	177	
	FF/ENG	1200	1180	1160	1140	1110	1090	1110	1130	
35	%N1	55.3	57.9	62.0	66.0	70.5	74.7	79.1	83.8	93.3
	KIAS	170	170	170	170	170	170	170	170	170
	FF/ENG	1090	1070	1050	1030	1000	980	990	1000	1090

This table includes 5% additional fuel for holding in a racetrack pattern.

Intentionally
Blank

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

WEIGHT (1000 KG)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFTDOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
70	66	213	2500	300	
65	62	208	5800	4000	2100
60	57	202	9100	7300	5700
55	52	196	12400	10600	8800
50	48	190	15600	14100	12300
45	43	184	18900	17500	15900
40	38	177	22200	21000	19700
35	34	170	25400	24600	23600

Includes APU fuel burn.

Long Range Cruise Altitude Capability

100 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
60	3600	500	
55	8100	5800	3200
50	12300	10100	8000
45	16500	14800	12500
40	20700	19300	17400
35	24500	23400	22100

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)									
		5	7	9	11	13	15	17	19	21	23
60	%N1	90.6									
	MACH	.364									
	KIAS	220									
	FF/ENG	3238									
55	%N1	88.1	89.7	91.5							
	MACH	.351	.362	.374							
	KIAS	212	211	210							
	FF/ENG	2958	2950	2951							
50	%N1	85.5	87.0	88.6	90.4	92.2					
	MACH	.338	.348	.359	.371	.384					
	KIAS	204	203	202	201	200					
	FF/ENG	2694	2675	2664	2665	2675					
45	%N1	82.8	84.2	85.7	87.3	89.0	90.8	93.4			
	MACH	.325	.334	.344	.355	.367	.380	.393			
	KIAS	196	195	193	192	191	190	189			
	FF/ENG	2442	2416	2396	2384	2383	2387	2401			
40	%N1	79.8	81.2	82.6	84.1	85.6	87.3	89.2	91.4	94.9	
	MACH	.311	.320	.329	.339	.349	.361	.374	.387	.402	
	KIAS	188	186	184	183	182	181	180	179	179	
	FF/ENG	2206	2171	2143	2123	2110	2103	2098	2099	2150	
35	%N1	76.7	78.0	79.3	80.7	82.1	83.7	85.5	87.5	89.4	92.7
	MACH	.296	.305	.313	.322	.331	.342	.354	.369	.384	.400
	KIAS	179	178	176	174	172	171	170	170	170	170
	FF/ENG	1973	1943	1906	1877	1856	1838	1828	1832	1839	1872

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Diversion Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
178	155	135	121	110	100	93	87	81	77	73
361	314	274	244	220	200	186	174	163	154	146
546	473	412	366	331	300	279	260	244	230	218
732	634	551	489	441	400	372	347	325	306	290
920	796	692	613	552	500	465	434	407	383	362
1109	958	832	737	663	600	558	520	487	458	434
1300	1122	973	861	774	700	651	607	568	534	505
1493	1287	1115	986	885	800	744	693	648	610	577
1688	1453	1257	1110	997	900	836	779	729	685	648
1884	1620	1400	1235	1108	1000	929	865	809	760	719

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)							
	6		10		14		18	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
100	1.1	0:29	1.0	0:28	0.9	0:27	0.8	0:26
200	2.4	0:56	2.2	0:54	2.0	0:52	1.9	0:50
300	3.6	1:24	3.3	1:21	3.1	1:17	3.0	1:14
400	4.8	1:52	4.4	1:47	4.2	1:42	4.1	1:37
500	6.0	2:20	5.6	2:14	5.2	2:08	5.1	2:02
600	7.1	2:49	6.7	2:41	6.3	2:34	6.1	2:26
700	8.3	3:18	7.7	3:09	7.3	3:00	7.1	2:50
800	9.4	3:47	8.8	3:37	8.3	3:26	8.0	3:15
900	10.5	4:16	9.9	4:05	9.3	3:52	9.0	3:40
1000	11.7	4:46	10.9	4:33	10.3	4:19	9.9	4:06

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	30	40	50	60	70
1	-0.2	-0.1	0.0	0.2	0.4
2	-0.4	-0.2	0.0	0.4	0.9
3	-0.6	-0.3	0.0	0.7	1.3
4	-0.8	-0.4	0.0	0.9	1.8
5	-1.0	-0.5	0.0	1.1	2.3
6	-1.2	-0.6	0.0	1.3	2.7
7	-1.4	-0.7	0.0	1.5	3.1
8	-1.6	-0.8	0.0	1.7	3.6
9	-1.8	-0.9	0.0	1.9	4.0
10	-2.0	-1.0	0.0	2.1	4.4
11	-2.2	-1.1	0.0	2.3	4.8
12	-2.4	-1.2	0.0	2.5	5.2

Includes APU fuel burn.

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Holding

Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)			
		1500	5000	10000	15000
70	%N1	89.7			
	KIAS	214			
	FF/ENG	3640			
65	%N1	87.6	90.8		
	KIAS	209	209		
	FF/ENG	3380	3410		
60	%N1	85.4	88.4		
	KIAS	203	203		
	FF/ENG	3120	3130		
55	%N1	83.0	86.0	90.6	
	KIAS	197	197	197	
	FF/ENG	2870	2870	2900	
50	%N1	80.4	83.5	87.9	93.2
	KIAS	190	190	190	190
	FF/ENG	2630	2620	2630	2690
45	%N1	77.8	80.7	85.1	89.9
	KIAS	184	184	184	184
	FF/ENG	2400	2380	2380	2410
40	%N1	75.1	77.9	82.2	86.7
	KIAS	177	177	177	177
	FF/ENG	2180	2160	2150	2160
35	%N1	72.1	75.0	79.1	83.6
	KIAS	170	170	170	170
	FF/ENG	1960	1940	1920	1920

This table includes 5% additional fuel for holding in a racetrack pattern.

Performance Inflight — Chapter PI

Text — Section 16

Introduction

This chapter contains information to supplement performance data from the Flight Management Computer (FMC). In addition, sufficient inflight data is provided to complete a flight with the FMC inoperative. In the event of conflict between data presented in this chapter and that contained in the approved Airplane Flight Manual, the Flight Manual shall always take precedence.

General

Takeoff Speeds

The speeds presented in the Takeoff Speeds table as well as FMC computed takeoff speeds can be used for all performance conditions except where adjustments must be made to V1 for clearway, stopway, anti-skid inoperative, thrust reversers inoperative, improved climb, contaminated runway situations or brake energy limits. 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 will not help this condition as the minimum control speeds are determined at the actual temperature and therefore are not reduced.

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

V1(MCG)

Regulations prohibit scheduling takeoff with a V1 less than minimum V1 for control on the ground, V1(MCG). It is therefore necessary to compare the adjusted V1 to V1(MCG). The V1(MCG) presented in this manual is conservative for all weight and bleed configurations.

To find V1(MCG) enter the V1(MCG) table with the airport pressure altitude and actual OAT. If the adjusted V1 is less than V1(MCG), set V1 equal to V1(MCG). If the adjusted VR is less than V1(MCG), set VR equal to V1(MCG), and determine a new V2 by adding the difference between the normal VR and V1(MCG) to the normal V2. No takeoff weight adjustment is necessary provided that the actual field length exceeds the minimum field length shown in the Field and Climb Limit Weight table in chapter Performance Dispatch.

Clearway and Stopway V1 Adjustments

Maximum allowable clearway limits are provided for guidance when more precise data is not available. Use of clearway is not allowed on wet runways.

Takeoff speed adjustments are to be applied to V1 speed when using takeoff weights based on the use of clearway and stopway.

Adjust V1 speed by the amount shown in the table. The adjusted V1 speed must not exceed VR. If the adjusted V1 speed is greater than VR, reduce V1 to equal VR.

Stab Trim

To find takeoff stabilizer trim setting, enter Stab Trim Setting table with anticipated brake release weight and center of gravity (C.G. % MAC) and read required stabilizer trim units.

VREF

This table contains flaps 40, 30 and 15 reference speeds for a given weight.

With autothrottles disengaged an approach speed wind correction (max 20 knots) of 1/2 steady headwind component + gust increment above steady wind is recommended. Do not apply a wind correction for tailwinds. The maximum command speed should not exceed landing flap placard speed minus 5 knots.

Flap Maneuver Speeds

This table provides flap maneuver speeds for various flap settings. During flap retraction, selection of the next flap position is initiated when reaching the maneuver speed for the existing flap position. During flap retraction, at least adequate maneuver capability or 30° of bank (15° of bank and 15° overshoot) to stick shaker is provided at the flap retraction speed. Full maneuver capability or at least 40° of bank (25° of bank and 15° overshoot) is provided when the airplane has accelerated to the recommended maneuver speed for the selected flap position.

During flap extension, selection of the flaps to the next flap position should be made when approaching, and before decelerating below, the maneuver speed for the existing flap position. The flap extension speed schedule varies with airplane weight and provides full maneuver capability or at least 40° of bank (25° of bank and 15° overshoot) to stick shaker at all weights.

Slush/Standing Water Takeoff

Experience has shown that aircraft performance may deteriorate significantly on runways covered with snow, slush, standing water or ice. Therefore, reductions in field/obstacle limited takeoff weight and revised takeoff speeds are necessary. The tables are intended for guidance in accordance with advisory material and assume an engine failure at the critical point during the takeoff.

The entire runway is assumed to be completely covered by a contaminant of uniform thickness and density. Therefore this information is conservative when operating under typical cold weather conditions where patches of slush exist and some degree of sanding is common. Takeoffs in slush depths greater than 13 mm (0.5 inches) are not recommended because of possible airplane damage as a result of slush impingement on the airplane structure. The use of assumed temperature for reduced thrust is not allowed on contaminated runways. Interpolation for slush/standing water depths between the values shown is permitted.

Takeoff weight determination:

1. Enter the Weight Adjustment table with the dry field/obstacle limit weight to obtain the weight reduction for the slush/standing water depth and airport pressure altitude.
2. Adjust field length available for temperature by amount shown beneath V1(MCG) limit weight table.
3. Enter the V1(MCG) Limit Weight table with the adjusted field length and pressure altitude to obtain the slush/standing water limit weight with respect to minimum field length required for V1(MCG) speed.

4. The maximum allowable takeoff weight in slush/standing water is the lesser of the limit weights found in steps 1 and 3.

Takeoff speed determination:

1. Determine takeoff speeds V1, VR and V2 for actual brake release weight using the Dry Runway Takeoff Speeds table for the appropriate flap setting and thrust rating.
2. If V1(MCG) limited, set V1=V1(MCG). If not limited by V1(MCG) considerations, enter the V1 Adjustment table with actual brake release weight to determine the V1 reduction to apply to V1 speed. If the adjusted V1 is less than V1(MCG), set V1=V1(MCG).

Slippery Runway Takeoff

Airplane braking action is reported as good, medium or poor, depending on existing runway conditions. If braking action is reported as good, conditions should not be expected to be as good as on clean, dry runways. The value “good” is comparative and is intended to mean that airplanes should not experience braking or directional control difficulties when stopping. The performance level used to calculate the “good” data is consistent with wet runway testing done on early Boeing jets. The performance level used to calculate the “poor” data reflects a runway covered with wet ice. Performance is based on a 15 ft screen height at the end of the runway. The tables provided are used in the same manner as the Slush/Standing Water tables.

Anti-Skid Inoperative

When operating with anti-skid inoperative, the field limit weight and V1 must be reduced to account for the effect on accelerate-stop performance. Anti-skid inoperative is only allowed on a dry runway. A simplified method which conservatively accounts for the effects of anti-skid inoperative is to reduce the normal dry field/obstacle limited weight by 7700 kg and the V1 associated with the reduced weight by the amount shown in the table below.

ANTI-SKID INOPERATIVE V1 ADJUSTMENTS

FIELD LENGTH (M)	V1 ADJUSTMENT (KIAS)
2000	-16
2500	-14
3000	-12
3500	-10
4000	-10

If the resulting V1 is less than V1(MCG), takeoff is permitted with V1 set equal to V1(MCG) provided the dry accelerate-stop distance corrected for wind and slope exceeds approximately 2150 m.

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

Thrust Reverser Inoperative

When dispatching on a wet runway with both thrust reversers operative, an operative anti-skid system, and all brakes operating, regulations allow deceleration credit for one thrust reverser in the engine failure case and two thrust reversers in the all engine stop case.

When dispatching on a wet runway with one thrust reverser inoperative, the field/obstacle limited weight and V1 speed must be reduced to account for the effect on accelerate-stop performance. A simplified method, which conservatively accounts for this, is to reduce the normal wet runway/field/obstacle limited weight by 1000 kg and the V1 associated with the reduced weight by 2 knots.

If the resulting V1 is less than minimum V1, takeoff is permitted with V1 set equal to V1(MCG) provided the accelerate-stop distance available adjusted for wind and slope exceeds approximately 1500 m.

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

Takeoff %N1

To find Max Takeoff %N1 based on normal engine bleed for air conditioning packs on, enter Takeoff %N1 Table with airport pressure altitude and airport OAT and read %N1. Apply %N1 adjustments as provided when applicable.

Assumed Temperature Reduced Thrust

Regulations permit the use of up to 25% takeoff thrust reduction for operation with assumed temperature reduced thrust. Use of assumed temperature reduced thrust is not allowed with anti-skid inoperative or on runways contaminated with standing water, ice, slush, or snow. Use of assumed temperature reduced thrust is not recommended if potential windshear conditions exist.

To find the maximum allowable assumed temperature enter the Maximum Assumed Temperature table with airport pressure altitude and OAT. Compare this temperature to that at which the airplane is performance limited as determined from available takeoff performance data. Next, enter the Maximum Takeoff %N1 table with airport pressure altitude and the lower of the two temperatures previously determined, to obtain a maximum takeoff %N1. Do not use an assumed temperature less than the minimum assumed temperature shown. Enter the %N1 Adjustment table with OAT and the difference between the assumed and actual OAT to obtain a %N1 adjustment. Subtract the %N1 adjustment from the maximum takeoff %N1 found previously to determine the assumed temperature reduced thrust %N1.

Apply %N1 adjustments as provided when applicable.

Max Climb %N1

This table shows Max Climb %N1 for a 280/.78 climb speed schedule, normal engine bleed for packs on or off and anti-ice off. Enter the table with airport pressure altitude and TAT and read %N1. %N1 adjustments are shown for anti-ice operation.

Go-around %N1

To find Max Go-around %N1 based on normal engine bleed for packs on (AUTO) and anti-ice on or off, enter the Go-around %N1 table with airport pressure altitude and reported OAT or TAT and read %N1. For packs OFF or HIGH operation, apply the %N1 adjustment shown below the table.

Flight with Unreliable Airspeed / Turbulent Air Penetration

Pitch attitude and average %N1 information is provided for use in all phases of flight in the event of unreliable airspeed/Mach indications resulting from blocking or freezing of the pitot system. Loss of radome or turbulent air may also cause unreliable airspeed/Mach indications. The cruise table in this section may also be used for turbulent air penetration.

Pitch attitude is shown in bold type for emphasis since altitude and/or vertical speed indications may also be unreliable.

All Engines

Long Range Cruise Maximum Operating Altitude

These tables provide the maximum operating altitude in the same manner as the FMC. Maximum altitudes are shown for a given cruise weight and maneuver capability. This table considers both thrust and buffet limits, providing the more limiting of the two. Any data that is thrust limited is denoted by an asterisk and represents only a thrust limited condition in level flight with 100 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 15° may cause the airplane to lose speed and/or altitude. The altitudes shown in the table are limited to the maximum certified altitude of 41000 ft.

Long Range Cruise Control

These tables provide target %N1, Long Range Cruise Mach number, IAS and standard day fuel flow per engine for the airplane weight and pressure altitude. As indicated by the shaded area, at optimum altitude .79M approximates the Long Range Cruise Mach schedule.

Long Range Cruise Enroute Fuel and Time

Long Range Cruise Enroute Fuel and Time tables are provided to determine remaining time and fuel required to destination. The data is based on Long Range Cruise and .78/280/250 descent. Tables are presented for low altitudes and high altitudes.

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

APU Operation During Flight

For APU operation during flight, increase fuel flow according to the table in the Engine Inoperative text section.

Long Range Cruise Wind-Altitude Trade

Wind is a factor which may justify operations considerably below optimum altitude. For example, a favorable wind component may have an effect on ground speed which more than compensates for the loss in air range.

Using this table, it is possible to determine the break-even wind (advantage necessary or disadvantage that can be tolerated) to maintain the same range at another altitude and long range cruise speed. The tables make no allowance for climb or descent time, fuel or distance, and are based on comparing ground fuel mileage.

Descent

Time, fuel, and distance for descent are shown for a .78/280/250 descent speed schedule. Enter the table with top of descent pressure altitude and read distance, time and fuel. Data is based on flight idle thrust descent in zero wind. Allowances are included for a straight-in approach with gear down and landing flaps at the outer marker.

Holding

Target %N1, indicated airspeed and fuel flow per engine information is tabulated for holding with flaps up based on the FMC optimum holding speed schedule. This is the higher of the maximum endurance speed and the maneuvering speed. Small variations in airspeed will not appreciably affect the overall endurance time. Enter the table with weight and pressure altitude to read %N1, IAS and fuel flow per engine.

Advisory Information

Normal Configuration Landing Distance

The normal configuration distance tables are provided as advisory information to help determine the actual landing distance performance of the airplane for different runway surface conditions and brake configurations.

Flaps 15, 30, and 40 landing distances and adjustments are provided for dry runways as well as runways with good, medium, and poor reported braking action, which are commonly referred to as slippery runway conditions.

If the surface is affected by water, snow or ice, and the braking action is reported as "good", conditions should not be expected to be as good as on clean, dry runways. The value "good" is comparative and is intended to mean that airplanes should not experience braking or directional control difficulties when landing. The performance level used to calculate the "good" data is consistent with wet runway testing done on early Boeing jets. The performance level used to calculate "poor" data reflects runways covered with wet ice.

Dry runway landing performance is shown for max manual braking configuration and autobrake settings max, 3, 2, and 1. The autobrake performance may be used to assist in the selection of the most desirable autobrake setting for a given field length. Selection of an autobrake setting results in a constant rate of deceleration. Maximum effort manual braking should achieve shorter landing distance than the max autobrake setting. The reference landing distance is a reference distance from 50 ft above the threshold to stop based on a reference landing weight and normal approach speed for the selected landing flap at sea level, zero wind, zero slope, and two engine detent reverse thrust. Subsequent columns provide adjustments for off-reference landing weight, altitude, wind, slope, temperature, speed, and reverse thrust. Each adjustment is independently added to the reference landing distance.

Non-normal Configuration Landing Distance

Advisory information is provided to support non-normal configurations that affect the landing performance of the airplane. Landing distances and adjustments are provided for dry runways and runways with good, medium, and poor reported braking action.

Enter the table with the applicable non-normal configuration and read the normal approach speed. The reference landing distance is a reference distance from 50 ft above the threshold to stop based on a reference landing weight and speed at sea level, zero wind, and zero slope. Subsequent columns provide adjustments for off-reference landing weight, altitude, wind, slope, and speed conditions. Each adjustment is independently added to the reference landing distance. Landing distance includes the effect of reverse thrust.

Recommended Brake Cooling Schedule

Advisory information is provided to assist in avoiding the problems associated with hot brakes. For normal operation, most landings are at weights below the AFM quick turnaround limit weight.

Use of the recommended cooling schedule will help avoid brake overheat and fuse plug problems that could result from repeated landings at short time intervals or a rejected takeoff.

Enter the Recommended Brake Cooling Schedule table with the airplane weight and brakes on speed, adjusted for wind at the appropriate temperature and altitude condition. Instructions for applying wind adjustments are included below the table. Linear interpolation may be used to obtain intermediate values. The resulting number is the reference brake energy per brake in millions of foot-pounds, and represents the amount of energy absorbed by each brake during a rejected takeoff. Notes providing adjustments for wind are included below the table.

To determine the energy per brake absorbed during landing, enter the appropriate Adjusted Brake Energy Per Brake table (No Reverse Thrust or 2 Engine Reverse) with the reference brake energy per brake and the type of braking used during landing (Max Manual, Max Auto, or Autobrake). The resulting number is the adjusted brake energy per brake and represents the energy absorbed in each brake during the landing.

The recommended cooling time is found in the appropriate (steel or carbon brakes) final table by entering with the adjusted brake energy per brake. Times are provided for ground cooling and inflight gear down cooling.

Brake Temperature Monitor System (BTMS) indications are also shown. If brake cooling is determined from the BTMS, use the hottest brake indication 10 to 15 minutes after the airplane has come to a complete stop, or inflight with gear retracted to determine recommended cooling schedule.

Engine Inoperative

Initial Max Continuous %N1

The Initial Max Continuous %N1 setting for use following an engine failure is shown. The table is based on the typical all engine cruise speed of .79M to provide a target %N1 setting at the start of driftdown. Once driftdown is established, the Max Continuous %N1 table should be used to determine %N1 for the given conditions.

Max Continuous %N1

Power setting is based on one engine operating with one A/C pack operating and all anti-ice bleeds off. Enter the table with pressure altitude, TAT, and IAS or Mach to read %N1.

It is desirable to maintain engine thrust level within the limits of the Max Cruise thrust rating. However, where thrust level in excess of Max Cruise rating is required, such as for meeting terrain clearance, ATC altitude assignments, or to attain maximum range capability, it is permissible to use the thrust needed up to the Max Continuous thrust rating. The Max Continuous thrust rating is intended primarily for emergency use at the discretion of the pilot and is the maximum thrust that may be used continuously.

Driftdown Speed/Level Off Altitude

The table shows optimum driftdown speed as a function of cruise weight at start of driftdown. Also shown are the approximate weight and pressure altitude at which the airplane will level off considering 100 ft/min residual rate of climb.

The level off altitude is dependent on air temperature (ISA deviation).

Driftdown/LRC Range Capability

This table shows the range capability from the start of driftdown. Driftdown is continued to level off altitude. As weight decreases due to fuel burn, the airplane is accelerated to Long Range Cruise speed. Cruise is continued at level off altitude and Long Range Cruise speed.

To determine fuel required, enter the Ground to Air Miles Conversion table with the desired ground distance and adjust for anticipated winds to obtain air distance to destination. Then enter the Driftdown/Cruise Fuel and Time table with air distance and weight at start of driftdown to determine fuel and time required. If altitudes other than the level off altitude is used, fuel and time required may be obtained by using the Engine Inoperative Long Range Cruise Enroute Fuel and Time table.

Long Range Cruise Altitude Capability

The table shows the maximum altitude that can be maintained at a given weight and air temperature (ISA deviation), based on Long Range Cruise speed, Max Continuous thrust, and 100 ft/min residual rate of climb.

Long Range Cruise Control

The table provides target %N1, engine inoperative Long Range Cruise Mach number, IAS and fuel flow for the airplane weight and pressure altitude. The fuel flow values in this table reflect single engine fuel burn.

APU Operation During Flight

For APU operation during flight, increase fuel flow according to the following table. These increments include the APU fuel flow and the effect of increased drag from the APU door.

PRESSURE ALTITUDE (1000 FT)	APU FUEL FLOW (KG/HR)
39	45
35	45
31	50
25	60
20	65
15	75
10	85
5	95

Long Range Cruise Diversion Fuel and Time

Tables are provided for crews to determine the fuel and time required to proceed to an alternate airfield with one engine inoperative. The data is based on single engine Long Range Cruise speed and .78/280/250 descent. Enter with Air Distance as determined from the Ground to Air Miles Conversion table and read Fuel and Time required at the cruise pressure altitude. Adjust the fuel obtained for deviation from the reference weight at checkpoint as required by entering the off reference fuel adjustments table with the fuel required for the reference weight and the actual weight at checkpoint. Read fuel required and time for the actual weight.

Holding

Single engine holding data is provided in the same format as the all engine holding data and is based on the same assumptions.

Gear Down Landing Rate of Climb Available

Rate of climb data is provided as guidance information in the event an engine inoperative landing (manual or autoland) is planned. The tables show gear down rate of climb available for Flaps 15 and Flaps 30. Enter the table with TAT and pressure altitude to read rate of climb available. Apply adjustments shown to correct for weight.

Alternate Mode EEC

Introduction

No takeoff speed adjustments or other performance adjustments are required of Electronic Engine Control (EEC) in the alternate mode (ALTN EEC switch illuminated) for the 7B18, -7B20, -7B22, -7B24 and -7B24A engine thrust ratings.

Operation with derate and/or assumed temperature reduced thrust is not permitted with the EEC in alternate mode.

Gear Down

This section contains performance for airplane operation with the landing gear extended. The data is based on engine bleeds for normal air conditioning.

Note: The Flight Management Computer System (FMCS) does not contain special provisions for operation with landing gear extended. As a result, the FMCS may generate inappropriate enroute speed schedules, display non-conservative predictions of fuel burn, estimated time of arrival (ETA), maximum altitude, and compute overly shallow descent path. An accurate estimated time of arrival (ETA) is available if current speed or Mach is entered into the VNAV cruise page.

Tables for gear down performance in this section are identical in format and used in the same manner as tables for the gear up configuration previously described.

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Performance Inflight Chapter PI
Table of Contents Section 20

737-700W CFM56-7B22 KG FAA CATA

General

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

Serial and tabulation number are supplied by Boeing.

Registry Number	Serial Number	Tabulation Number
B-5216	34026	YM482
B-5218	34027	YM483
B-5219	34028	YM484

Intentionally
Blank

Performance Inflight — Chapter PI

General — Section 20

Takeoff Speeds - Dry Runway

Flaps 1 and 5

V1, VR, V2 for Max Takeoff Thrust

WEIGHT (1000 KG)	FLAPS 1			FLAPS 5		
	V1	VR	V2	V1	VR	V2
72	144	146	151	141	143	147
68	140	141	147	136	138	143
64	135	136	143	132	134	139
60	129	131	138	126	128	135
56	124	125	133	121	123	130
52	118	119	128	115	117	126
48	112	113	123	109	112	121
44	106	107	118	103	105	115
40	99	101	113	96	99	110

Check V1(MCG).

V1, VR, V2 Adjustments*

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

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
72	-2	-1	0	2	2	-1	0	0	0	0	1	1	2
68	-2	-1	0	2	2	-1	-1	0	0	0	1	1	1
64	-2	-1	0	1	2	-1	-1	0	0	0	1	1	1
60	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
56	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
52	-1	-1	0	1	1	-1	-1	0	0	0	1	1	1
48	-1	0	0	1	1	-1	-1	0	0	0	1	1	1
44	-1	0	0	1	1	-1	-1	0	0	1	1	1	1
40	0	0	0	1	1	-1	-1	0	0	1	1	1	1

***V1 not to exceed VR.**

Takeoff Speeds - Dry Runway

Flaps 1 and 5

V1(MCG)

Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	98	96					
60	140	98	96	95	93			
50	122	100	98	95	93	91	89	87
40	104	105	103	99	96	92	89	87
30	86	108	108	104	100	97	92	89
20	68	108	108	106	104	101	96	93
-60	-76	110	109	107	105	103	100	98

Flaps 10, 15 and 25

V1, VR, V2 for Max Takeoff Thrust

WEIGHT (1000 KG)	FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2
72	135	135	140						
68	131	131	137	129	129	134	127	127	133
64	126	127	133	125	125	131	123	123	129
60	121	123	129	120	120	127	119	119	126
56	116	118	125	115	116	123	114	114	122
52	111	113	121	110	111	119	109	109	118
48	106	107	117	105	106	115	103	104	114
44	100	102	112	99	100	111	98	99	109
40	95	96	108	93	95	106	92	94	105

Check V1(MCG).

V1, VR, V2 Adjustments*

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

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
72	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
68	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
64	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
60	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
56	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
52	-2	-1	0	1	1	-2	-1	0	0	0	1	1	1
48	-1	-1	0	1	1	-2	-1	0	0	0	1	1	1
44	-1	0	0	1	1	-2	-1	0	0	0	1	1	1
40	-1	0	0	1	1	-2	-1	-1	0	0	1	1	1

***V1 not to exceed VR.**

Takeoff Speeds - Dry Runway
Flaps 10, 15 and 25
V1(MCG)
Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	98	96					
60	140	98	96	95	93			
50	122	100	98	95	93	91	89	87
40	104	105	103	99	96	92	89	87
30	86	108	108	104	100	97	92	89
20	68	108	108	106	104	101	96	93
-60	-76	110	109	107	105	103	100	98

Takeoff Speeds - Wet Runway
Flaps 1 and 5
V1, VR, V2 for Max Takeoff Thrust

WEIGHT (1000 KG)	FLAPS 1			FLAPS 5		
	V1	VR	V2	V1	VR	V2
72	139	146	151	135	143	147
68	133	141	147	130	138	143
64	128	136	143	125	134	139
60	122	131	138	119	128	135
56	116	125	133	113	123	130
52	110	119	128	107	117	126
48	104	113	123	101	112	121
44	97	107	118	94	105	115
40	90	101	113	87	99	110

Check V1(MCG).

V1, VR, V2 Adjustment*

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

Slope and Wind V1 Adjustment*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
72	-4	-2	0	3	5	-3	-1	0	0	1	2	2	3
68	-4	-2	0	2	5	-3	-2	-1	0	1	2	2	3
64	-4	-2	0	2	4	-3	-2	-1	0	1	2	2	3
60	-3	-2	0	2	4	-3	-2	-1	0	1	2	2	3
56	-3	-1	0	2	4	-3	-2	-1	0	1	2	2	3
52	-3	-1	0	2	3	-3	-2	-1	0	1	2	3	3
48	-2	-1	0	2	3	-4	-2	-1	0	1	2	3	4
44	-2	-1	0	2	3	-4	-2	-1	0	1	2	3	4
40	-1	0	0	2	3	-4	-2	-1	0	1	3	4	5

***V1 not to exceed VR.**

V1(MCG)
Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	98	96					
60	140	98	96	95	93			
50	122	100	98	95	93	91	89	87
40	104	105	103	99	96	92	89	87
30	86	108	108	104	100	97	92	89
20	68	108	108	106	104	101	96	93
-60	-76	110	109	107	105	103	100	98

Takeoff Speeds - Wet Runway
Flaps 10, 15 and 25
V1, VR, V2 for Max Takeoff Thrust

WEIGHT (1000 KG)	FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2
72	130	135	140						
68	125	131	137	125	129	134	124	127	133
64	120	127	133	120	125	131	118	123	129
60	115	123	129	114	120	127	113	119	126
56	109	118	125	109	116	123	107	114	122
52	104	113	121	103	111	119	102	109	118
48	98	107	117	97	106	115	96	104	114
44	92	102	112	92	100	111	90	99	110
40	86	96	108	85	95	106	84	94	105

Check V1(MCG).

V1, VR, V2 Adjustment*

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

Slope and Wind V1 Adjustment*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
72	-3	-1	0	2	4	-3	-2	-1	0	1	2	2	3
68	-3	-1	0	2	4	-3	-2	-1	0	1	2	2	3
64	-3	-1	0	2	4	-3	-2	-1	0	1	2	2	3
60	-3	-1	0	2	3	-3	-2	-1	0	1	2	2	3
56	-3	-1	0	2	3	-3	-2	-1	0	1	2	2	3
52	-3	-1	0	2	3	-4	-2	-1	0	1	2	2	3
48	-2	-1	0	1	3	-4	-2	-1	0	1	2	3	3
44	-2	-1	0	1	2	-4	-3	-1	0	1	2	3	4
40	-2	-1	0	1	2	-4	-3	-1	0	1	2	3	4

***V1 not to exceed VR.**

V1(MCG)
Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	98	96					
60	140	98	96	95	93			
50	122	100	98	95	93	91	89	87
40	104	105	103	99	96	92	89	87
30	86	108	108	104	100	97	92	89
20	68	108	108	106	104	101	96	93
-60	-76	110	109	107	105	103	100	98

Maximum Allowable Clearway

FIELD LENGTH (M)	MAX ALLOWABLE CLEARWAY FOR V1 REDUCTION (M)
1200	140
1600	190
2000	230
2400	270
2800	320
3200	360

Clearway and Stopway V1 Adjustments

CLEARWAY MINUS STOPWAY (M)	NORMAL V1 (KIAS)					
	DRY RUNWAY			WET RUNWAY		
	100	120	140	100	120	140
300	-4	-4	-4			
200	-4	-4	-3			
100	-3	-2	-1			
0	0	0	0	0	0	0
-100	1	1	1	3	2	1
-200	1	1	1	4	3	3
-300	1	1	1	4	4	4

Use of clearway not allowed on wet runways.
V1 not to exceed VR.

Stab Trim Setting

Max Takeoff Thrust

Flaps 1 and 5

WEIGHT (1000 KG)	C.G. (%MAC)									
	9	11	13	16	20	24	28	30	32	33
80	8 1/2	8 1/2	8 1/2	7 3/4	7	6 1/4	5 1/2	5	4 3/4	4 1/2
70	8 1/2	8 1/2	8 1/2	7 3/4	7	6	5 1/4	5	4 1/2	4 1/4
60	8 1/2	8 1/4	7 3/4	7 1/4	6 1/4	5 1/2	4 3/4	4 1/2	4	4
50	7 3/4	7 1/2	7	6 1/4	5 3/4	5	4 1/4	4	4	4
45	7	6 3/4	6 1/2	6	5 1/4	4 1/2	4	4	4	4

Flaps 10, 15 and 25

WEIGHT (1000 KG)	C.G. (%MAC)									
	9	11	13	16	20	24	28	30	32	33
80	8 1/2	8 1/2	8 1/2	7 1/2	6 3/4	5 3/4	5	4 1/2	4	4
70	8 1/2	8 1/2	8 1/4	7 1/2	6 1/2	5 3/4	4 3/4	4 1/2	4	4
60	8 1/2	8 1/4	7 3/4	6 3/4	6	5	4 1/4	4	4	4
50	7 1/2	7 1/4	6 3/4	6	5 1/4	4 1/4	4	4	4	4
45	6 3/4	6 1/4	6	5 1/2	4 3/4	4	4	4	4	4

VREF

WEIGHT (1000 KG)	FLAPS		
	40	30	15
85	159	161	167
80	154	156	162
75	149	151	157
70	144	146	152
65	139	141	147
60	133	135	140
55	127	129	134
50	120	123	127
45	114	117	121

Flap Maneuver Speeds

FLAP POSITION	MANEUVER SPEED
UP	VREF40 + 70
1	VREF40 + 50
5	VREF40 + 30
10	VREF40 + 30
15	VREF40 + 20
25	VREF40 + 10
30	VREF30
40	VREF40

ADVISORY INFORMATION

Slush/Standing Water Takeoff

Maximum Reverse Thrust

Weight Adjustments (1000 KG)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-13.2	-16.4	-19.6	-16.3	-19.4	-22.6	-24.2	-27.3	-30.5
85	-11.5	-14.7	-17.9	-14.1	-17.2	-20.4	-20.4	-23.6	-26.8
80	-10.0	-13.1	-16.3	-12.0	-15.2	-18.4	-17.0	-20.2	-23.3
75	-8.6	-11.8	-14.9	-10.2	-13.4	-16.5	-14.0	-17.2	-20.3
70	-7.4	-10.5	-13.7	-8.6	-11.8	-15.0	-11.4	-14.6	-17.8
65	-6.3	-9.5	-12.7	-7.3	-10.5	-13.6	-9.3	-12.5	-15.7
60	-5.4	-8.6	-11.8	-6.2	-9.4	-12.5	-7.7	-10.9	-14.0
55	-4.8	-7.9	-11.1	-5.3	-8.5	-11.7	-6.5	-9.7	-12.8
50	-4.2	-7.4	-10.5	-4.6	-7.8	-11.0	-5.6	-8.8	-12.0
45	-3.7	-6.8	-10.0	-4.0	-7.2	-10.3	-4.8	-8.0	-11.2
40	-3.1	-6.3	-9.5	-3.3	-6.5	-9.7	-4.0	-7.2	-10.4

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1400	31.1			34.0			38.5		
1600	44.9			47.7			52.0	33.6	
1800	59.3	39.8		61.9	42.5		65.9	47.0	
2000	74.3	53.9	34.7	76.8	56.6	37.5	80.1	60.7	42.0
2200	90.1	68.7	48.6	92.3	71.2	51.3	94.7	74.8	55.6
2400		84.1	63.1		86.5	65.7		89.3	69.5
2600			78.3			80.7			83.8
2800			94.2			96.4			98.4

1. **Enter Weight Adjustment table with slush/standing water depth and 22K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -40 m/+35 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
85	-11	-9	-6	-3	-1	0	0	0	0
80	-13	-10	-8	-6	-3	-1	0	0	0
75	-14	-12	-9	-8	-6	-3	0	0	0
70	-15	-13	-10	-11	-8	-6	0	0	0
65	-17	-14	-12	-13	-10	-8	-4	-1	0
60	-18	-15	-13	-15	-12	-10	-7	-4	-2
55	-19	-17	-14	-16	-14	-11	-10	-8	-5
50	-20	-18	-15	-18	-15	-13	-13	-10	-8
45	-21	-19	-16	-20	-17	-15	-15	-13	-10
40	-22	-20	-17	-21	-18	-16	-18	-15	-13

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff

No Reverse Thrust

Weight Adjustments (1000 KG)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-15.6	-18.3	-21.0	-18.6	-21.3	-24.0	-24.9	-27.6	-30.4
85	-13.7	-16.4	-19.1	-16.2	-18.9	-21.6	-21.4	-24.2	-26.9
80	-11.9	-14.7	-17.4	-14.0	-16.7	-19.4	-18.2	-20.9	-23.7
75	-10.4	-13.1	-15.8	-12.0	-14.7	-17.4	-15.4	-18.1	-20.8
70	-9.0	-11.7	-14.4	-10.3	-13.0	-15.7	-13.0	-15.7	-18.4
65	-7.8	-10.5	-13.2	-8.8	-11.5	-14.2	-10.9	-13.6	-16.4
60	-6.8	-9.5	-12.2	-7.5	-10.3	-13.0	-9.2	-12.0	-14.7
55	-6.0	-8.7	-11.4	-6.5	-9.3	-12.0	-8.0	-10.7	-13.4
50	-5.3	-8.0	-10.7	-5.7	-8.5	-11.2	-7.0	-9.7	-12.4
45	-4.6	-7.4	-10.1	-5.0	-7.7	-10.4	-6.1	-8.8	-11.5
40	-4.0	-6.7	-9.4	-4.2	-6.9	-9.6	-5.1	-7.8	-10.6

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1600							33.7		
1800	30.3			37.5			47.9		
2000	46.5			53.2			62.8	39.3	
2200	63.2	36.7		69.4	43.7		78.4	53.8	30.9
2400	80.7	53.1		86.3	59.6	34.4	94.9	68.9	45.0
2600	98.7	70.1	43.2		76.1	50.0		85.0	59.7
2800		87.9	59.8		93.2	66.1			75.2
3000			77.1			82.9			91.6
3200			95.1						

1. **Enter Weight Adjustment table with slush/standing water depth and dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -55 m/+55 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-15	-7	0	-2	0	0	0	0	0
85	-16	-9	-1	-5	0	0	0	0	0
80	-18	-10	-3	-9	-1	0	0	0	0
75	-20	-12	-5	-12	-4	0	0	0	0
70	-21	-13	-6	-15	-7	0	0	0	0
65	-22	-15	-7	-17	-10	-2	-5	0	0
60	-24	-16	-9	-20	-12	-5	-10	-2	0
55	-25	-17	-10	-22	-14	-7	-14	-6	0
50	-26	-19	-11	-24	-16	-9	-17	-10	-2
45	-27	-20	-12	-25	-18	-10	-20	-13	-5
40	-28	-21	-13	-26	-19	-11	-23	-15	-8

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff

Maximum Reverse Thrust

Weight Adjustment (1000 KG)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-1.6	-1.6	-1.6	-6.9	-6.9	-6.9	-11.8	-11.8	-11.8
85	-1.5	-1.5	-1.5	-6.4	-6.4	-6.4	-10.8	-10.8	-10.8
80	-1.3	-1.3	-1.3	-5.9	-5.9	-5.9	-9.8	-9.8	-9.8
75	-1.2	-1.2	-1.2	-5.4	-5.4	-5.4	-9.0	-9.0	-9.0
70	-1.1	-1.1	-1.1	-5.0	-5.0	-5.0	-8.2	-8.2	-8.2
65	-1.1	-1.1	-1.1	-4.7	-4.7	-4.7	-7.6	-7.6	-7.6
60	-1.1	-1.1	-1.1	-4.4	-4.4	-4.4	-7.0	-7.0	-7.0
55	-1.1	-1.1	-1.1	-4.1	-4.1	-4.1	-6.5	-6.5	-6.5
50	-1.2	-1.2	-1.2	-3.9	-3.9	-3.9	-6.1	-6.1	-6.1
45	-1.3	-1.3	-1.3	-3.7	-3.7	-3.7	-5.8	-5.8	-5.8
40	-1.4	-1.4	-1.4	-3.6	-3.6	-3.6	-5.6	-5.6	-5.6

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1200	50.3	32.0							
1400	72.5	53.9	35.5	35.2					
1600	95.0	76.1	57.4	51.3	31.7				
1800		98.7	79.7	68.4	47.6		34.3		
2000				86.9	64.5	44.1	45.1		
2200					82.7	60.7	56.5	36.9	
2400						78.6	68.6	47.8	
2600						97.8	81.6	59.4	39.6
2800							95.6	71.7	50.6
3000								85.0	62.4
3200								99.1	74.9
3400									88.4

1. **Enter Weight Adjustment table with reported braking action and dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust “Good” field length available by -25 m/+25 m for every 5°C above/below 4°C.**
   Adjust “Medium” field length available by -25 m/+25 m for every 5°C above/below 4°C.
   Adjust “Poor” field length available by -40 m/+35 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
85	-4	-2	0	-12	-9	-7	-21	-19	-16
80	-5	-2	0	-13	-10	-8	-23	-20	-18
75	-6	-3	-1	-14	-12	-9	-25	-22	-20
70	-6	-4	-1	-15	-13	-10	-27	-24	-22
65	-7	-5	-2	-17	-14	-12	-28	-26	-23
60	-8	-6	-3	-18	-16	-13	-30	-28	-25
55	-9	-7	-4	-20	-17	-15	-32	-30	-27
50	-10	-8	-5	-21	-19	-16	-34	-31	-29
45	-12	-9	-7	-23	-20	-18	-36	-33	-31
40	-13	-10	-8	-25	-22	-20	-38	-35	-33

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff

No Reverse Thrust

Weight Adjustments (1000 KG)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-2.6	-2.9	-3.3	-9.5	-9.8	-10.2	-15.7	-16.0	-16.4
85	-2.6	-2.9	-3.3	-8.9	-9.3	-9.7	-14.5	-14.9	-15.2
80	-2.6	-2.9	-3.3	-8.4	-8.8	-9.2	-13.4	-13.7	-14.1
75	-2.6	-2.9	-3.3	-8.0	-8.4	-8.7	-12.3	-12.7	-13.0
70	-2.6	-3.0	-3.3	-7.6	-7.9	-8.3	-11.3	-11.7	-12.0
65	-2.6	-3.0	-3.3	-7.2	-7.5	-7.9	-10.3	-10.7	-11.1
60	-2.6	-3.0	-3.3	-6.8	-7.2	-7.5	-9.4	-9.8	-10.2
55	-2.6	-3.0	-3.3	-6.5	-6.8	-7.2	-8.6	-9.0	-9.3
50	-2.6	-3.0	-3.3	-6.2	-6.5	-6.9	-7.8	-8.2	-8.5
45	-2.6	-3.0	-3.3	-5.9	-6.3	-6.6	-7.1	-7.4	-7.8
40	-2.6	-3.0	-3.3	-5.6	-6.0	-6.4	-6.4	-6.7	-7.1

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT(FT)			PRESS ALT(FT)			PRESS ALT(FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1400	52.8								
1600	80.5								
1800		51.2							
2000		79.3		39.8					
2200			49.6	68.4					
2400			78.0	94.0	56.0				
2600					82.8	42.9			
2800						71.1			
3000						96.5			
3200							46.7		
3400							68.1	43.5	
3600							89.5	64.9	40.3
3800								86.3	61.7
4000									83.0

1. **Enter Weight Adjustment table with reported braking action and dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust “Good” field length available by -35 m/+35 m for every 5°C above/below 4°C.**
   Adjust “Medium” field length available by -35 m/+35 m for every 5°C above/below 4°C.
   Adjust “Poor” field length available by -55 m/+55 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-8	-3	0	-18	-13	-8	-31	-26	-21
85	-8	-3	0	-19	-14	-9	-34	-29	-24
80	-8	-3	0	-19	-14	-9	-37	-32	-27
75	-8	-3	0	-21	-16	-11	-40	-35	-30
70	-9	-4	0	-23	-18	-13	-43	-38	-33
65	-11	-6	-1	-25	-20	-15	-47	-42	-37
60	-12	-7	-2	-28	-23	-18	-50	-45	-40
55	-14	-9	-4	-31	-26	-21	-54	-49	-44
50	-17	-12	-7	-35	-30	-25	-58	-53	-48
45	-20	-15	-10	-39	-34	-29	-62	-57	-52
40	-24	-19	-14	-44	-39	-34	-66	-61	-56

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Takeoff %N1

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

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
60	87.7	88.3	88.7	88.8	88.9	89.1	89.2	89.2	89.1	88.6	88.3	88.7	89.2
55	88.5	89.1	89.5	89.7	89.8	89.9	90.0	90.0	90.0	89.5	89.0	88.8	88.6
50	89.3	89.8	90.4	90.5	90.6	90.7	90.9	90.8	90.8	90.4	89.9	89.7	89.6
45	90.2	90.7	91.2	91.3	91.4	91.5	91.7	91.6	91.6	91.2	90.8	90.7	90.5
40	91.1	91.6	92.1	92.2	92.3	92.4	92.5	92.4	92.4	92.1	91.7	91.6	91.5
35	91.9	92.5	93.0	93.1	93.2	93.2	93.3	93.3	93.2	92.9	92.5	92.5	92.4
30	91.5	92.6	93.8	93.9	94.0	94.0	94.1	94.0	93.9	93.7	93.4	93.3	93.2
25	90.8	91.9	93.1	93.7	94.4	94.8	94.9	94.8	94.8	94.4	94.0	94.0	94.0
20	90.0	91.1	92.3	93.0	93.6	94.3	95.0	95.6	95.6	95.3	94.9	94.8	94.7
15	89.3	90.4	91.6	92.2	92.8	93.6	94.3	94.8	95.3	95.9	96.1	95.9	95.5
10	88.5	89.6	90.8	91.4	92.1	92.8	93.5	94.0	94.5	95.1	95.7	96.4	97.1
5	87.8	88.9	90.0	90.7	91.3	92.0	92.7	93.2	93.7	94.3	94.9	95.6	96.3
0	87.0	88.1	89.2	89.9	90.5	91.2	91.9	92.4	92.9	93.5	94.1	94.8	95.5
-5	86.2	87.3	88.4	89.1	89.7	90.4	91.1	91.6	92.1	92.7	93.3	94.0	94.7
-10	85.4	86.5	87.6	88.3	88.9	89.6	90.3	90.8	91.3	91.9	92.5	93.2	93.9
-15	84.6	85.7	86.8	87.5	88.1	88.8	89.4	90.0	90.5	91.1	91.7	92.4	93.1
-20	83.8	84.9	86.0	86.6	87.3	87.9	88.6	89.1	89.7	90.3	90.8	91.6	92.3
-25	83.0	84.1	85.2	85.8	86.4	87.1	87.8	88.3	88.8	89.4	90.0	90.7	91.5
-30	82.2	83.3	84.4	85.0	85.6	86.3	86.9	87.4	88.0	88.6	89.2	89.9	90.6
-35	81.4	82.4	83.5	84.1	84.7	85.4	86.1	86.6	87.1	87.7	88.3	89.0	89.8
-40	80.6	81.6	82.7	83.3	83.9	84.5	85.2	85.7	86.2	86.8	87.4	88.2	88.9
-45	79.7	80.7	81.8	82.4	83.0	83.7	84.3	84.8	85.3	86.0	86.6	87.3	88.0
-50	78.9	79.9	80.9	81.5	82.1	82.8	83.4	83.9	84.5	85.1	85.7	86.4	87.2

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.9	0.9	0.9

Assumed Temperature Reduced Thrust

Maximum Assumed Temperature (Table 1 of 3)

Based on 25% Takeoff Thrust Reduction

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
55	73	71	69	67								
50	73	71	69	67	65	63						
45	73	71	69	67	65	63	61	59	57			
40	72	71	69	67	65	63	61	59	57	55		
35	66	66	66	66	65	63	61	59	57	55	53	
30	63	61	61	61	61	61	61	59	57	55	53	51
25	63	61	59	57	56	56	56	56	56	55	53	51
20	63	61	59	57	55	53	51	51	51	50	50	50
15	63	61	59	57	55	53	51	50	47	45	45	45
10 & BELOW	63	61	59	57	55	53	51	50	47	45	43	41

Takeoff %N1 (Table 2 of 3)

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

ASSUMED TEMP (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
75	85.7	86.0	86.7	87.4	88.2	88.9	89.5	90.1	90.2	90.2	90.6	91.1
70	86.6	87.0	87.1	87.1	87.5	88.3	88.9	89.4	89.5	89.6	90.0	90.4
65	87.4	87.8	88.0	88.0	88.2	88.3	88.3	88.8	88.9	88.9	89.4	89.8
60	88.3	88.7	88.8	88.9	89.1	89.2	89.2	89.1	88.6	88.3	88.7	89.2
55	89.1	89.5	89.7	89.8	89.9	90.0	90.0	90.0	89.5	89.0	88.8	88.6
50	89.8	90.4	90.5	90.6	90.7	90.9	90.8	90.8	90.4	89.9	89.7	89.6
45	90.7	91.2	91.3	91.4	91.5	91.7	91.6	91.6	91.2	90.8	90.7	90.5
40	91.6	92.1	92.2	92.3	92.4	92.5	92.4	92.4	92.1	91.7	91.6	91.5
35	92.5	93.0	93.1	93.2	93.2	93.3	93.3	93.2	92.9	92.5	92.5	92.4
30	92.6	93.8	93.9	94.0	94.0	94.1	94.0	93.9	93.7	93.4	93.3	93.2
25	91.9	93.1	93.7	94.4	94.8	94.9	94.8	94.8	94.4	94.0	94.0	94.0
20	91.1	92.3	93.0	93.6	94.3	95.0	95.6	95.6	95.3	94.9	94.8	94.7
15	90.4	91.6	92.2	92.8	93.6	94.3	94.8	95.3	95.9	96.1	95.9	95.5
10	89.6	90.8	91.4	92.1	92.8	93.5	94.0	94.5	95.1	95.7	96.4	97.1
MINIMUM ASSUMED TEMP (°C)	32	30	28	26	24	22	20	18	16	15	12	10

With engine bleed for packs off, increase %N1 by 0.9.

Assumed Temperature Reduced Thrust

%N1 Adjustment for Temperature Difference (Table 3 of 3)

ASSUMED TEMP MINUS OAT (°C)	OUTSIDE AIR TEMPERATURE (°C)													
	-40	-20	0	5	10	15	20	25	30	35	40	45	50	55
110	11.6													
100	10.3	7.9												
90	10.8	8.4												
80	12.2	7.1	5.0											
70	11.0	7.6	5.4	5.2	3.5									
60	9.6	9.0	4.1	4.0	3.9	3.8	2.1							
50	8.0	7.7	4.5	2.8	2.6	2.7	2.6	2.4	0.8					
40		6.2	5.9	4.7	3.0	2.6	2.7	2.8	2.6	2.5	2.9			
30		4.7	4.6	4.5	4.4	4.2	4.1	4.0	4.0	3.9	3.8	3.7	3.6	
20			3.1	3.0	3.0	3.0	2.9	2.8	2.7	2.7	2.6	2.6	2.5	2.4
10			1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.3	1.3	1.3
0			0	0	0	0	0	0	0	0	0	0	0	0

1. **Determine Maximum Assumed Temperature allowed from Table 1.**
2. **Find Maximum %N1 from Table 2 using the desired assumed temperature (no greater than temperature from Table 1).**
3. **Use the difference between assumed temperature and OAT to determine the %N1 adjustment from Table 3.**
4. **Subtract %N1 adjustment from Maximum %N1 in Table 2.**

Takeoff Speeds - Dry Runway (20K Derate)
Flaps 1 and 5
V1, VR, V2

WEIGHT (1000 KG)	FLAPS 1			FLAPS 5		
	V1	VR	V2	V1	VR	V2
72	146	147	150			
68	142	143	147	140	140	143
64	138	138	142	134	135	139
60	132	133	138	129	130	135
56	126	127	133	124	125	130
52	120	121	128	118	119	125
48	114	115	123	112	113	120
44	108	109	118	106	107	115
40	101	102	112	99	101	110

Check V1(MCG).

V1, VR, V2 Adjustments*

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

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
72	-2	-1	0	1	1	-1	0	0	0	0	1	1	1
68	-2	-1	0	1	1	-1	0	0	0	0	1	1	1
64	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
60	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
56	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
52	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
48	-1	0	0	1	1	-1	-1	0	0	0	1	1	1
44	-1	0	0	1	1	-1	-1	0	0	0	1	1	1
40	0	0	0	1	1	-1	0	0	0	0	1	1	1

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	93	91					
60	140	93	91	92	93			
50	122	95	93	92	93	91	88	84
40	104	100	98	97	96	92	88	84
30	86	103	103	102	101	97	92	86
20	68	103	103	102	101	99	96	90
-60	-76	105	104	104	102	100	97	95

Takeoff Speeds - Dry Runway (20K Derate)

Flaps 10, 15 and 25

V1, VR, V2

WEIGHT (1000 KG)	FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2
64	128	129	133	126	126	130			
60	123	124	129	121	121	126	120	120	125
56	118	119	125	117	117	122	115	115	121
52	113	114	121	112	112	118	110	111	117
48	108	109	116	107	107	114	105	106	113
44	102	103	112	101	102	110	100	100	109
40	96	98	107	95	96	105	94	95	104

Check V1(MCG).

V1, VR, V2 Adjustments*

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

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
64	-2	-1	0	0	0	-1	-1	0	0	0	0	0	0
60	-2	-1	0	0	0	-1	-1	0	0	0	0	0	0
56	-2	-1	0	0	0	-1	-1	0	0	0	0	0	0
52	-2	-1	0	0	0	-1	-1	0	0	0	0	0	0
48	-1	-1	0	0	1	-1	-1	0	0	0	0	0	0
44	-1	0	0	1	1	-2	-1	0	0	0	1	1	1
40	-1	0	0	1	1	-2	-1	0	0	0	1	1	1

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	93	91					
60	140	93	91	92	93			
50	122	95	93	92	93	91	88	84
40	104	100	98	97	96	92	88	84
30	86	103	103	102	101	97	92	86
20	68	103	103	102	101	99	96	90
-60	-76	105	104	104	102	100	97	95

Takeoff Speeds - Wet Runway (20K Derate)

Flaps 1 and 5

V1, VR, V2

WEIGHT (1000 KG)	FLAPS 1			FLAPS 5		
	V1	VR	V2	V1	VR	V2
72	142	147	150			
68	137	143	147	134	140	143
64	131	138	142	128	135	139
60	126	133	138	122	130	135
56	120	127	133	117	125	130
52	113	121	128	110	119	125
48	107	115	123	104	113	120
44	100	109	118	97	107	115
40	93	102	112	91	101	110

Check V1(MCG).

V1, VR, V2 Adjustments*

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

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
72	-4	-2	0	3	5	-2	-1	0	0	1	2	2	3
68	-4	-2	0	3	5	-2	-1	-1	0	1	2	2	3
64	-4	-2	0	2	4	-3	-2	-1	0	1	1	2	3
60	-3	-2	0	2	4	-3	-2	-1	0	1	1	2	3
56	-3	-1	0	2	4	-3	-2	-1	0	1	2	2	3
52	-3	-1	0	2	3	-3	-2	-1	0	1	2	2	3
48	-2	-1	0	2	3	-3	-2	-1	0	1	2	3	3
44	-2	-1	0	2	3	-3	-2	-1	0	1	2	3	4
40	-1	0	0	2	3	-4	-2	-1	0	1	2	3	4

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	93	91					
60	140	93	91	92	93			
50	122	95	93	92	93	91	88	84
40	104	100	98	97	96	92	88	84
30	86	103	103	102	101	97	92	86
20	68	103	103	102	101	99	96	90
-60	-76	105	104	104	102	100	97	95

Takeoff Speeds - Wet Runway (20K Derate)
Flaps 10, 15 and 25
V1, VR, V2

WEIGHT (1000 KG)	FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2
64	123	129	133	124	126	130			
60	118	124	129	118	121	126	116	120	125
56	112	119	125	112	117	122	111	115	121
52	107	114	121	106	112	118	105	111	117
48	101	109	116	100	107	114	99	106	113
44	95	103	112	94	102	110	93	100	109
40	89	98	107	88	96	105	87	95	104

Check V1(MCG).

V1, VR, V2 Adjustments*

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

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
64	-3	-1	0	2	4	-3	-2	-1	0	1	1	2	3
60	-3	-1	0	2	3	-3	-2	-1	0	1	1	2	3
56	-3	-1	0	2	3	-3	-2	-1	0	1	1	2	3
52	-3	-1	0	2	3	-3	-2	-1	0	1	2	2	3
48	-2	-1	0	1	3	-3	-2	-1	0	1	2	2	3
44	-2	-1	0	1	3	-4	-2	-1	0	1	2	3	3
40	-2	-1	0	1	2	-4	-2	-1	0	1	2	3	4

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	93	91					
60	140	93	91	92	93			
50	122	95	93	92	93	91	88	84
40	104	100	98	97	96	92	88	84
30	86	103	103	102	101	97	92	86
20	68	103	103	102	101	99	96	90
-60	-76	105	104	104	102	100	97	95

Maximum Allowable Clearway (20K Derate)

FIELD LENGTH (M)	MAX ALLOWABLE CLEARWAY FOR V1 REDUCTION (M)
1200	140
1800	200
2400	250
3000	310
3600	430
4200	470

Clearway and Stopway V1 Adjustments (20K Derate)

CLEARWAY MINUS STOPWAY (M)	NORMAL V1 (KIAS)					
	DRY RUNWAY			WET RUNWAY		
	100	120	140	100	120	140
300	-4	-4	-3			
200	-4	-4	-3			
100	-3	-2	-2			
0	0	0	0	0	0	0
-100	1	0	0	3	2	1
-200	1	0	0	4	3	2
-300	1	0	0	4	3	2

Use of clearway not allowed on wet runways.
V1 not to exceed VR.

Stab Trim Setting (20K Derate)

Flaps 1 and 5

WEIGHT (1000 KG)	C.G. (%MAC)									
	9	11	13	16	20	24	27	30	32	33
80	8 1/2	8 1/2	8 1/2	8 1/4	7 1/2	6 3/4	6	5 1/2	5	5
70	8 1/2	8 1/2	8 1/2	8	7 1/4	6 1/2	6	5 1/4	5	4 3/4
60	8 1/2	8 1/2	8	7 1/2	6 3/4	6	5 1/4	4 3/4	4 1/4	4
50	8	7 3/4	7 1/4	6 3/4	6	5 1/4	4 1/2	4	4	4
45	7 3/4	7 1/4	6 3/4	6 1/4	5 1/2	4 3/4	4 1/4	4	4	4

Flaps 10, 15 and 25

WEIGHT (1000 KG)	C.G. (%MAC)									
	9	11	13	16	20	24	27	30	32	33
80	8 1/2	8 1/2	8 1/2	7 3/4	6 3/4	5 3/4	5 1/4	4 1/2	4 1/4	4
70	8 1/2	8 1/2	8 1/4	7 1/2	6 3/4	5 3/4	5 1/4	4 1/2	4	4
60	8 1/2	8 1/4	7 3/4	7	6 1/4	5 1/2	4 3/4	4	4	4
50	8	7 1/2	7	6 1/4	5 1/2	4 3/4	4 1/4	4	4	4
45	7 1/4	6 3/4	6 1/2	6	5 1/4	4 1/2	4	4	4	4

ADVISORY INFORMATION

Slush/Standing Water Takeoff (20K Derate)

Maximum Reverse Thrust

Weight Adjustments (1000 KG)

20K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-15.5	-17.8	-20.1	-19.0	-21.3	-23.6	-29.9	-32.1	-34.4
85	-13.3	-15.5	-17.8	-16.2	-18.5	-20.7	-24.9	-27.1	-29.4
80	-11.2	-13.4	-15.7	-13.6	-15.8	-18.1	-20.2	-22.5	-24.8
75	-9.3	-11.6	-13.9	-11.3	-13.5	-15.8	-16.3	-18.5	-20.8
70	-7.8	-10.1	-12.3	-9.3	-11.6	-13.8	-13.0	-15.2	-17.5
65	-6.5	-8.8	-11.1	-7.7	-9.9	-12.2	-10.3	-12.5	-14.8
60	-5.5	-7.8	-10.0	-6.4	-8.6	-10.9	-8.2	-10.5	-12.8
55	-4.8	-7.0	-9.3	-5.4	-7.7	-10.0	-6.9	-9.1	-11.4
50	-4.2	-6.5	-8.8	-4.7	-7.0	-9.3	-6.0	-8.3	-10.5
45	-3.7	-6.0	-8.3	-4.1	-6.3	-8.6	-5.2	-7.4	-9.7
40	-3.2	-5.5	-7.7	-3.4	-5.7	-7.9	-4.3	-6.6	-8.9

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1200							30.7		
1400	37.9			40.3			44.1		
1600	52.8			55.1	30.7		58.6	35.0	
1800	68.4	42.7		70.5	45.0		74.5	48.7	
2000	84.7	57.8	32.8	86.7	60.0	35.3	92.2	63.6	39.3
2200		73.6	47.5		75.6	49.8		80.1	53.4
2400		90.2	62.9		92.1	65.0		98.2	68.7
2600			78.9			80.9			85.9
2800			95.6			97.5			

1. **Enter Weight Adjustment table with slush/standing water depth and 20K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -35 m/+30 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (20K Derate)
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-7	-2	0	0	0	0	0	0	0
85	-9	-4	0	0	0	0	0	0	0
80	-10	-5	0	-1	0	0	0	0	0
75	-12	-7	-2	-4	0	0	0	0	0
70	-13	-8	-3	-7	-2	0	0	0	0
65	-14	-9	-4	-9	-4	0	0	0	0
60	-15	-10	-5	-12	-7	-2	-3	0	0
55	-17	-12	-7	-14	-9	-4	-7	-2	0
50	-18	-13	-8	-16	-11	-6	-10	-5	0
45	-19	-14	-9	-17	-12	-7	-13	-8	-3
40	-20	-15	-10	-18	-13	-8	-15	-10	-5

1. **Obtain V1, VR and V2 for the actual weight using the 20K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (20K Derate)

No Reverse Thrust

Weight Adjustments (1000 KG)

20K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-18.0	-20.3	-22.6	-21.6	-23.8	-26.1	-30.2	-32.5	-34.7
85	-15.5	-17.8	-20.1	-18.5	-20.8	-23.0	-25.5	-27.8	-30.1
80	-13.2	-15.5	-17.8	-15.6	-17.9	-20.2	-21.2	-23.5	-25.8
75	-11.2	-13.5	-15.7	-13.1	-15.4	-17.7	-17.5	-19.8	-22.1
70	-9.5	-11.7	-14.0	-11.0	-13.3	-15.5	-14.4	-16.6	-18.9
65	-8.0	-10.3	-12.6	-9.2	-11.5	-13.8	-11.8	-14.0	-16.3
60	-6.9	-9.1	-11.4	-7.8	-10.1	-12.3	-9.8	-12.0	-14.3
55	-6.0	-8.3	-10.6	-6.7	-9.0	-11.2	-8.3	-10.6	-12.8
50	-5.4	-7.7	-9.9	-5.9	-8.2	-10.5	-7.3	-9.6	-11.9
45	-4.8	-7.1	-9.3	-5.2	-7.4	-9.7	-6.4	-8.6	-10.9
40	-4.2	-6.4	-8.7	-4.4	-6.7	-8.9	-5.4	-7.7	-10.0

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1600				32.2			41.7		
1800	42.9			48.8			57.5	30.2	
2000	60.9			66.1	35.0		77.5	44.2	
2200	79.3	45.9		84.3	51.7			60.6	32.6
2400	98.0	64.0	31.1		69.1	37.8		81.7	46.8
2600		82.4	49.0		87.6	54.6			63.7
2800			67.1			72.2			86.2
3000			85.6			90.7			

1. **Enter Weight Adjustment table with slush/standing water depth and 20K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -40 m/+35 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (20K Derate)
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-10	-5	0	0	0	0	0	0	0
85	-12	-7	-2	0	0	0	0	0	0
80	-14	-9	-4	-2	0	0	0	0	0
75	-16	-11	-6	-6	-1	0	0	0	0
70	-18	-13	-8	-10	-5	0	0	0	0
65	-19	-14	-9	-13	-8	-3	0	0	0
60	-21	-16	-11	-16	-11	-6	-4	0	0
55	-22	-17	-12	-19	-14	-9	-9	-4	0
50	-23	-18	-13	-21	-16	-11	-14	-9	-4
45	-24	-19	-14	-22	-17	-12	-17	-12	-7
40	-25	-20	-15	-24	-19	-14	-19	-14	-9

1. **Obtain V1, VR and V2 for the actual weight using the 20K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (20K Derate)

Maximum Reverse Thrust

Weight Adjustment (1000 KG)

20K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-2.1	-2.1	-2.1	-7.8	-7.8	-7.8	-12.4	-12.4	-12.4
85	-1.8	-1.8	-1.8	-7.0	-7.0	-7.0	-11.2	-11.2	-11.2
80	-1.6	-1.6	-1.6	-6.3	-6.3	-6.3	-10.2	-10.2	-10.2
75	-1.4	-1.4	-1.4	-5.6	-5.6	-5.6	-9.2	-9.2	-9.2
70	-1.3	-1.3	-1.3	-5.1	-5.1	-5.1	-8.4	-8.4	-8.4
65	-1.1	-1.1	-1.1	-4.6	-4.6	-4.6	-7.6	-7.6	-7.6
60	-1.1	-1.1	-1.1	-4.3	-4.3	-4.3	-7.0	-7.0	-7.0
55	-1.1	-1.1	-1.1	-4.0	-4.0	-4.0	-6.4	-6.4	-6.4
50	-1.1	-1.1	-1.1	-3.8	-3.8	-3.8	-6.0	-6.0	-6.0
45	-1.1	-1.1	-1.1	-3.7	-3.7	-3.7	-5.6	-5.6	-5.6
40	-1.3	-1.3	-1.3	-3.7	-3.7	-3.7	-5.4	-5.4	-5.4

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1000	34.4								
1200	56.6	31.0							
1400	78.9	53.3		41.2					
1600		75.5	49.9	58.2	33.7				
1800		97.9	72.2	76.3	50.5		39.3		
2000			94.5	95.7	68.0	42.9	51.0		
2200					86.8	60.0	63.3	39.6	
2400						78.2	76.4	51.3	
2600						97.6	90.6	63.6	39.9
2800								76.8	51.6
3000								91.0	63.9
3200									77.1
3400									91.3

1. **Enter Weight Adjustment table with reported braking action and 20K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust “Good” field length available by -25 m/+25 m for every 5°C above/below 4°C.
Adjust “Medium” field length available by -25 m/+25 m for every 5°C above/below 4°C.
Adjust “Poor” field length available by -40 m/+35 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (20K Derate)
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-6	-3	-1	-11	-8	-6	-18	-15	-13
85	-5	-3	0	-11	-9	-6	-19	-17	-14
80	-5	-3	0	-12	-9	-7	-20	-18	-15
75	-6	-3	-1	-13	-10	-8	-22	-19	-17
70	-6	-3	-1	-14	-11	-9	-23	-21	-18
65	-6	-4	-1	-15	-12	-10	-25	-23	-20
60	-7	-5	-2	-16	-13	-11	-27	-24	-22
55	-8	-5	-3	-17	-15	-12	-29	-26	-24
50	-9	-6	-4	-19	-16	-14	-31	-28	-26
45	-10	-8	-5	-20	-18	-15	-33	-30	-28
40	-12	-9	-7	-22	-20	-17	-35	-32	-30

1. **Obtain V1, VR and V2 for the actual weight using the 20K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (20K Derate)

No Reverse Thrust

Weight Adjustments (1000 KG)

20K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-3.0	-3.0	-3.0	-9.8	-9.8	-9.8	-15.2	-15.2	-15.2
85	-2.7	-2.7	-2.7	-8.8	-8.8	-8.8	-13.9	-13.9	-13.9
80	-2.4	-2.4	-2.4	-8.0	-8.0	-8.0	-12.6	-12.6	-12.6
75	-2.2	-2.2	-2.2	-7.2	-7.2	-7.2	-11.5	-11.5	-11.5
70	-2.0	-2.0	-2.0	-6.5	-6.5	-6.5	-10.4	-10.4	-10.4
65	-1.8	-1.8	-1.8	-6.0	-6.0	-6.0	-9.5	-9.5	-9.5
60	-1.7	-1.7	-1.7	-5.5	-5.5	-5.5	-8.7	-8.7	-8.7
55	-1.7	-1.7	-1.7	-5.2	-5.2	-5.2	-8.0	-8.0	-8.0
50	-1.7	-1.7	-1.7	-4.9	-4.9	-4.9	-7.4	-7.4	-7.4
45	-1.7	-1.7	-1.7	-4.8	-4.8	-4.8	-6.9	-6.9	-6.9
40	-1.8	-1.8	-1.8	-4.7	-4.7	-4.7	-6.5	-6.5	-6.5

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1200	48.8								
1400	72.9	45.2							
1600	96.2	69.3	41.5	35.3					
1800		92.7	65.7	56.5					
2000			89.2	78.1	45.3				
2200					66.7	34.2			
2400					88.6	55.4	35.0		
2600						77.0	50.2		
2800						99.1	66.0	31.9	
3000							82.6	47.1	
3200							99.9	62.8	
3400								79.2	44.0
3600								96.4	59.6
3800									75.8
4000									92.9

1. **Enter Weight Adjustment table with reported braking action and 20K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust “Good” field length available by -30 m/+25 m for every 5°C above/below 4°C.
Adjust “Medium” field length available by -30 m/+25 m for every 5°C above/below 4°C.
Adjust “Poor” field length available by -50 m/+45 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (20K Derate)
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-7	-4	-2	-12	-10	-7	-24	-21	-19
85	-6	-4	-1	-13	-11	-8	-26	-24	-21
80	-6	-4	-1	-15	-12	-10	-28	-26	-23
75	-7	-4	-2	-16	-13	-11	-30	-28	-25
70	-7	-5	-2	-17	-15	-12	-33	-30	-28
65	-8	-5	-3	-19	-16	-14	-35	-32	-30
60	-9	-6	-4	-20	-18	-15	-37	-35	-32
55	-10	-7	-5	-22	-20	-17	-39	-37	-34
50	-11	-9	-6	-24	-22	-19	-42	-39	-37
45	-13	-10	-8	-26	-24	-21	-44	-41	-39
40	-14	-12	-9	-28	-26	-23	-46	-44	-41

1. **Obtain V1, VR and V2 for the actual weight using the 20K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Takeoff %N1 (20K Derate)

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

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
60	84.0	84.4	84.7	86.1	87.3	88.1	89.1	89.3	89.5	88.8	88.2	87.9	87.5
55	84.8	85.3	85.8	87.0	88.1	89.0	90.0	90.1	90.3	89.6	88.8	87.9	86.9
50	85.8	86.3	86.8	87.9	88.9	89.8	90.8	90.9	91.0	90.3	89.6	88.7	87.7
45	86.8	87.2	87.7	88.7	89.7	90.7	91.7	91.7	91.7	91.1	90.4	89.5	88.6
40	87.7	88.2	88.6	89.7	90.6	91.6	92.5	92.4	92.4	91.8	91.2	90.3	89.4
35	88.6	89.0	89.5	90.6	91.5	92.4	93.4	93.3	93.2	92.5	91.9	91.0	90.1
30	88.2	89.3	90.5	91.4	92.5	93.3	94.3	94.1	94.0	93.4	92.7	91.8	90.9
25	87.5	88.6	89.7	90.7	91.8	92.7	93.8	94.2	94.7	94.2	93.5	92.6	91.7
20	86.8	87.9	89.0	90.0	91.1	91.9	93.0	93.4	93.9	94.5	94.3	93.4	92.5
15	86.0	87.2	88.3	89.3	90.3	91.2	92.2	92.6	93.1	93.7	94.2	94.2	93.4
10	85.3	86.4	87.5	88.5	89.6	90.4	91.5	91.9	92.3	92.9	93.4	93.7	94.3
5	84.6	85.7	86.8	87.7	88.8	89.6	90.7	91.1	91.6	92.1	92.6	92.9	93.5
0	83.8	84.9	86.0	87.0	88.0	88.9	89.9	90.3	90.8	91.4	91.8	92.1	92.7
-5	83.1	84.2	85.2	86.2	87.2	88.1	89.1	89.5	90.0	90.5	91.0	91.3	91.9
-10	82.3	83.4	84.5	85.4	86.4	87.3	88.3	88.7	89.2	89.7	90.2	90.5	91.0
-15	81.6	82.6	83.7	84.6	85.6	86.5	87.5	87.9	88.3	88.9	89.3	89.7	90.2
-20	80.8	81.8	82.9	83.8	84.8	85.7	86.7	87.0	87.5	88.1	88.5	88.8	89.4
-25	80.0	81.1	82.1	83.0	84.0	84.8	85.8	86.2	86.7	87.3	87.7	88.0	88.5
-30	79.2	80.3	81.3	82.2	83.2	84.0	85.0	85.4	85.8	86.4	86.8	87.2	87.7
-35	78.4	79.5	80.5	81.4	82.4	83.2	84.1	84.5	85.0	85.6	86.0	86.3	86.8
-40	77.6	78.6	79.6	80.6	81.5	82.3	83.3	83.7	84.1	84.7	85.1	85.4	86.0
-45	76.8	77.8	78.8	79.7	80.7	81.5	82.4	82.8	83.3	83.8	84.2	84.5	85.1
-50	76.0	77.0	78.0	78.9	79.8	80.6	81.6	81.9	82.4	82.9	83.3	83.7	84.2

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.9	0.9	0.9

Assumed Temperature Reduced Thrust (20K Derate)

Maximum Assumed Temperature (Table 1 of 3)

Based on 25% Takeoff Thrust Reduction

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
55	73	71	69	67								
50	73	71	69	67	65	63						
45	73	71	69	67	65	63	61	59	57			
40	69	68	69	67	65	63	61	59	57	55		
35	64	63	65	66	65	63	61	59	57	55	53	
30	61	59	60	61	61	61	61	59	57	55	53	51
25	61	59	60	60	60	60	59	58	57	55	53	51
20	61	59	60	60	60	60	59	58	53	51	52	51
15	61	59	60	60	60	60	59	58	53	49	46	46
10 & BELOW	61	59	60	60	60	60	59	58	53	49	45	40

Takeoff %N1 (Table 2 of 3)

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

ASSUMED TEMP (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
75	81.4	81.5	84.0	85.8	87.2	88.8	89.7	90.6	90.4	90.1	89.8	89.4
70	82.5	82.6	84.3	85.5	86.6	88.2	89.1	89.9	89.7	89.5	89.2	88.8
65	83.4	83.7	85.2	86.4	87.2	88.2	88.5	89.3	89.1	88.9	88.6	88.1
60	84.4	84.7	86.1	87.3	88.1	89.1	89.3	89.5	88.8	88.2	87.9	87.5
55	85.3	85.8	87.0	88.1	89.0	90.0	90.1	90.3	89.6	88.8	87.9	86.9
50	86.3	86.8	87.9	88.9	89.8	90.8	90.9	91.0	90.3	89.6	88.7	87.7
45	87.2	87.7	88.7	89.7	90.7	91.7	91.7	91.7	91.1	90.4	89.5	88.6
40	88.2	88.6	89.7	90.6	91.6	92.5	92.4	92.4	91.8	91.2	90.3	89.4
35	89.0	89.5	90.6	91.5	92.4	93.4	93.3	93.2	92.5	91.9	91.0	90.1
30	89.3	90.5	91.4	92.5	93.3	94.3	94.1	94.0	93.4	92.7	91.8	90.9
25	88.6	89.7	90.7	91.8	92.7	93.8	94.2	94.7	94.2	93.5	92.6	91.7
20	87.9	89.0	90.0	91.1	91.9	93.0	93.4	93.9	94.5	94.3	93.4	92.5
15	87.2	88.3	89.3	90.3	91.2	92.2	92.6	93.1	93.7	94.2	94.2	93.4
10	86.4	87.5	88.5	89.6	90.4	91.5	91.9	92.3	92.9	93.4	93.7	94.3
MINIMUM ASSUMED TEMP (°C)	32	30	30	30	29	29	27	25	21	18	14	10

With engine bleed for packs off, increase %N1 by 0.9.

Assumed Temperature Reduced Thrust (20K Derate)

%N1 Adjustment for Temperature Difference (Table 3 of 3)

ASSUMED TEMP MINUS OAT (°C)	OUTSIDE AIR TEMPERATURE (°C)													
	-40	-20	0	5	10	15	20	25	30	35	40	45	50	55
110	11.2													
100	10.3	6.0												
90	10.5	8.2												
80	11.8	7.1	3.2											
70	10.7	7.4	5.3	3.6	1.8									
60	9.2	8.7	4.1	4.0	3.9	2.2	0.5							
50	7.8	7.5	4.3	2.7	2.6	3.7	2.7	0.9	0.5					
40		6.0	5.7	4.4	2.8	2.9	3.3	3.1	1.4	1.1	0.8			
30		4.6	4.4	4.3	4.2	4.1	4.0	3.9	3.5	3.3	3.0	2.8	3.4	
20			3.0	2.9	2.9	2.9	2.8	2.7	2.6	2.6	2.5	2.5	2.4	2.3
10			1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.3	1.3	1.3	1.2	1.2
0			0	0	0	0	0	0	0	0	0	0	0	0

1. **Determine Maximum Assumed Temperature allowed from Table 1.**
2. **Find Maximum %N1 from Table 2 using the desired assumed temperature (no greater than temperature from Table 1).**
3. **Use the difference between assumed temperature and OAT to determine the %N1 adjustment from Table 3.**
4. **Subtract %N1 adjustment from Maximum %N1 in Table 2.**

Takeoff Speeds - Dry Runway (18K Derate)

Flaps 1 and 5

V1, VR, V2

WEIGHT (1000 KG)	FLAPS1			FLAPS5		
	V1	VR	V2	V1	VR	V2
68	143	143	146			
64	139	139	142	136	136	139
60	133	134	138	130	131	135
56	128	128	133	125	126	130
52	122	122	128	119	120	125
48	116	116	123	114	114	120
44	110	110	117	107	108	115
40	103	103	112	101	102	110

Check V1(MCG).

V1, VR, V2 Adjustments*

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

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
68	-1	0	0	0	0	0	0	0	0	0	0	0	0
64	-1	0	0	0	0	-1	0	0	0	0	0	0	0
60	-2	-1	0	0	0	-1	0	0	0	0	0	0	0
56	-2	-1	0	0	0	-1	0	0	0	0	0	0	0
52	-1	-1	0	0	0	-1	0	0	0	0	0	0	0
48	-1	0	0	0	0	-1	-1	0	0	0	0	0	0
44	-1	0	0	0	0	-1	-1	0	0	0	0	0	0
40	-1	0	0	0	0	-1	0	0	0	0	0	0	0

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	90	88					
60	140	90	88	89	90			
50	122	92	90	89	90	88	85	81
40	104	97	95	94	92	89	85	81
30	86	100	100	99	97	93	88	83
20	68	100	100	99	98	95	92	87
-60	-76	102	101	100	99	96	94	92

Takeoff Speeds - Dry Runway (18K Derate)

Flaps 10, 15 and 25

V1, VR, V2

WEIGHT (1000 KG)	FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2
60	124	125	129	122	122	126			
56	120	120	124	117	118	122	116	116	121
52	115	115	120	113	113	118	111	111	117
48	109	110	116	108	108	114	106	106	113
44	104	104	111	102	103	109	101	101	108
40	98	98	107	96	96	105	95	96	104

Check V1(MCG).

V1, VR, V2 Adjustments*

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

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
60	-1	0	0	0	0	-1	0	0	0	0	0	0	0
56	-1	0	0	0	0	-1	0	0	0	0	0	0	0
52	-1	0	0	0	0	-1	0	0	0	0	0	0	0
48	-1	0	0	0	0	-1	-1	0	0	0	0	0	0
44	-1	0	0	0	0	-1	-1	0	0	0	0	0	0
40	-1	0	0	1	1	-2	-1	0	0	0	1	1	1

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	90	88					
60	140	90	88	89	90			
50	122	92	90	89	90	88	85	81
40	104	97	95	94	92	89	85	81
30	86	100	100	99	97	93	88	83
20	68	100	100	99	98	95	92	87
-60	-76	102	101	100	99	96	94	92

Takeoff Speeds - Wet Runway (18K Derate)

Flaps 1 and 5

V1, VR, V2

WEIGHT (1000 KG)	FLAPS 1			FLAPS 5		
	V1	VR	V2	V1	VR	V2
68	139	143	146			
64	133	139	142	130	136	139
60	128	134	138	125	131	135
56	122	128	133	119	126	130
52	115	122	128	113	120	125
48	109	116	123	106	114	120
44	102	110	117	99	108	115
40	95	103	112	92	102	110

Check V1(MCG).

V1, VR, V2 Adjustments*

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

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
68	-3	-1	0	3	5	-2	-1	0	0	1	2	2	3
64	-3	-1	0	2	5	-2	-1	0	0	1	1	2	3
60	-3	-1	0	2	4	-3	-2	-1	0	1	1	2	2
56	-3	-1	0	2	4	-3	-2	-1	0	1	1	2	3
52	-3	-1	0	2	4	-3	-2	-1	0	1	2	2	3
48	-2	-1	0	2	3	-3	-2	-1	0	1	2	2	3
44	-2	-1	0	2	3	-3	-2	-1	0	1	2	3	3
40	-1	0	0	2	3	-3	-2	-1	0	1	2	3	4

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	90	88					
60	140	90	88	89	90			
50	122	92	90	89	90	88	85	81
40	104	97	95	94	92	89	85	81
30	86	100	100	99	97	93	88	83
20	68	100	100	99	98	95	92	87
-60	-76	102	101	100	99	96	94	92

Takeoff Speeds - Wet Runway (18K Derate)

Flaps 10, 15 and 25

V1, VR, V2

WEIGHT (1000 KG)	FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2
60	120	125	129	121	122	126			
56	114	120	124	114	118	122	113	116	121
52	108	115	120	108	113	118	107	111	117
48	103	110	116	102	108	114	101	106	113
44	97	104	111	96	103	109	95	101	108
40	89	98	107	90	96	105	89	96	104

Check V1(MCG).

V1, VR, V2 Adjustments*

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

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
60	-2	-1	0	2	4	-3	-1	0	0	1	2	2	3
56	-3	-1	0	2	3	-3	-2	-1	0	1	1	2	3
52	-3	-1	0	1	3	-3	-2	-1	0	1	1	2	3
48	-3	-1	0	1	3	-3	-2	-1	0	1	1	2	3
44	-2	-1	0	2	3	-3	-2	-1	0	1	2	2	3
40	-1	0	0	2	3	-3	-2	-1	0	1	2	3	4

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	90	88					
60	140	90	88	89	90			
50	122	92	90	89	90	88	85	81
40	104	97	95	94	92	89	85	81
30	86	100	100	99	97	93	88	83
20	68	100	100	99	98	95	92	87
-60	-76	102	101	100	99	96	94	92

Maximum Allowable Clearway (18K Derate)

FIELD LENGTH (M)	MAX ALLOWABLE CLEARWAY FOR V1 REDUCTION (M)
1200	140
1800	200
2400	250
3000	310
3600	430
4200	470

Clearway and Stopway V1 Adjustments (18K Derate)

CLEARWAY MINUS STOPWAY (M)	NORMAL V1 (KIAS)					
	DRY RUNWAY			WET RUNWAY		
	100	120	140	100	120	140
300	-4	-3	-3			
200	-4	-3	-3			
100	-2	-1	-1			
0	0	0	0	0	0	0
-100	1	0	0	3	2	1
-200	1	0	0	3	2	1
-300	1	0	0	3	2	1

Use of clearway not allowed on wet runways.
V1 not to exceed VR.

Stab Trim Setting (18K Derate)

Flaps 1 and 5

WEIGHT (1000 KG)	C.G. (%MAC)									
	9	11	13	16	20	24	27	30	32	33
80	8 1/2	8 1/2	8 1/2	8 1/2	7 3/4	6 3/4	6 1/4	5 3/4	5 1/4	5
70	8 1/2	8 1/2	8 1/2	8 1/4	7 1/2	6 3/4	6	5 1/2	5	4 3/4
60	8 1/2	8 1/2	8 1/4	7 3/4	7	6 1/4	5 1/2	5	4 3/4	4 1/2
50	8 1/4	8	7 1/2	7	6 1/4	5 1/2	5	4 1/2	4	4
45	8	7 1/2	7 1/4	6 3/4	6	5 1/4	4 3/4	4 1/4	4	4

Flaps 10, 15 and 25

WEIGHT (1000 KG)	C.G. (%MAC)									
	9	11	13	16	20	24	27	30	32	33
80	8 1/2	8 1/2	8 1/2	7 3/4	7	6	5 1/4	4 3/4	4 1/4	4
70	8 1/2	8 1/2	8 1/2	7 3/4	6 3/4	6	5 1/4	4 1/2	4	4
60	8 1/2	8 1/4	8	7 1/4	6 1/4	5 1/2	4 3/4	4	4	4
50	8	7 1/2	7	6 1/2	5 3/4	4 3/4	4 1/4	4	4	4
45	7 1/2	7	6 1/2	6	5 1/4	4 1/2	4	4	4	4

ADVISORY INFORMATION

Slush/Standing Water Takeoff (18K Derate)

Maximum Reverse Thrust

Weight Adjustments (1000 KG)

18K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-18.1	-20.4	-22.6	-24.2	-26.5	-28.7	-32.7	-35.0	-37.3
85	-15.1	-17.4	-19.7	-19.9	-22.2	-24.5	-27.7	-30.0	-32.3
80	-12.5	-14.7	-17.0	-16.1	-18.4	-20.6	-22.7	-25.0	-27.3
75	-10.1	-12.4	-14.7	-12.8	-15.1	-17.4	-18.1	-20.4	-22.7
70	-8.2	-10.5	-12.8	-10.1	-12.4	-14.6	-14.3	-16.5	-18.8
65	-6.7	-8.9	-11.2	-8.0	-10.2	-12.5	-11.1	-13.4	-15.7
60	-5.5	-7.7	-10.0	-6.4	-8.7	-10.9	-8.7	-11.0	-13.3
55	-4.7	-6.9	-9.2	-5.4	-7.7	-9.9	-7.1	-9.4	-11.6
50	-4.2	-6.4	-8.7	-4.9	-7.1	-9.4	-6.0	-8.3	-10.6
45	-3.7	-6.0	-8.2	-4.4	-6.7	-8.9	-5.0	-7.3	-9.5
40	-3.2	-5.5	-7.8	-3.9	-6.2	-8.4	-4.0	-6.3	-8.5

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1200							33.3		
1400	42.3			44.4			47.7		
1600	57.9	36.6		59.7	38.7		62.2	42.3	
1800	74.2	51.9	30.9	75.7	53.9	33.2	77.1	56.7	36.9
2000	91.2	68.0	46.1	92.3	69.6	48.1	92.1	71.5	51.3
2200		84.7	61.9		86.0	63.6		86.5	65.9
2400			78.3			79.8			80.8
2600			95.5			96.5			95.9

1. **Enter Weight Adjustment table with slush/standing water depth and 18K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -35 m/+30 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (18K Derate)

Maximum Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
85	-6	-1	0	0	0	0	0	0	0
80	-7	-2	0	0	0	0	0	0	0
75	-9	-4	0	-1	0	0	0	0	0
70	-11	-6	-1	-4	0	0	0	0	0
65	-12	-7	-2	-7	-2	0	0	0	0
60	-14	-9	-4	-10	-5	0	0	0	0
55	-15	-10	-5	-12	-7	-2	-4	0	0
50	-16	-11	-6	-14	-9	-4	-8	-3	0
45	-18	-13	-8	-16	-11	-6	-11	-6	-1
40	-19	-14	-9	-17	-12	-7	-13	-8	-3

1. **Obtain V1, VR and V2 for the actual weight using the 18K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG).If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (18K Derate)

No Reverse Thrust

Weight Adjustments (1000 KG)

18K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-21.9	-24.0	-26.0	-26.7	-28.8	-30.8	-33.1	-35.1	-37.2
85	-18.4	-20.4	-22.5	-22.3	-24.3	-26.4	-28.1	-30.1	-32.2
80	-15.1	-17.2	-19.2	-18.2	-20.3	-22.3	-23.2	-25.2	-27.3
75	-12.4	-14.4	-16.5	-14.8	-16.8	-18.9	-18.9	-20.9	-23.0
70	-10.1	-12.1	-14.2	-11.9	-13.9	-16.0	-15.3	-17.3	-19.4
65	-8.2	-10.3	-12.3	-9.6	-11.6	-13.7	-12.3	-14.4	-16.4
60	-6.9	-8.9	-10.9	-7.9	-9.9	-11.9	-10.1	-12.1	-14.1
55	-6.0	-8.0	-10.0	-6.7	-8.8	-10.8	-8.4	-10.5	-12.5
50	-5.4	-7.5	-9.5	-6.0	-8.1	-10.1	-7.4	-9.4	-11.4
45	-4.9	-7.0	-9.0	-5.4	-7.4	-9.5	-6.3	-8.4	-10.4
40	-4.5	-6.5	-8.5	-4.8	-6.8	-8.8	-5.3	-7.3	-9.4

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1400							30.5		
1600	32.6			38.5			47.0		
1800	51.3			56.2			62.4	38.4	
2000	70.0	41.5		73.9	46.9		77.1	54.4	
2200	88.7	60.1	31.7	91.6	64.6	37.7	91.0	69.5	46.2
2400		78.9	50.3		82.3	55.3		83.8	61.7
2600		97.7	69.0		100.0	73.0		97.6	76.4
2800			87.8			90.7			90.4

1. **Enter Weight Adjustment table with slush/standing water depth and 18K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -40 m/+35 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (18K Derate)

No Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
85	-9	-4	0	0	0	0	0	0	0
80	-11	-6	-1	0	0	0	0	0	0
75	-13	-8	-3	-2	0	0	0	0	0
70	-15	-10	-5	-6	-1	0	0	0	0
65	-17	-12	-7	-10	-5	0	0	0	0
60	-19	-14	-9	-13	-8	-3	0	0	0
55	-20	-15	-10	-16	-11	-6	-6	-1	0
50	-22	-17	-12	-19	-14	-9	-11	-6	-1
45	-23	-18	-13	-21	-16	-11	-15	-10	-5
40	-24	-19	-14	-22	-17	-12	-18	-13	-8

1. **Obtain V1, VR and V2 for the actual weight using the 18K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG).If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (18K Derate)

Maximum Reverse Thrust

Weight Adjustment (1000 KG)

18K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-2.4	-2.4	-2.4	-7.7	-7.7	-7.7	-11.8	-11.8	-11.8
85	-2.0	-2.0	-2.0	-6.9	-6.9	-6.9	-10.8	-10.8	-10.8
80	-1.7	-1.7	-1.7	-6.1	-6.1	-6.1	-9.8	-9.8	-9.8
75	-1.4	-1.4	-1.4	-5.5	-5.5	-5.5	-9.0	-9.0	-9.0
70	-1.1	-1.1	-1.1	-4.9	-4.9	-4.9	-8.2	-8.2	-8.2
65	-1.0	-1.0	-1.0	-4.5	-4.5	-4.5	-7.5	-7.5	-7.5
60	-0.9	-0.9	-0.9	-4.1	-4.1	-4.1	-6.8	-6.8	-6.8
55	-0.9	-0.9	-0.9	-3.8	-3.8	-3.8	-6.3	-6.3	-6.3
50	-0.9	-0.9	-0.9	-3.6	-3.6	-3.6	-5.8	-5.8	-5.8
45	-1.0	-1.0	-1.0	-3.5	-3.5	-3.5	-5.4	-5.4	-5.4
40	-1.1	-1.1	-1.1	-3.4	-3.4	-3.4	-5.1	-5.1	-5.1

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1000	37.8								
1200	60.3	37.8							
1400	82.5	60.3	37.8	45.0					
1600		82.5	60.3	62.6	39.9		31.0		
1800			82.5	81.1	57.2	34.8	42.7		
2000					75.4	51.9	54.8	33.9	
2200					94.7	69.9	67.6	45.6	
2400						88.8	81.4	57.9	36.8
2600							96.2	71.0	48.6
2800								85.0	61.1
3000								100.0	74.4
3200									88.7

1. **Enter Weight Adjustment table with reported braking action and 18K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -25 m/+25 m for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -25 m/+25 m for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -40 m/+35 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (18K Derate)

Maximum Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-6	-3	-1	-9	-7	-4	-16	-13	-11
85	-5	-3	0	-10	-7	-5	-17	-14	-12
80	-5	-2	0	-10	-8	-5	-18	-16	-13
75	-5	-2	0	-11	-8	-6	-19	-17	-14
70	-5	-3	0	-12	-9	-7	-21	-18	-16
65	-5	-3	0	-13	-10	-8	-23	-20	-18
60	-6	-4	-1	-14	-12	-9	-24	-22	-19
55	-7	-5	-2	-16	-13	-11	-26	-24	-21
50	-8	-6	-3	-17	-15	-12	-29	-26	-24
45	-9	-7	-4	-19	-17	-14	-31	-28	-26
40	-11	-8	-6	-21	-19	-16	-33	-31	-28

1. **Obtain V1, VR and V2 for the actual weight using the 18K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG).If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (18K Derate)

No Reverse Thrust

Weight Adjustments (1000 KG)

18K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-3.4	-3.4	-3.4	-9.7	-9.7	-9.7	-15.0	-15.0	-15.0
85	-2.9	-2.9	-2.9	-8.7	-8.7	-8.7	-13.7	-13.7	-13.7
80	-2.5	-2.5	-2.5	-7.8	-7.8	-7.8	-12.5	-12.5	-12.5
75	-2.1	-2.1	-2.1	-7.1	-7.1	-7.1	-11.4	-11.4	-11.4
70	-1.9	-1.9	-1.9	-6.4	-6.4	-6.4	-10.4	-10.4	-10.4
65	-1.6	-1.6	-1.6	-5.8	-5.8	-5.8	-9.5	-9.5	-9.5
60	-1.5	-1.5	-1.5	-5.4	-5.4	-5.4	-8.6	-8.6	-8.6
55	-1.5	-1.5	-1.5	-5.0	-5.0	-5.0	-7.9	-7.9	-7.9
50	-1.5	-1.5	-1.5	-4.7	-4.7	-4.7	-7.3	-7.3	-7.3
45	-1.6	-1.6	-1.6	-4.5	-4.5	-4.5	-6.7	-6.7	-6.7
40	-1.7	-1.7	-1.7	-4.5	-4.5	-4.5	-6.3	-6.3	-6.3

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1200	53.5								
1400	77.2	51.7							
1600	99.8	75.5	49.8	41.6					
1800		98.1	73.7	63.4	33.4				
2000			96.4	85.0	55.3				
2200					76.9	47.1			
2400					98.4	68.8	42.2		
2600						90.4	58.0		
2800							74.4	42.5	
3000							91.4	58.4	
3200								74.9	42.9
3400								91.8	58.8
3600									75.3
3800									92.3

1. **Enter Weight Adjustment table with reported braking action and 18K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust “Good” field length available by -30 m/+25 m for every 5°C above/below 4°C.**
   Adjust “Medium” field length available by -30 m/+25 m for every 5°C above/below 4°C.
   Adjust “Poor” field length available by -45 m/+40 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (18K Derate)
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
85	-6	-3	-1	-12	-9	-7	-23	-20	-18
80	-6	-3	-1	-13	-10	-8	-25	-22	-20
75	-6	-3	-1	-14	-11	-9	-27	-25	-22
70	-6	-4	-1	-15	-13	-10	-29	-27	-24
65	-7	-4	-2	-17	-14	-12	-32	-29	-27
60	-8	-5	-3	-18	-16	-13	-34	-32	-29
55	-9	-6	-4	-20	-18	-15	-37	-34	-32
50	-10	-7	-5	-22	-20	-17	-39	-37	-34
45	-12	-9	-7	-25	-22	-20	-42	-39	-37
40	-13	-11	-8	-27	-25	-22	-45	-42	-40

1. **Obtain V1, VR and V2 for the actual weight using the 18K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG).If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG).V1 not to exceed VR.**

Takeoff %N1 (18K Derate)

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

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
60	82.0	82.4	82.8	83.6	84.5	85.5	86.5	86.4	86.4	85.6	85.2	84.7	84.3
55	82.8	83.3	83.7	84.5	85.5	86.4	87.3	87.3	87.2	86.5	85.8	84.8	83.8
50	83.7	84.1	84.5	85.5	86.5	87.3	88.2	88.1	88.1	87.4	86.7	85.7	84.7
45	84.6	85.1	85.5	86.4	87.4	88.2	89.0	88.9	88.9	88.2	87.5	86.6	85.6
40	85.7	86.1	86.6	87.4	88.2	89.0	89.8	89.7	89.6	89.0	88.4	87.4	86.5
35	86.6	87.1	87.5	88.3	89.1	89.9	90.7	90.5	90.4	89.8	89.2	88.3	87.4
30	86.2	87.3	88.4	89.2	90.1	90.8	91.6	91.4	91.3	90.6	90.0	89.1	88.2
25	85.5	86.6	87.7	88.5	89.4	90.2	91.0	91.6	92.0	91.5	90.9	90.0	89.0
20	84.8	85.9	87.0	87.8	88.7	89.5	90.3	90.8	91.3	91.8	91.7	90.8	90.0
15	84.1	85.2	86.3	87.1	88.0	88.8	89.5	90.1	90.5	91.1	91.6	91.7	90.8
10	83.4	84.5	85.5	86.3	87.2	88.0	88.8	89.3	89.8	90.3	90.8	91.3	91.9
5	82.7	83.7	84.8	85.6	86.5	87.3	88.0	88.5	89.0	89.5	90.1	90.5	91.1
0	82.0	83.0	84.1	84.9	85.7	86.5	87.3	87.8	88.2	88.8	89.3	89.7	90.3
-5	81.2	82.3	83.3	84.1	85.0	85.7	86.5	87.0	87.4	88.0	88.5	88.9	89.5
-10	80.5	81.5	82.5	83.3	84.2	84.9	85.7	86.2	86.6	87.2	87.7	88.1	88.7
-15	79.7	80.8	81.8	82.6	83.4	84.2	84.9	85.4	85.8	86.4	86.9	87.3	87.9
-20	79.0	80.0	81.0	81.8	82.6	83.4	84.1	84.6	85.0	85.6	86.1	86.5	87.1
-25	78.2	79.2	80.2	81.0	81.8	82.6	83.3	83.8	84.2	84.7	85.2	85.7	86.2
-30	77.5	78.4	79.4	80.2	81.0	81.8	82.5	82.9	83.4	83.9	84.4	84.8	85.4
-35	76.7	77.7	78.6	79.4	80.2	80.9	81.7	82.1	82.6	83.1	83.6	84.0	84.6
-40	75.9	76.9	77.8	78.6	79.4	80.1	80.8	81.3	81.7	82.2	82.7	83.1	83.7
-45	75.1	76.1	77.0	77.8	78.6	79.3	80.0	80.4	80.9	81.4	81.9	82.3	82.8
-50	74.3	75.2	76.2	76.9	77.7	78.4	79.1	79.6	80.0	80.5	81.0	81.4	81.9

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.9	0.9	0.9

Assumed Temperature Reduced Thrust (18K Derate)

Maximum Assumed Temperature (Table 1 of 3)

Based on 25% Takeoff Thrust Reduction

OAT (°C)	PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
54	73	71	69	67								
50	73	71	69	67	65	63						
45	73	71	69	67	65	63	61	59	57			
40	69	69	68	67	65	63	61	59	57	55		
35	64	64	63	64	65	63	61	59	57	55	53	
30	61	59	59	59	60	61	61	59	57	55	53	51
25	61	59	58	59	59	60	58	57	56	55	53	51
20	61	59	58	59	59	60	58	57	52	51	50	50
15	61	59	58	59	59	60	58	57	52	48	45	44
10 & BELOW	61	59	58	59	59	60	58	57	52	48	44	39

Takeoff %N1 (Table 2 of 3)

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

ASSUMED TEMP (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
75	79.8	80.1	81.1	82.7	84.5	86.2	86.7	87.3	87.1	87.0	86.6	86.2
70	80.7	81.1	81.5	82.5	83.9	85.6	86.1	86.7	86.5	86.4	86.0	85.6
65	81.6	82.0	82.6	83.5	84.5	85.6	85.5	86.1	85.9	85.8	85.4	84.9
60	82.4	82.8	83.6	84.5	85.5	86.5	86.4	86.4	85.6	85.2	84.7	84.3
55	83.3	83.7	84.5	85.5	86.4	87.3	87.3	87.2	86.5	85.8	84.8	83.8
50	84.1	84.5	85.5	86.5	87.3	88.2	88.1	88.1	87.4	86.7	85.7	84.7
45	85.1	85.5	86.4	87.4	88.2	89.0	88.9	88.9	88.2	87.5	86.6	85.6
40	86.1	86.6	87.4	88.2	89.0	89.8	89.7	89.6	89.0	88.4	87.4	86.5
35	87.1	87.5	88.3	89.1	89.9	90.7	90.5	90.4	89.8	89.2	88.3	87.4
30	87.3	88.4	89.2	90.1	90.8	91.6	91.4	91.3	90.6	90.0	89.1	88.2
25	86.6	87.7	88.5	89.4	90.2	91.0	91.6	92.0	91.5	90.9	90.0	89.0
20	85.9	87.0	87.8	88.7	89.5	90.3	90.8	91.3	91.8	91.7	90.8	90.0
15	85.2	86.3	87.1	88.0	88.8	89.5	90.1	90.5	91.1	91.6	91.7	90.8
10	84.5	85.5	86.3	87.2	88.0	88.8	89.3	89.8	90.3	90.8	91.3	91.9
MINIMUM ASSUMED TEMP (°C)	32	30	30	30	29	29	27	25	21	18	14	10

With engine bleed for packs off, increase %N1 by 0.9.

Assumed Temperature Reduced Thrust (18K Derate)
%N1 Adjustment for Temperature Difference (Table 3 of 3)

ASSUMED TEMP MINUS OAT (°C)	OUTSIDE AIR TEMPERATURE (°C)													
	-40	-20	0	5	10	15	20	25	30	35	40	45	50	55
110	10.4													
100	9.2	6.5												
90	9.6	7.3												
80	11.3	6.1	3.7											
70	10.5	6.5	4.4	4.0	2.4									
60	9.0	8.2	3.1	3.0	2.9	2.7	1.1							
50	7.6	7.3	3.5	1.9	1.7	2.9	2.7	1.4	1.2					
40		5.9	5.3	3.7	2.1	2.2	2.8	3.1	1.5	1.6	1.5			
30		4.5	4.3	4.2	3.9	4.0	3.9	3.8	3.5	3.3	3.2	3.4	3.4	
20			2.9	2.9	2.8	2.8	2.7	2.7	2.6	2.5	2.5	2.4	2.3	2.3
10			1.5	1.4	1.4	1.4	1.4	1.4	1.3	1.3	1.3	1.2	1.2	1.2
0			0	0	0	0	0	0	0	0	0	0	0	0

1. **Determine Maximum Assumed Temperature allowed from Table 1.**
2. **Find Maximum %N1 from Table 2 using the desired assumed temperature (no greater than temperature from Table 1).**
3. **Use the difference between assumed temperature and OAT to determine the %N1 adjustment from Table 3.**
4. **Subtract %N1 adjustment from Maximum %N1 in Table 2.**

Max Climb %N1

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

TAT (°C)	PRESSURE ALTITUDE (FT)/SPEED (KIAS/MACH)									
	0	5000	10000	15000	20000	25000	30000	35000	37000	41000
	280	280	280	280	280	280	280	.78	.78	.78
60	88.4	88.6	88.5	88.2	88.9	91.3	92.9	94.3	94.4	92.7
55	89.2	89.4	89.3	89.1	89.3	90.6	92.3	93.6	93.7	92.0
50	90.0	90.1	90.1	89.9	90.2	90.7	91.6	92.9	93.0	91.3
45	90.7	90.8	90.9	90.7	91.1	91.6	91.6	92.2	92.3	90.6
40	91.5	91.6	91.6	91.4	92.0	92.4	92.4	91.5	91.6	89.9
35	92.0	92.3	92.3	92.2	92.8	93.2	93.2	92.3	91.6	90.0
30	91.3	93.0	93.0	92.9	93.6	94.0	93.9	93.1	92.5	91.0
25	90.5	93.0	93.8	93.6	94.3	94.8	94.6	93.9	93.3	92.0
20	89.8	92.3	94.5	94.3	95.1	95.5	95.3	94.6	94.1	92.9
15	89.1	91.5	93.9	95.1	95.8	96.2	96.0	95.4	94.9	93.9
10	88.3	90.8	93.1	95.3	96.7	96.9	96.6	96.1	95.7	94.8
5	87.5	90.0	92.4	94.5	97.7	97.8	97.3	96.9	96.5	95.7
0	86.8	89.2	91.6	93.7	97.1	98.9	98.3	97.8	97.4	96.6
-5	86.0	88.4	90.8	92.9	96.3	98.8	99.3	98.5	98.2	97.7
-10	85.2	87.6	89.9	92.1	95.5	98.0	99.6	99.4	99.1	98.6
-15	84.4	86.8	89.1	91.2	94.7	97.3	98.8	100.4	100.1	99.6
-20	83.6	86.0	88.3	90.4	93.9	96.5	98.0	100.1	100.6	100.2
-25	82.8	85.2	87.5	89.6	93.1	95.7	97.2	99.2	99.8	99.4
-30	82.0	84.3	86.6	88.7	92.3	94.9	96.4	98.4	98.9	98.6
-35	81.2	83.5	85.8	87.9	91.4	94.0	95.5	97.6	98.1	97.7
-40	80.4	82.6	84.9	87.0	90.6	93.2	94.7	96.7	97.2	96.9

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)					
	0	10	20	30	35	41
ENGINE ANTI-ICE	-0.6	-0.8	-0.9	-0.9	-0.8	-0.8
ENGINE & WING ANTI-ICE*	-1.8	-2.1	-2.5	-2.7	-3.0	-3.0

***Dual bleed sources**

Go-around %N1

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

AIRPORT OAT		TAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
°C	°F		-2000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
57	134	60	88.5	89.3	89.4									
52	125	55	89.2	90.1	90.3	90.4	90.5							
47	116	50	90.0	90.9	91.0	91.2	91.3	91.4	91.4	91.3				
42	108	45	90.9	91.7	91.9	92.0	92.1	92.2	92.2	92.1	91.8	91.4		
37	99	40	91.8	92.6	92.7	92.8	92.9	93.0	93.0	92.9	92.6	92.2	92.1	92.0
32	90	35	91.9	93.5	93.6	93.7	93.7	93.8	93.7	93.7	93.4	93.0	93.0	92.9
27	81	30	91.2	93.4	94.1	94.5	94.6	94.6	94.6	94.5	94.1	93.8	93.8	93.7
22	72	25	90.5	92.6	93.3	94.0	94.7	95.5	95.4	95.3	95.0	94.6	94.5	94.5
17	63	20	89.7	91.9	92.6	93.3	94.0	94.7	95.2	95.8	96.0	95.7	95.3	95.3
12	54	15	89.0	91.1	91.8	92.5	93.2	93.9	94.5	95.0	95.6	96.2	96.8	96.5
7	45	10	88.3	90.4	91.0	91.7	92.4	93.2	93.7	94.2	94.8	95.4	96.1	96.7
2	36	5	87.5	89.6	90.3	90.9	91.6	92.4	92.9	93.4	94.0	94.6	95.3	95.9
-3	27	0	86.7	88.8	89.5	90.1	90.9	91.6	92.1	92.6	93.2	93.8	94.5	95.1
-8	18	-5	86.0	88.0	88.7	89.4	90.1	90.8	91.3	91.8	92.4	93.0	93.7	94.3
-13	9	-10	85.2	87.2	87.9	88.5	89.2	89.9	90.5	91.0	91.6	92.2	92.9	93.5
-17	1	-15	84.4	86.4	87.1	87.7	88.4	89.1	89.7	90.2	90.8	91.4	92.0	92.7
-22	-8	-20	83.6	85.6	86.3	86.9	87.6	88.3	88.8	89.3	90.0	90.5	91.2	91.9
-27	-17	-25	82.8	84.8	85.4	86.1	86.8	87.5	88.0	88.5	89.1	89.7	90.4	91.1
-32	-26	-30	82.0	84.0	84.6	85.2	85.9	86.6	87.1	87.6	88.3	88.9	89.5	90.2
-37	-35	-35	81.2	83.1	83.8	84.4	85.1	85.8	86.3	86.8	87.4	88.0	88.7	89.4
-42	-44	-40	80.3	82.3	82.9	83.5	84.2	84.9	85.4	85.9	86.5	87.1	87.8	88.5
-47	-53	-45	79.5	81.4	82.1	82.7	83.4	84.0	84.5	85.0	85.7	86.3	87.0	87.6
-52	-62	-50	78.6	80.6	81.2	81.8	82.5	83.1	83.6	84.1	84.8	85.4	86.1	86.8

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (FT)											
	-2000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.8	0.8	0.8
A/C HIGH	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Climb (280/.76)

Flaps Up, Set Max Climb Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		40	50	60	70	80
40000	**PITCH ATT**	**4.0**	**4.0**	**4.5**		
	V/S (FT/MIN)	1800	1200	600		
30000	**PITCH ATT**	**4.0**	**4.0**	**4.0**	**4.0**	**4.0**
	V/S (FT/MIN)	2600	2000	1500	1200	900
20000	**PITCH ATT**	**7.0**	**6.5**	**6.0**	**6.0**	**6.0**
	V/S (FT/MIN)	4100	3200	2600	2100	1700
10000	**PITCH ATT**	**10.5**	**9.0**	**8.5**	**8.0**	**7.5**
	V/S (FT/MIN)	5400	4200	3400	2900	2400
SEA LEVEL	**PITCH ATT**	**14.5**	**12.5**	**11.0**	**10.0**	**9.5**
	V/S (FT/MIN)	6600	5200	4300	3600	3000

Cruise (.76/280)

Flaps Up, %N1 for Level Flight

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		40	50	60	70	80
40000	**PITCH ATT**	**2.0**	**2.5**	**3.5**		
	%N1	82.4	85.0	89.0		
35000	**PITCH ATT**	**1.0**	**2.0**	**2.5**	**3.0**	**3.5**
	%N1	80.7	82.1	84.1	86.5	90.5
30000	**PITCH ATT**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**
	%N1	80.2	81.0	82.2	83.8	85.7
25000	**PITCH ATT**	**1.0**	**1.5**	**2.0**	**2.5**	**3.5**
	%N1	76.6	77.4	78.5	80.0	81.9
20000	**PITCH ATT**	**1.0**	**1.5**	**2.0**	**3.0**	**3.5**
	%N1	73.0	73.8	74.8	76.1	77.9
15000	**PITCH ATT**	**1.0**	**1.5**	**2.5**	**3.0**	**3.5**
	%N1	69.2	70.0	71.1	72.3	74.0

Descent (.76/280)

Flaps Up, Set Idle Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		40	50	60	70	80
40000	**PITCH ATT**	**-1.5**	**-0.5**	**0.5**	**1.0**	**1.5**
	V/S (FT/MIN)	-2800	-2500	-2400	-2600	-2700
30000	**PITCH ATT**	**-3.0**	**-2.0**	**-1.0**	**0.0**	**0.5**
	V/S (FT/MIN)	-3000	-2500	-2200	-2000	-1900
20000	**PITCH ATT**	**-3.0**	**-2.0**	**-1.0**	**0.0**	**1.0**
	V/S (FT/MIN)	-2700	-2300	-2000	-1800	-1700
10000	**PITCH ATT**	**-3.0**	**-2.0**	**-1.0**	**0.0**	**1.0**
	V/S (FT/MIN	-2400	-2000	-1800	-1600	-1500
SEA LEVEL	**PITCH ATT**	**-3.5**	**-2.0**	**-1.0**	**0.0**	**1.0**
	V/S (FT/MIN)	-2200	-1800	-1600	-1500	-1400

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Holding (VREF40 + 70)

Flaps Up, %N1 for Level Flight

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		40	50	60	70	80
15000	**PITCH ATT**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
	%N1	55.8	61.5	65.8	69.7	73.1
	KIAS	177	195	214	231	247
10000	**PITCH ATT**	**5.0**	**5.5**	**5.0**	**5.0**	**5.0**
	%N1	52.2	57.2	61.9	65.8	69.0
	KIAS	177	194	213	230	246
5000	**PITCH ATT**	**5.5**	**5.5**	**5.5**	**5.0**	**5.0**
	%N1	48.6	53.6	57.8	61.7	65.4
	KIAS	177	193	212	229	245

Terminal Area (5000 FT)

%N1 for Level Flight

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS UP (GEAR UP)	**PITCH ATT.**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
(VREF40 + 70)	%N1	49.0	53.0	58.0	61.0	65.0
FLAPS 1 (GEAR UP)	**PITCH ATT.**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
(VREF40 + 50)	%N1	50.0	56.0	60.0	64.0	67.0
FLAPS 5 (GEAR UP)	**PITCH ATT.**	**5.5**	**6.0**	**6.5**	**6.5**	**7.0**
(VREF40 + 30)	%N1	50.0	56.0	61.0	65.0	68.0
FLAPS 15 (GEAR DOWN)	**PITCH ATT.**	**6.0**	**6.0**	**6.5**	**6.5**	**7.0**
(VREF40 + 20)	%N1	59.0	65.0	70.0	74.0	78.0

Final Approach (1500 FT)

Gear Down, %N1 for 3° Glideslope

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS 15	**PITCH ATT**	**3.5**	**3.5**	**3.5**	**4.0**	**4.0**
(VREF15 + 10)	%N1	41.5	45.4	49.3	53.1	56.2
FLAPS 30	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.5**
(VREF30 + 10)	%N1	45.4	50.4	54.6	58.2	61.7
FLAPS 40	**PITCH ATT**	**0.0**	**0.0**	**0.5**	**0.5**	**1.0**
(VREF40 + 10)	%N1	52.4	57.5	62.3	66.0	69.7

Go-Around

Flaps 15, Gear Up, Set Go-Around Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		40	50	60	70	80
10000	**PITCH ATT**	**20.0**	**16.5**	**14.0**	**12.0**	**10.5**
	V/S (FT/MIN)	3600	2800	2200	1800	1400
	KIAS	126	139	151	163	174
5000	**PITCH ATT**	**23.0**	**18.5**	**15.5**	**13.5**	**12.0**
	V/S (FT/MIN)	4000	3200	2600	2100	1700
	KIAS	126	138	150	161	172
SEA LEVEL	**PITCH ATT**	**25.5**	**20.5**	**17.0**	**15.0**	**13.0**
	V/S (FT/MIN)	4200	3400	2700	2300	1900
	KIAS	126	138	149	160	170

Intentionally
Blank

Performance Inflight Chapter PI

All Engine Section 21

Long Range Cruise Maximum Operating Altitude

Max Cruise Thrust

ISA + 10°C and Below

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
85	31000	-8	34200*	34200*	33800	32200	30800
80	32300	-10	35700*	35700*	35100	33500	32100
75	33700	-14	37000*	37000*	36500	34900	33500
70	35200	-17	38300*	38300*	37900	36400	35000
65	36700	-19	39700*	39700*	39400	37900	36500
60	38400	-19	41000	41000	41000	39600	38200
55	40200	-19	41000	41000	41000	41000	40000
50	41000	-19	41000	41000	41000	41000	41000
45	41000	-19	41000	41000	41000	41000	41000
40	41000	-19	41000	41000	41000	41000	41000

ISA + 15°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
85	31000	-2	32900*	32900*	32900*	32200	30800
80	32300	-5	34600*	34600*	34600*	33500	32100
75	33700	-8	36100*	36100*	36100*	34900	33500
70	35200	-11	37500*	37500*	37500*	36400	35000
65	36700	-13	38900*	38900*	38900*	37900	36500
60	38400	-13	40300*	40300*	40300*	39600	38200
55	40200	-13	41000	41000	41000	41000	40000
50	41000	-13	41000	41000	41000	41000	41000
45	41000	-13	41000	41000	41000	41000	41000
40	41000	-13	41000	41000	41000	41000	41000

ISA + 20°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
85	31000	4	30400*	30400*	30400*	30400*	30400*
80	32300	1	32900*	32900*	32900*	32900*	32100
75	33700	-2	34800*	34800*	34800*	34800*	33500
70	35200	-6	36300*	36300*	36300*	36300*	35000
65	36700	-8	37800*	37800*	37800*	37800*	36500
60	38400	-8	39200*	39200*	39200*	39200*	38200
55	40200	-8	40700*	40700*	40700*	40700*	40000
50	41000	-8	41000	41000	41000	41000	41000
45	41000	-8	41000	41000	41000	41000	41000
40	41000	-8	41000	41000	41000	41000	41000

***Denotes altitude thrust limited in level flight, 100 fpm residual rate of climb.**

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)								
		25	27	29	31	33	35	37	39	41
85	%N1	84.8	85.9	87.1	88.5	90.5				
	MACH	.740	.756	.769	.781	.789				
	KIAS	310	305	297	290	280				
	FF/ENG	1521	1505	1488	1480	1503				
80	%N1	83.5	84.7	85.9	87.2	88.7	91.3			
	MACH	.725	.745	.760	.773	.785	.788			
	KIAS	304	300	294	286	279	267			
	FF/ENG	1440	1429	1412	1395	1395	1431			
75	%N1	82.1	83.4	84.6	85.9	87.1	88.9	92.9		
	MACH	.707	.731	.750	.764	.777	.787	.784		
	KIAS	295	294	289	283	275	267	254		
	FF/ENG	1354	1350	1338	1319	1304	1313	1371		
70	%N1	80.5	82.0	83.3	84.5	85.8	87.1	89.6		
	MACH	.685	.712	.736	.754	.767	.780	.789		
	KIAS	286	286	283	279	272	264	256		
	FF/ENG	1262	1266	1260	1246	1226	1216	1244		
65	%N1	78.8	80.3	81.8	83.1	84.3	85.6	87.4	90.7	
	MACH	.663	.690	.717	.740	.757	.770	.783	.789	
	KIAS	276	276	275	273	268	261	254	244	
	FF/ENG	1169	1176	1178	1170	1154	1135	1141	1179	
60	%N1	77.1	78.4	80.0	81.4	82.8	84.0	85.6	88.0	91.9
	MACH	.642	.665	.693	.720	.742	.759	.772	.785	.788
	KIAS	267	265	266	265	262	257	250	243	233
	FF/ENG	1083	1082	1089	1089	1079	1062	1055	1069	1111
55	%N1	75.3	76.6	78.0	79.5	81.0	82.3	84.0	86.0	88.5
	MACH	.621	.642	.666	.694	.721	.744	.760	.773	.786
	KIAS	257	256	255	255	254	251	245	239	232
	FF/ENG	1003	996	996	1000	999	989	980	979	994
50	%N1	73.3	74.6	76.0	77.4	78.9	80.5	82.1	84.2	86.2
	MACH	.598	.619	.641	.664	.693	.721	.744	.760	.773
	KIAS	248	246	244	243	243	243	240	234	228
	FF/ENG	930	916	910	908	911	909	905	903	902
45	%N1	71.1	72.5	73.8	75.2	76.6	78.1	80.1	82.2	84.3
	MACH	.571	.594	.615	.637	.661	.689	.718	.742	.759
	KIAS	236	235	234	232	231	231	231	228	223
	FF/ENG	851	843	832	824	821	822	833	836	834
40	%N1	68.4	70.0	71.4	72.8	74.1	75.6	77.5	79.8	82.0
	MACH	.541	.563	.587	.609	.631	.655	.682	.712	.737
	KIAS	223	223	223	222	220	219	218	218	216
	FF/ENG	785	779	771	759	749	743	746	754	757

Shaded area approximates optimum altitude.

Long Range Cruise Enroute Fuel and Time - Low Altitudes

Ground to Air Miles Conversions

AIR DISTANCE (NM) HEADWIND COMPONENT (KTS) 100	80	60	40	20	GROUND DISTANCE (NM)	AIR DISTANCE (NM) TAILWIND COMPONENT (KTS) 20	40	60	80	100
294	269	248	230	214	200	190	181	173	166	159
442	404	371	344	321	300	286	272	260	249	239
590	540	496	459	428	400	381	363	347	332	319
739	676	621	575	535	500	476	454	434	415	399
888	812	746	690	642	600	571	544	520	498	479
1038	949	871	806	750	700	667	636	607	582	559
1188	1086	996	921	857	800	762	727	694	665	638
1339	1224	1122	1037	965	900	857	817	781	747	718
1490	1361	1248	1153	1072	1000	952	908	867	830	797
1642	1499	1374	1269	1180	1100	1047	998	954	913	877
1794	1637	1500	1385	1287	1200	1142	1089	1040	996	956
1947	1776	1626	1501	1395	1300	1237	1180	1127	1079	1036
2101	1916	1753	1618	1502	1400	1332	1270	1213	1161	1115
2255	2055	1880	1734	1610	1500	1428	1361	1300	1244	1195
2409	2195	2007	1851	1718	1600	1523	1451	1386	1327	1274
2564	2335	2134	1968	1826	1700	1618	1542	1473	1410	1353
2720	2476	2262	2084	1934	1800	1713	1633	1559	1492	1432
2876	2617	2390	2201	2042	1900	1808	1723	1645	1574	1511
3033	2758	2518	2318	2150	2000	1903	1813	1731	1657	1590

Reference Fuel And Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT) 10		14		20		24		28	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	1.4	0:42	1.3	0:40	1.1	0:38	0.9	0:37	0.8	0:36
300	2.2	1:01	1.9	0:58	1.7	0:54	1.5	0:52	1.4	0:51
400	2.9	1:21	2.6	1:17	2.3	1:11	2.1	1:08	1.9	1:06
500	3.6	1:40	3.3	1:35	2.9	1:28	2.6	1:24	2.4	1:21
600	4.4	2:00	4.0	1:54	3.5	1:45	3.2	1:40	3.0	1:36
700	5.1	2:20	4.7	2:12	4.1	2:02	3.7	1:56	3.5	1:51
800	5.9	2:40	5.4	2:31	4.7	2:19	4.3	2:12	4.0	2:06
900	6.6	3:00	6.1	2:50	5.3	2:36	4.8	2:28	4.5	2:22
1000	7.3	3:21	6.7	3:09	5.9	2:53	5.4	2:45	5.0	2:37
1100	8.0	3:41	7.4	3:28	6.5	3:11	5.9	3:01	5.6	2:52
1200	8.7	4:02	8.1	3:47	7.1	3:28	6.5	3:17	6.1	3:08
1300	9.5	4:23	8.7	4:07	7.7	3:46	7.0	3:34	6.6	3:23
1400	10.2	4:44	9.4	4:26	8.3	4:03	7.6	3:50	7.1	3:39
1500	10.9	5:05	10.0	4:46	8.9	4:21	8.1	4:07	7.6	3:55
1600	11.6	5:26	10.7	5:06	9.5	4:39	8.7	4:23	8.1	4:10
1700	12.3	5:47	11.4	5:26	10.1	4:57	9.2	4:40	8.6	4:26
1800	13.0	6:09	12.0	5:46	10.7	5:15	9.7	4:57	9.1	4:42
1900	13.7	6:30	12.6	6:06	11.2	5:33	10.2	5:14	9.6	4:58
2000	14.3	6:52	13.3	6:26	11.8	5:51	10.8	5:31	10.1	5:14

Long Range Cruise Enroute Fuel and Time - Low Altitudes

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	40	50	60	70	80
1	-0.1	0.0	0.0	0.1	0.1
2	-0.2	-0.1	0.0	0.1	0.3
3	-0.4	-0.2	0.0	0.2	0.5
4	-0.5	-0.3	0.0	0.3	0.6
5	-0.7	-0.3	0.0	0.4	0.8
6	-0.8	-0.4	0.0	0.5	1.0
7	-0.9	-0.5	0.0	0.6	1.2
8	-1.0	-0.5	0.0	0.7	1.4
9	-1.2	-0.6	0.0	0.8	1.6
10	-1.3	-0.7	0.0	0.9	1.7
11	-1.4	-0.8	0.0	1.0	1.9
12	-1.6	-0.8	0.0	1.1	2.1
13	-1.7	-0.9	0.0	1.2	2.3
14	-1.8	-1.0	0.0	1.3	2.5
15	-1.9	-1.0	0.0	1.4	2.7

Based on .78/280/250 descent.

Long Range Cruise Enroute Fuel and Time - High Altitudes
Ground to Air Miles Conversions

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
537	503	472	445	422	400	382	365	350	336	324
803	753	707	667	632	600	573	548	526	505	486
1070	1003	943	890	843	800	765	732	702	674	649
1337	1254	1179	1113	1054	1000	956	915	878	843	812
1605	1505	1415	1335	1264	1200	1147	1099	1054	1012	975
1874	1757	1651	1558	1475	1400	1339	1282	1230	1181	1138
2144	2009	1888	1781	1686	1600	1530	1465	1405	1350	1300
2413	2262	2125	2005	1898	1800	1721	1648	1581	1519	1463
2684	2515	2362	2228	2109	2000	1913	1831	1756	1688	1625
2956	2769	2600	2452	2320	2200	2104	2014	1932	1856	1787
3228	3023	2838	2676	2531	2400	2295	2198	2107	2024	1949
3502	3278	3076	2900	2743	2600	2486	2380	2283	2193	2111
3775	3534	3315	3124	2954	2800	2677	2563	2458	2361	2273
4050	3789	3554	3349	3166	3000	2868	2746	2633	2529	2435
4325	4046	3794	3573	3378	3200	3059	2928	2807	2697	2596
4602	4303	4034	3798	3590	3400	3250	3110	2982	2864	2757
4878	4561	4274	4024	3802	3600	3441	3293	3157	3032	2919
5156	4819	4515	4249	4014	3800	3632	3475	3331	3199	3079
5435	5078	4756	4475	4226	4000	3822	3658	3506	3366	3240
5715	5338	4997	4701	4438	4200	4013	3839	3679	3533	3400
5996	5598	5239	4927	4651	4400	4203	4021	3853	3699	3560
6278	5859	5482	5154	4864	4600	4394	4203	4027	3866	3720
6562	6122	5725	5381	5076	4800	4584	4384	4200	4032	3879
6846	6385	5969	5608	5289	5000	4775	4566	4374	4198	4038

Long Range Cruise Enroute Fuel and Time - High Altitudes

Reference Fuel And Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	29		31		33		35		37	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
400	1.9	1:05	1.8	1:03	1.7	1:02	1.7	1:02	1.6	1:01
600	2.9	1:35	2.8	1:32	2.7	1:30	2.6	1:29	2.6	1:29
800	3.9	2:05	3.8	2:01	3.7	1:59	3.6	1:57	3.5	1:56
1000	5.0	2:35	4.8	2:30	4.7	2:27	4.5	2:25	4.4	2:23
1200	6.0	3:05	5.8	3:00	5.6	2:56	5.4	2:53	5.3	2:51
1400	7.0	3:36	6.8	3:30	6.6	3:24	6.3	3:21	6.2	3:18
1600	8.0	4:07	7.7	4:00	7.5	3:53	7.3	3:49	7.1	3:46
1800	8.9	4:38	8.7	4:30	8.4	4:22	8.2	4:17	8.0	4:13
2000	9.9	5:09	9.6	5:00	9.3	4:52	9.1	4:46	8.8	4:41
2200	10.9	5:41	10.6	5:31	10.2	5:22	9.9	5:15	9.7	5:09
2400	11.8	6:13	11.5	6:02	11.2	5:51	10.8	5:43	10.5	5:37
2600	12.8	6:45	12.4	6:33	12.0	6:21	11.7	6:12	11.4	6:05
2800	13.7	7:18	13.3	7:05	12.9	6:52	12.5	6:42	12.2	6:34
3000	14.6	7:50	14.2	7:36	13.8	7:22	13.4	7:11	13.1	7:02
3200	15.5	8:23	15.1	8:08	14.7	7:53	14.2	7:41	13.9	7:31
3400	16.5	8:56	16.0	8:40	15.5	8:25	15.1	8:11	14.7	8:00
3600	17.4	9:30	16.9	9:13	16.4	8:56	15.9	8:41	15.5	8:29
3800	18.3	10:04	17.7	9:45	17.2	9:28	16.7	9:12	16.3	8:58
4000	19.2	10:37	18.6	10:18	18.1	9:59	17.6	9:42	17.1	9:28
4200	20.1	11:12	19.5	10:52	18.9	10:32	18.4	10:14	17.9	9:57
4400	20.9	11:46	20.3	11:25	19.7	11:04	19.2	10:45	18.7	10:27
4600	21.8	12:22	21.2	11:59	20.6	11:37	20.0	11:16	19.4	10:58
4800	22.7	12:57	22.0	12:33	21.4	12:10	20.8	11:48	20.2	11:28
5000	23.6	13:32	22.9	13:07	22.2	12:43	21.5	12:20	21.0	11:59

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	40	50	60	70	80
2	-0.3	-0.2	0.0	0.2	0.7
4	-0.6	-0.3	0.0	0.5	1.3
6	-0.9	-0.5	0.0	0.7	1.9
8	-1.2	-0.7	0.0	1.0	2.5
10	-1.5	-0.8	0.0	1.2	3.0
12	-1.8	-1.0	0.0	1.4	3.5
14	-2.1	-1.1	0.0	1.6	3.9
16	-2.5	-1.3	0.0	1.8	4.3
18	-2.8	-1.4	0.0	2.0	4.7
20	-3.1	-1.6	0.0	2.1	5.0
22	-3.5	-1.7	0.0	2.3	5.3
24	-3.8	-1.9	0.0	2.4	5.5

Based on .78/280/250 descent.

Long Range Cruise Wind-Altitude Trade

PRESSURE ALTITUDE (1000 FT)	CRUISE WEIGHT (1000 KG)								
	80	75	70	65	60	55	50	45	40
41				43	15	2	1	11	27
39			33	11	1	1	10	24	42
37	51	23	7	0	2	10	23	39	56
35	14	3	0	3	11	23	37	53	69
33	1	0	4	13	24	37	51	66	80
31	2	7	15	26	38	51	64	77	88
29	10	18	28	39	51	64	75	86	95
27	22	31	42	53	64	75	85	93	101
25	35	45	55	65	75	84	92	99	104

The above wind factor table is for calculation of wind required to maintain present range capability at new pressure altitude, i.e., break-even wind.

Method:

1. **Read wind factors for present and new altitudes from table.**
2. **Determine difference (new altitude wind factor minus present altitude wind factor); This difference may be negative or positive.**
3. **Break-even wind at new altitude is present altitude wind plus difference from step 2.**

Descent

.78/280/250

PRESSURE ALTITUDE (FT)	TIME (MIN)	FUEL (KG)	DISTANCE (NM)			
			LANDING WEIGHT (1000 KG)			
			40	50	60	70
41000	27	340	104	122	135	144
39000	26	340	99	116	130	138
37000	25	340	94	111	124	133
35000	25	330	90	106	118	127
33000	24	330	87	102	114	122
31000	23	320	82	96	107	115
29000	22	310	77	90	101	108
27000	21	310	73	85	94	101
25000	20	300	68	79	88	94
23000	19	290	63	73	81	87
21000	18	280	59	68	75	80
19000	17	270	54	62	69	73
17000	16	260	49	57	63	66
15000	14	240	45	51	56	59
10000	11	200	31	35	38	39
5000	7	150	18	20	21	21
1500	4	110	9	9	9	9

Allowances for a straight-in approach are included.

Holding

Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)								
		1500	5000	10000	15000	20000	25000	30000	35000	41000
80	%N1	62.4	65.4	69.0	73.1	77.2	81.5	85.4		
	KIAS	244	245	246	247	249	251	254		
	FF/ENG	1410	1380	1370	1360	1330	1330	1360		
75	%N1	60.7	63.7	67.4	71.5	75.5	79.9	83.8	88.2	
	KIAS	236	237	238	239	241	243	245	249	
	FF/ENG	1330	1300	1290	1280	1250	1240	1270	1300	
70	%N1	58.9	61.7	65.8	69.7	73.8	78.2	82.2	86.4	
	KIAS	228	229	230	231	232	234	237	240	
	FF/ENG	1250	1220	1210	1200	1170	1160	1180	1200	
65	%N1	57.2	59.8	64.1	67.7	72.0	76.3	80.4	84.6	
	KIAS	220	220	222	223	224	225	227	230	
	FF/ENG	1170	1150	1130	1110	1100	1070	1090	1100	
60	%N1	55.3	57.8	61.9	65.8	70.0	74.2	78.5	82.6	
	KIAS	211	212	213	213	215	216	218	220	
	FF/ENG	1090	1070	1050	1030	1020	990	1000	1010	
55	%N1	53.2	55.8	59.6	63.8	67.7	72.1	76.4	80.5	87.8
	KIAS	202	203	203	204	205	206	208	210	214
	FF/ENG	1010	990	970	950	940	910	910	920	980
50	%N1	51.0	53.6	57.2	61.5	65.3	69.8	73.9	78.3	85.3
	KIAS	192	193	194	195	195	197	198	200	203
	FF/ENG	940	910	890	870	860	850	840	850	890
45	%N1	48.7	51.1	54.8	58.6	63.0	67.0	71.3	75.8	82.7
	KIAS	184	184	184	184	185	186	187	189	191
	FF/ENG	860	830	830	810	790	780	760	760	790
40	%N1	46.2	48.6	52.2	55.8	60.2	64.1	68.5	72.9	79.9
	KIAS	177	177	177	177	177	177	177	177	180
	FF/ENG	800	780	750	730	710	700	690	680	700

This table includes 5% additional fuel for holding in a racetrack pattern.

Intentionally
Blank

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF15	ONE REV	NO REV

Dry Runway

MAX MANUAL	890	65/-50	20/25	-30/110	10/-10	20/-20	30	15	35
AUTOBRAKE MAX	1125	60/-60	25/35	-40/140	0/0	25/-25	55	0	0
AUTOBRAKE 3	1570	95/-100	40/60	-70/230	0/0	40/-40	90	0	0
AUTOBRAKE 2	2020	135/-150	60/85	-95/325	15/-30	55/-55	100	25	25
AUTOBRAKE 1	2255	170/-180	75/105	-110/385	50/-65	65/-65	95	185	205

Good Reported Braking Action

MAX MANUAL	1220	70/-75	30/45	-55/190	30/-25	30/-30	45	65	145
AUTOBRAKE MAX	1290	75/-80	35/45	-55/195	25/-20	30/-30	55	70	160
AUTOBRAKE 3	1575	95/-100	40/60	-70/235	5/0	40/-40	90	5	15
AUTOBRAKE 2	2020	135/-150	60/85	-95/325	15/-30	55/-55	100	25	25
AUTOBRAKE 1	2255	170/-180	75/105	-110/385	50/-65	65/-65	95	185	205

Medium Reported Braking Action

MAX MANUAL	1680	115/-115	50/70	-85/320	75/-60	40/-45	60	185	455
AUTOBRAKE MAX	1690	115/-115	50/75	-90/320	70/-55	45/-45	70	180	450
AUTOBRAKE 3	1750	115/-120	50/75	-90/325	60/-35	45/-45	90	150	425
AUTOBRAKE 2	2070	140/-150	60/85	-105/365	45/-45	55/-60	100	65	195
AUTOBRAKE 1	2270	170/-180	75/105	-115/400	70/-70	65/-65	95	200	265

Poor Reported Braking Action

MAX MANUAL	2210	165/-165	70/105	-135/505	185/-120	55/-60	75	405	1120
AUTOBRAKE MAX	2210	165/-165	75/105	-135/505	185/-120	55/-60	75	405	1120
AUTOBRAKE 3	2210	165/-165	75/105	-135/505	185/-115	55/-60	80	405	1120
AUTOBRAKE 2	2340	170/-175	75/110	-140/520	165/-105	60/-65	95	310	1005
AUTOBRAKE 1	2460	185/-195	80/115	-145/540	170/-120	65/-70	95	365	920

Reference distance is based on sea level, standard day, no wind or slope, VREF15 approach speed, two-engine detent No. 2 reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 55 m.
For autobrake and manual speedbrakes, increase reference landing distance by 45 m.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF30	ONE REV	NO REV

Dry Runway

MAX MANUAL	860	55/-45	20/25	-30/110	10/-10	15/-15	30	15	35
AUTOBRAKE MAX	1070	55/-60	25/30	-40/135	0/0	25/-25	50	0	0
AUTOBRAKE 3	1490	85/-95	40/55	-65/225	0/0	40/-40	85	0	0
AUTOBRAKE 2	1900	125/-135	55/80	-90/315	15/-30	55/-55	90	30	30
AUTOBRAKE 1	2110	155/-160	70/95	-110/370	50/-60	60/-60	85	165	195

Good Reported Braking Action

MAX MANUAL	1180	65/-70	30/40	-55/190	30/-25	25/-30	45	60	135
AUTOBRAKE MAX	1250	70/-75	30/45	-55/195	25/-20	30/-30	55	65	145
AUTOBRAKE 3	1490	90/-95	40/55	-65/230	5/0	40/-40	85	5	15
AUTOBRAKE 2	1900	125/-135	55/80	-90/315	15/-30	55/-55	90	30	30
AUTOBRAKE 1	2110	155/-160	70/95	-110/370	50/-60	60/-60	85	165	195

Medium Reported Braking Action

MAX MANUAL	1610	105/-110	45/65	-85/310	70/-55	40/-40	60	165	400
AUTOBRAKE MAX	1620	110/-110	50/70	-85/315	70/-50	40/-40	70	165	400
AUTOBRAKE 3	1670	110/-110	50/70	-90/320	60/-35	45/-45	85	140	385
AUTOBRAKE 2	1955	130/-140	55/80	-100/355	45/-45	55/-55	90	65	180
AUTOBRAKE 1	2125	155/-165	70/95	-110/385	70/-65	60/-60	85	180	255

Poor Reported Braking Action

MAX MANUAL	2090	155/-155	65/100	-130/495	175/-115	55/-60	70	355	955
AUTOBRAKE MAX	2095	155/-155	65/100	-130/495	180/-115	55/-60	70	355	960
AUTOBRAKE 3	2095	155/-155	65/100	-130/495	175/-110	55/-60	80	355	960
AUTOBRAKE 2	2210	160/-160	70/100	-135/510	160/-105	55/-60	90	280	860
AUTOBRAKE 1	2310	170/-175	75/105	-140/525	165/-115	60/-65	85	330	805

Reference distance is based on sea level, standard day, no wind or slope, VREF30 approach speed, two-engine detent No. 2 reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 50 m.
For autobrake and manual speedbrakes, increase reference landing distance by 45 m.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 40

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF40	ONE REV	NO REV

Dry Runway

BRAKING CONFIGURATION	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	ONE REV	NO REV
MAX MANUAL	845	55/-45	15/25	-30/105	10/-10	15/-15	35	15	30
AUTOBRAKE MAX	1045	50/-55	25/35	-40/130	0/0	20/-25	50	0	0
AUTOBRAKE 3	1440	85/-90	40/55	-65/220	0/0	35/-35	85	0	0
AUTOBRAKE 2	1835	120/-130	55/80	-90/305	10/-30	50/-50	90	20	20
AUTOBRAKE 1	2045	150/-155	65/90	-105/365	45/-55	60/-55	85	145	175

Good Reported Braking Action

BRAKING CONFIGURATION	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	ONE REV	NO REV
MAX MANUAL	1165	65/-70	30/45	-55/190	30/-25	25/-25	45	55	130
AUTOBRAKE MAX	1235	70/-75	30/45	-55/195	25/-20	30/-30	55	60	140
AUTOBRAKE 3	1445	85/-90	40/55	-65/225	10/-5	35/-35	85	5	15
AUTOBRAKE 2	1835	120/-130	55/80	-90/305	10/-30	50/-50	90	20	20
AUTOBRAKE 1	2045	150/-155	65/90	-105/365	45/-55	60/-55	85	145	175

Medium Reported Braking Action

BRAKING CONFIGURATION	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	ONE REV	NO REV
MAX MANUAL	1575	105/-105	45/65	-85/310	70/-55	40/-40	60	155	375
AUTOBRAKE MAX	1590	105/-110	45/70	-85/310	70/-50	40/-40	70	155	370
AUTOBRAKE 3	1630	105/-110	50/70	-85/315	60/-40	40/-45	85	140	370
AUTOBRAKE 2	1895	125/-135	55/80	-100/350	45/-45	50/-50	90	60	175
AUTOBRAKE 1	2055	150/-155	65/95	-110/380	70/-65	55/-60	85	160	235

Poor Reported Braking Action

BRAKING CONFIGURATION	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	ONE REV	NO REV
MAX MANUAL	2040	150/-150	65/95	-130/490	175/-110	50/-55	70	330	875
AUTOBRAKE MAX	2045	150/-150	65/100	-130/490	175/-115	50/-55	70	330	875
AUTOBRAKE 3	2050	155/-150	65/100	-130/490	175/-110	50/-55	80	330	875
AUTOBRAKE 2	2150	155/-155	70/100	-130/500	155/-105	55/-60	85	260	795
AUTOBRAKE 1	2240	165/-170	70/105	-135/515	165/-115	60/-65	85	305	745

Reference distance is based on sea level, standard day, no wind or slope, VREF40 approach speed, two-engine detent No. 2 reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 50 m.
For autobrake and manual speedbrakes, increase reference landing distance by 45 m.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Airspeed Unreliable (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	950	75/-55	20/30	-35/115	10/-10	20/-20	N/A	20	45
AUTOBRAKE MAX	1230	65/-65	30/40	-45/150	0/0	30/-30	N/A	0	5
AUTOBRAKE 2	2195	150/-160	70/95	-100/340	30/-45	60/-60	N/A	105	105

Good Reported Braking Action

MAX MANUAL	1300	75/-75	35/45	-55/195	30/-25	30/-30	N/A	75	175
AUTOBRAKE MAX	1385	80/-80	35/50	-60/205	25/-20	35/-35	N/A	85	190
AUTOBRAKE 2	2195	150/-160	70/95	-100/340	30/-45	60/-60	N/A	105	105

Medium Reported Braking Action

MAX MANUAL	1775	120/-120	55/75	-90/325	75/-60	45/-45	N/A	210	525
AUTOBRAKE MAX	1800	120/-120	55/75	-90/325	70/-55	45/-50	N/A	210	525
AUTOBRAKE 3	1915	120/-125	55/80	-95/340	50/-35	50/-50	N/A	135	445

Poor Reported Braking Action

MAX MANUAL	2305	170/-170	75/110	-135/510	180/-120	60/-65	N/A	445	1250
AUTOBRAKE MAX	2305	170/-170	75/110	-135/510	180/-120	60/-65	N/A	440	1250
AUTOBRAKE 3	2320	170/-170	75/110	-135/510	175/-105	60/-65	N/A	440	1250

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Airspeed Unreliable (Flaps 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	920	65/-50	20/25	-35/115	10/-10	20/-20	N/A	20	40
AUTOBRAKE MAX	1175	60/-60	25/35	-45/145	0/0	25/-25	N/A	0	0
AUTOBRAKE 2	2065	135/-145	65/85	-95/325	35/-40	60/-60	N/A	100	100

Good Reported Braking Action

MAX MANUAL	1265	70/-75	35/45	-55/195	30/-25	30/-30	N/A	70	165
AUTOBRAKE MAX	1350	75/-80	35/50	-60/200	25/-25	30/-30	N/A	80	180
AUTOBRAKE 2	2065	135/-145	65/85	-95/325	35/-40	60/-60	N/A	100	100

Medium Reported Braking Action

MAX MANUAL	1705	110/-115	50/70	-85/320	70/-55	45/-45	N/A	190	465
AUTOBRAKE MAX	1735	115/-115	50/70	-90/320	65/-55	45/-45	N/A	190	470
AUTOBRAKE 3	1830	115/-115	55/75	-90/330	50/-35	50/-50	N/A	125	405

Poor Reported Braking Action

MAX MANUAL	2185	160/-155	70/100	-130/500	170/-115	55/-60	N/A	390	1070
AUTOBRAKE MAX	2190	160/-160	70/100	-130/500	175/-115	55/-60	N/A	390	1070
AUTOBRAKE 3	2210	160/-160	70/100	-130/500	165/-100	55/-60	N/A	390	1075

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Airspeed Unreliable (Flaps 40)

VREF40

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	910	60/-45	20/25	-35/110	10/-10	20/-20	N/A	20	40
AUTOBRAKE MAX	1145	55/-60	25/35	-40/140	0/0	25/-25	N/A	0	0
AUTOBRAKE 2	1995	135/-140	60/85	-95/320	30/-40	55/-55	N/A	90	90

Good Reported Braking Action

MAX MANUAL	1250	70/-70	35/45	-55/195	30/-25	30/-30	N/A	70	155
AUTOBRAKE MAX	1335	75/-80	35/50	-60/200	25/-25	30/-30	N/A	75	170
AUTOBRAKE 2	1995	135/-140	60/85	-95/320	35/-40	55/-55	N/A	90	90

Medium Reported Braking Action

MAX MANUAL	1675	110/-110	50/70	-85/315	70/-60	40/-45	N/A	180	435
AUTOBRAKE MAX	1705	115/-115	50/75	-90/320	65/-55	45/-45	N/A	180	440
AUTOBRAKE 3	1785	110/-115	50/75	-90/330	50/-40	45/-50	N/A	125	390

Poor Reported Braking Action

MAX MANUAL	2140	155/-155	70/100	-130/495	170/-110	55/-60	N/A	365	975
AUTOBRAKE MAX	2145	155/-155	70/100	-130/495	170/-110	55/-60	N/A	360	975
AUTOBRAKE 3	2165	160/-155	70/100	-130/495	165/-105	55/-60	N/A	365	985

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

All Flaps Up Landing

VREF40 + 55

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1240	170/-80	30/80	-40/145	15/-15	30/-30	40	40	85
AUTOBRAKE MAX	1730	95/-80	45/60	-55/185	5/-5	45/-45	70	5	15
AUTOBRAKE 2	3090	195/-215	105/145	-120/405	70/-75	95/-95	95	275	320

Good Reported Braking Action

MAX MANUAL	1635	85/-90	45/65	-65/220	35/-30	40/-45	45	105	240
AUTOBRAKE MAX	1860	90/-95	50/70	-70/235	25/-20	50/-50	65	80	215
AUTOBRAKE 2	3090	195/-215	105/145	-120/405	70/-75	95/-95	95	275	320

Medium Reported Braking Action

MAX MANUAL	2305	145/-150	75/105	-100/360	90/-75	65/-65	60	295	735
AUTOBRAKE MAX	2380	145/-150	75/110	-105/365	85/-70	65/-65	70	300	760
AUTOBRAKE 3	2720	140/-160	85/120	-115/395	55/-50	80/-80	105	150	485

Poor Reported Braking Action

MAX MANUAL	3050	215/-215	110/155	-155/570	215/-150	85/-90	75	640	1825
AUTOBRAKE MAX	3050	215/-215	110/155	-155/570	215/-140	85/-90	85	635	1810
AUTOBRAKE 3	3165	205/-210	110/155	-155/580	190/-130	90/-95	105	555	1750

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

ANTISKID INOPERATIVE (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1570	95/-100	40/60	-75/265	45/-40	35/-40	60	125	295
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1760	115/-115	50/70	-90/325	70/-55	40/-45	65	185	460
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2250	165/-160	70/105	-135/505	170/-110	55/-60	75	400	1135
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	3015	240/-235	100/150	-220/935	1360/-260	65/-90	90	985	3725
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

ANTISKID INOPERATIVE (Flaps 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1510	90/-95	40/55	-75/260	45/-40	35/-35	60	110	265
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1685	105/-110	45/65	-85/320	65/-55	40/-40	65	165	405
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2140	150/-150	65/95	-130/495	165/-105	50/-55	75	350	970
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	2845	225/-215	90/140	-215/915	1265/-245	60/-85	85	865	3105
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

ANTISKID INOPERATIVE (Flaps 40)

VREF40

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1480	90/-90	40/55	-75/260	45/-40	35/-35	60	105	250
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1650	105/-105	45/65	-85/315	65/-55	40/-40	65	155	375
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2090	150/-145	65/95	-130/490	165/-105	50/-55	75	325	885
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	2765	215/-210	90/135	-210/905	1220/-240	60/-80	80	805	2815
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Jammed or Restricted Flight Controls (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	885	70/-50	20/25	-30/110	10/-10	20/-20	30	20	40
AUTOBRAKE MAX	1125	60/-60	25/35	-40/140	0/0	25/-25	55	0	0
AUTOBRAKE 2	2000	140/-150	60/85	-95/320	20/-30	55/-55	100	45	45

Good Reported Braking Action

MAX MANUAL	1210	70/-70	30/45	-55/190	25/-25	30/-30	45	70	155
AUTOBRAKE MAX	1280	75/-80	35/45	-55/195	25/-20	30/-30	50	75	170
AUTOBRAKE 2	2000	140/-150	60/85	-95/320	20/-30	55/-55	100	45	45

Medium Reported Braking Action

MAX MANUAL	1655	110/-110	50/70	-85/315	70/-55	40/-45	60	190	480
AUTOBRAKE MAX	1665	115/-115	50/70	-85/315	65/-50	40/-45	70	190	475
AUTOBRAKE 3	1735	115/-115	50/70	-90/325	55/-35	45/-45	90	145	440

Poor Reported Braking Action

MAX MANUAL	2155	165/-160	70/105	-130/500	175/-115	55/-60	75	415	1170
AUTOBRAKE MAX	2155	165/-160	70/105	-130/500	175/-115	55/-60	75	415	1170
AUTOBRAKE 3	2155	165/-160	70/105	-130/500	175/-110	55/-60	75	415	1170

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
LEADING EDGE FLAPS TRANSIT (Flaps 15)
VREF15 + 15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	1000	80/-60	20/30	-35/120	10/-10	20/-20	35	25	55
AUTOBRAKE MAX	1290	65/-70	30/40	-45/150	0/0	30/-30	60	0	5
AUTOBRAKE 2	2345	155/-170	75/100	-105/350	30/-45	70/-65	100	95	95
Good Reported Braking Action									
MAX MANUAL	1385	80/-80	35/50	-60/205	30/-30	35/-35	50	90	205
AUTOBRAKE MAX	1465	85/-85	40/55	-60/210	30/-25	35/-35	55	95	220
AUTOBRAKE 2	2345	155/-170	75/100	-105/350	30/-45	70/-65	100	95	95
Medium Reported Braking Action									
MAX MANUAL	1900	125/-130	60/85	-95/335	80/-65	50/-50	65	240	610
AUTOBRAKE MAX	1915	130/-130	60/85	-95/335	75/-60	50/-50	70	240	610
AUTOBRAKE 3	2025	125/-130	60/85	-95/350	55/-35	55/-55	95	165	540
Poor Reported Braking Action									
MAX MANUAL	2470	185/-180	85/120	-140/525	195/-130	65/-70	75	510	1460
AUTOBRAKE MAX	2470	185/-180	85/120	-140/525	195/-130	65/-70	75	510	1460
AUTOBRAKE 3	2475	185/-180	85/125	-140/525	195/-115	65/-70	90	505	1460

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

LOSS OF SYSTEM A (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	965	65/-50	20/30	-35/120	15/-10	20/-20	40	25	40
AUTOBRAKE MAX	1125	60/-60	25/35	-40/140	0/0	25/-25	55	0	0
AUTOBRAKE 2	2050	135/-145	60/80	-95/325	0/-5	60/-60	125	0	0

Good Reported Braking Action

MAX MANUAL	1395	85/-85	40/55	-60/210	40/-35	35/-35	60	110	220
AUTOBRAKE MAX	1395	85/-90	40/55	-60/210	35/-25	35/-35	65	105	215
AUTOBRAKE 2	2050	135/-145	60/80	-95/325	0/-5	60/-60	125	0	0

Medium Reported Braking Action

MAX MANUAL	1920	135/-135	60/85	-95/345	95/-75	50/-50	80	295	705
AUTOBRAKE MAX	1905	135/-135	60/85	-95/345	100/-75	50/-50	80	290	695
AUTOBRAKE 3	1905	135/-135	60/85	-95/345	100/-75	50/-50	80	290	695

Poor Reported Braking Action

MAX MANUAL	2495	195/-190	85/125	-145/540	220/-145	65/-70	95	605	1765
AUTOBRAKE MAX	2490	195/-190	85/125	-145/540	225/-150	65/-70	95	605	1765
AUTOBRAKE 3	2490	195/-190	85/125	-145/540	225/-150	65/-70	95	605	1765

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

LOSS OF SYSTEM A (Flaps 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	935	60/-45	20/30	-35/115	15/-10	20/-20	45	25	35
AUTOBRAKE MAX	1070	55/-60	25/30	-40/135	0/0	25/-25	50	5	5
AUTOBRAKE 2	1930	125/-135	55/75	-95/315	0/0	55/-55	120	0	0

Good Reported Braking Action

MAX MANUAL	1350	80/-80	35/50	-60/210	40/-35	30/-35	65	100	200
AUTOBRAKE MAX	1350	80/-85	35/50	-60/210	30/-30	30/-35	65	100	195
AUTOBRAKE 2	1930	125/-135	55/75	-95/315	0/0	55/-55	120	0	0

Medium Reported Braking Action

MAX MANUAL	1830	125/-125	55/80	-95/340	90/-70	45/-50	80	260	615
AUTOBRAKE MAX	1820	125/-125	55/80	-95/340	95/-75	45/-50	80	260	610
AUTOBRAKE 3	1820	125/-125	55/80	-95/340	95/-75	45/-50	80	260	610

Poor Reported Braking Action

MAX MANUAL	2360	180/-175	80/115	-140/530	210/-135	60/-65	90	530	1475
AUTOBRAKE MAX	2355	180/-175	80/115	-140/530	215/-140	60/-65	90	530	1475
AUTOBRAKE 3	2360	180/-175	80/115	-140/530	215/-140	60/-65	90	530	1475

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
LOSS OF SYSTEM A (Flaps 40)
VREF40

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	930	60/-45	20/30	-35/115	15/-10	20/-20	45	25	35
AUTOBRAKE MAX	1045	55/-55	25/35	-40/135	5/0	25/-25	50	10	20
AUTOBRAKE 2	1860	120/-130	55/75	-90/310	0/0	50/-50	115	0	0

Good Reported Braking Action

MAX MANUAL	1330	80/-80	35/50	-60/210	40/-35	30/-30	65	95	190
AUTOBRAKE MAX	1335	80/-85	35/55	-60/210	35/-30	30/-30	70	95	185
AUTOBRAKE 2	1860	120/-130	55/75	-90/310	0/0	50/-50	115	0	0

Medium Reported Braking Action

MAX MANUAL	1790	125/-120	55/80	-95/335	90/-70	45/-45	80	240	560
AUTOBRAKE MAX	1785	125/-120	55/80	-95/335	95/-75	45/-45	80	240	560
AUTOBRAKE 3	1785	125/-120	55/80	-95/335	95/-75	45/-45	80	240	560

Poor Reported Braking Action

MAX MANUAL	2285	175/-170	75/115	-140/525	205/-135	60/-65	90	480	1305
AUTOBRAKE MAX	2290	175/-170	75/115	-140/525	210/-140	60/-65	90	480	1305
AUTOBRAKE 3	2290	175/-170	75/115	-140/525	210/-140	60/-65	90	480	1305

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

LOSS OF SYSTEM A AND SYSTEM B (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	1375	75/-75	35/50	-55/190	35/-30	30/-35	70	-10	60
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								
Good Reported Braking Action									
MAX MANUAL	1605	90/-95	40/60	-70/235	55/-45	40/-40	80	10	150
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								
Medium Reported Braking Action									
MAX MANUAL	2230	145/-145	65/95	-110/380	120/-95	55/-60	100	150	670
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								
Poor Reported Braking Action									
MAX MANUAL	2890	215/-205	95/140	-160/585	265/-175	70/-80	115	455	1925
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

LOSS OF SYSTEM B (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1015	50/-55	25/30	-40/135	15/-15	20/-20	40	35	55
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1280	75/-75	35/45	-55/195	30/-25	30/-30	50	80	155
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	1755	120/-120	50/75	-90/325	80/-60	45/-45	65	225	510
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	2285	175/-170	75/110	-135/515	190/-125	55/-65	80	475	1290
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

MANUAL REVERSION (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1375	75/-75	35/50	-55/190	35/-30	30/-35	70	-10	60
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1605	90/-95	40/60	-70/235	55/-45	40/-40	80	10	150
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2230	145/-145	65/95	-110/380	120/-95	55/-60	100	150	670
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	2890	215/-205	95/140	-160/585	265/-175	70/-80	115	455	1925
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

One Engine Inoperative Landing (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	885	75/-55	20/30	-35/115	10/-10	20/-20	35	0	20
AUTOBRAKE MAX	1125	65/-60	30/40	-40/140	0/0	25/-25	55	0	0
AUTOBRAKE 2	2045	135/-145	65/90	-95/325	0/-10	60/-60	120	0	0

Good Reported Braking Action

MAX MANUAL	1260	75/-75	35/50	-55/200	30/-30	30/-30	50	0	85
AUTOBRAKE MAX	1340	80/-85	40/50	-60/205	30/-25	30/-30	55	0	90
AUTOBRAKE 2	2045	135/-145	65/90	-95/325	0/-10	60/-60	120	0	0

Medium Reported Braking Action

MAX MANUAL	1800	120/-125	60/80	-95/340	90/-70	45/-50	70	0	270
AUTOBRAKE MAX	1815	125/-125	60/85	-95/345	85/-65	50/-50	80	0	270
AUTOBRAKE 3	1845	125/-130	60/85	-95/345	85/-55	50/-50	85	0	275

Poor Reported Braking Action

MAX MANUAL	2470	185/-185	90/125	-150/560	245/-155	65/-70	85	0	685
AUTOBRAKE MAX	2470	185/-185	90/125	-150/560	250/-160	70/-70	85	0	685
AUTOBRAKE 3	2475	190/-190	90/125	-150/560	250/-150	70/-70	95	0	685

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

One Engine Inoperative Landing (Flaps 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	855	60/-50	20/25	-30/110	10/-10	15/-20	35	0	20
AUTOBRAKE MAX	1070	55/-60	25/35	-40/135	0/0	25/-25	50	0	0
AUTOBRAKE 2	1920	125/-130	60/85	-95/315	5/-10	55/-55	115	0	0

Good Reported Braking Action

MAX MANUAL	1215	70/-75	35/45	-55/195	30/-25	30/-30	50	0	75
AUTOBRAKE MAX	1295	75/-80	35/50	-60/205	30/-25	30/-30	60	0	85
AUTOBRAKE 2	1920	125/-130	60/85	-95/315	5/-10	55/-55	115	0	0

Medium Reported Braking Action

MAX MANUAL	1710	115/-115	55/75	-90/335	90/-70	45/-45	65	0	235
AUTOBRAKE MAX	1730	115/-120	55/75	-95/335	80/-60	45/-45	75	0	235
AUTOBRAKE 3	1755	115/-120	55/80	-95/335	85/-55	45/-45	85	0	245

Poor Reported Braking Action

MAX MANUAL	2315	170/-170	80/115	-145/545	230/-145	65/-65	80	0	575
AUTOBRAKE MAX	2315	170/-170	80/115	-145/545	235/-150	65/-65	85	0	575
AUTOBRAKE 3	2330	175/-175	80/115	-145/545	230/-140	65/-65	90	0	580

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Stabilizer Trim Inoperative (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	885	70/-50	20/25	-30/110	10/-10	20/-20	30	20	40
AUTOBRAKE MAX	1125	60/-60	25/35	-40/140	0/0	25/-25	55	0	0
AUTOBRAKE 2	2000	140/-150	60/85	-95/320	20/-30	55/-55	100	45	45

Good Reported Braking Action

MAX MANUAL	1210	70/-70	30/45	-55/190	25/-25	30/-30	45	70	155
AUTOBRAKE MAX	1280	75/-80	35/45	-55/195	25/-20	30/-30	50	75	170
AUTOBRAKE 2	2000	140/-150	60/85	-95/320	20/-30	55/-55	100	45	45

Medium Reported Braking Action

MAX MANUAL	1655	110/-110	50/70	-85/315	70/-55	40/-45	60	190	480
AUTOBRAKE MAX	1665	115/-115	50/70	-85/315	65/-50	40/-45	70	190	475
AUTOBRAKE 3	1735	115/-115	50/70	-90/325	55/-35	45/-45	90	145	440

Poor Reported Braking Action

MAX MANUAL	2155	165/-160	70/105	-130/500	175/-115	55/-60	75	415	1170
AUTOBRAKE MAX	2155	165/-160	70/105	-130/500	175/-115	55/-60	75	415	1170
AUTOBRAKE 3	2155	165/-160	70/105	-130/500	175/-110	55/-60	75	415	1170

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Asymmetry (1 ≤ Flap Lever <15)

VREF40 + 30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1020	95/-65	25/35	-35/125	10/-10	25/-25	35	25	55
AUTOBRAKE MAX	1400	70/-70	35/50	-50/160	5/-5	35/-35	65	0	5
AUTOBRAKE 2	2495	160/-175	90/125	-110/360	45/-55	75/-70	95	155	160

Good Reported Braking Action

MAX MANUAL	1410	75/-80	40/60	-60/205	30/-25	35/-35	45	85	195
AUTOBRAKE MAX	1540	80/-85	45/65	-60/215	25/-20	40/-40	60	90	215
AUTOBRAKE 2	2500	160/-175	90/125	-110/360	45/-55	75/-70	95	155	160

Medium Reported Braking Action

MAX MANUAL	1955	125/-125	65/95	-95/335	80/-65	50/-55	60	235	590
AUTOBRAKE MAX	2000	125/-130	70/100	-95/340	75/-60	50/-55	70	240	600
AUTOBRAKE 3	2180	125/-130	70/105	-100/360	50/-35	60/-60	100	135	450

Poor Reported Braking Action

MAX MANUAL	2555	185/-185	95/140	-140/530	195/-130	70/-75	75	505	1425
AUTOBRAKE MAX	2555	185/-180	95/140	-140/530	195/-130	70/-75	75	500	1420
AUTOBRAKE 3	2595	180/-180	95/140	-140/535	180/-110	70/-75	95	485	1410

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Asymmetry (Flap Lever 15 or 25)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	875	70/-50	20/30	-30/110	10/-10	20/-20	30	20	40
AUTOBRAKE MAX	1125	60/-60	30/40	-40/140	0/0	25/-25	55	0	0
AUTOBRAKE 2	2000	140/-150	70/90	-95/320	20/-30	55/-55	100	45	45

Good Reported Braking Action

MAX MANUAL	1210	70/-70	35/50	-55/190	25/-25	30/-30	45	70	155
AUTOBRAKE MAX	1280	75/-80	35/50	-55/195	25/-20	30/-30	50	75	170
AUTOBRAKE 2	2000	140/-150	70/90	-95/320	20/-30	55/-55	100	45	45

Medium Reported Braking Action

MAX MANUAL	1655	110/-110	55/75	-85/315	70/-55	40/-45	60	190	480
AUTOBRAKE MAX	1665	115/-115	55/80	-85/315	65/-50	40/-45	70	190	475
AUTOBRAKE 3	1735	115/-115	55/80	-90/325	55/-35	45/-45	90	145	440

Poor Reported Braking Action

MAX MANUAL	2155	165/-160	80/115	-130/500	175/-115	55/-60	75	415	1170
AUTOBRAKE MAX	2155	165/-160	80/115	-130/500	175/-115	55/-60	75	415	1170
AUTOBRAKE 3	2155	165/-160	80/115	-130/500	175/-110	55/-60	75	415	1170

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Asymmetry (Flap Lever 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	845	60/-45	20/25	-30/110	10/-10	15/-15	30	15	35
AUTOBRAKE MAX	1070	55/-60	25/35	-40/135	0/0	25/-25	50	0	0
AUTOBRAKE 2	1885	125/-135	60/85	-90/310	20/-30	50/-50	90	45	45

Good Reported Braking Action

MAX MANUAL	1175	65/-70	30/45	-55/185	25/-25	25/-25	45	65	145
AUTOBRAKE MAX	1240	70/-75	35/50	-55/195	25/-20	30/-30	55	70	155
AUTOBRAKE 2	1885	125/-135	60/85	-90/310	20/-30	50/-50	90	45	45

Medium Reported Braking Action

MAX MANUAL	1585	105/-105	50/70	-85/310	70/-55	40/-40	60	170	425
AUTOBRAKE MAX	1600	110/-110	50/75	-85/310	65/-50	40/-40	65	170	420
AUTOBRAKE 3	1655	105/-110	50/75	-85/315	55/-35	40/-45	85	135	400

Poor Reported Braking Action

MAX MANUAL	2045	150/-150	70/105	-125/485	165/-110	50/-55	70	365	1000
AUTOBRAKE MAX	2050	150/-150	70/105	-125/485	170/-110	50/-55	70	365	1000
AUTOBRAKE 3	2050	155/-150	75/105	-125/485	170/-100	50/-55	80	365	1005

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Disagree (1 ≤ Indicated Flaps <15)

VREF40 + 30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1020	95/-65	25/35	-35/125	10/-10	25/-25	35	25	55
AUTOBRAKE MAX	1400	70/-70	35/50	-50/160	5/-5	35/-35	65	0	5
AUTOBRAKE 2	2495	160/-175	90/125	-110/360	45/-55	75/-70	95	155	160

Good Reported Braking Action

MAX MANUAL	1410	75/-80	40/60	-60/205	30/-25	35/-35	45	85	195
AUTOBRAKE MAX	1540	80/-85	45/65	-60/215	25/-20	40/-40	60	90	215
AUTOBRAKE 2	2500	160/-175	90/125	-110/360	45/-55	75/-70	95	155	160

Medium Reported Braking Action

MAX MANUAL	1955	125/-125	65/95	-95/335	80/-65	50/-55	60	235	590
AUTOBRAKE MAX	2000	125/-130	70/100	-95/340	75/-60	50/-55	70	240	600
AUTOBRAKE 3	2180	125/-130	70/105	-100/360	50/-35	60/-60	100	135	450

Poor Reported Braking Action

MAX MANUAL	2555	185/-185	95/140	-140/530	195/-130	70/-75	75	505	1425
AUTOBRAKE MAX	2555	185/-180	95/140	-140/530	195/-130	70/-75	75	500	1420
AUTOBRAKE 3	2595	180/-180	95/140	-140/535	180/-110	70/-75	95	485	1410

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Disagree (15 ≤ Indicated Flaps <30)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	875	70/-50	20/30	-30/110	10/-10	20/-20	30	20	40
AUTOBRAKE MAX	1125	60/-60	30/40	-40/140	0/0	25/-25	55	0	0
AUTOBRAKE 2	2000	140/-150	70/90	-95/320	20/-30	55/-55	100	45	45

Good Reported Braking Action

MAX MANUAL	1210	70/-70	35/50	-55/190	25/-25	30/-30	45	70	155
AUTOBRAKE MAX	1280	75/-80	35/50	-55/195	25/-20	30/-30	50	75	170
AUTOBRAKE 2	2000	140/-150	70/90	-95/320	20/-30	55/-55	100	45	45

Medium Reported Braking Action

MAX MANUAL	1655	110/-110	55/75	-85/315	70/-55	40/-45	60	190	480
AUTOBRAKE MAX	1665	115/-115	55/80	-85/315	65/-50	40/-45	70	190	475
AUTOBRAKE 3	1735	115/-115	55/80	-90/325	55/-35	45/-45	90	145	440

Poor Reported Braking Action

MAX MANUAL	2155	165/-160	80/115	-130/500	175/-115	55/-60	75	415	1170
AUTOBRAKE MAX	2155	165/-160	80/115	-130/500	175/-115	55/-60	75	415	1170
AUTOBRAKE 3	2155	165/-160	80/115	-130/500	175/-110	55/-60	75	415	1170

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Disagree (30 ≤ Indicated Flaps <40)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	845	60/-45	20/25	-30/110	10/-10	15/-15	30	15	35
AUTOBRAKE MAX	1070	55/-60	25/35	-40/135	0/0	25/-25	50	0	0
AUTOBRAKE 2	1885	125/-135	60/85	-90/310	20/-30	50/-50	90	45	45

Good Reported Braking Action

MAX MANUAL	1175	65/-70	30/45	-55/185	25/-25	25/-25	45	65	145
AUTOBRAKE MAX	1240	70/-75	35/50	-55/195	25/-20	30/-30	55	70	155
AUTOBRAKE 2	1885	125/-135	60/85	-90/310	20/-30	50/-50	90	45	45

Medium Reported Braking Action

MAX MANUAL	1585	105/-105	50/70	-85/310	70/-55	40/-40	60	170	425
AUTOBRAKE MAX	1600	110/-110	50/75	-85/310	65/-50	40/-40	65	170	420
AUTOBRAKE 3	1655	105/-110	50/75	-85/315	55/-35	40/-45	85	135	400

Poor Reported Braking Action

MAX MANUAL	2045	150/-150	70/105	-125/485	165/-110	50/-55	70	365	1000
AUTOBRAKE MAX	2050	150/-150	70/105	-125/485	170/-110	50/-55	70	365	1000
AUTOBRAKE 3	2050	155/-150	75/105	-125/485	170/-100	50/-55	80	365	1005

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flaps Up Landing

VREF40 + 40

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1085	115/-65	30/45	-40/130	10/-10	25/-25	40	30	60
AUTOBRAKE MAX	1530	80/-75	40/55	-50/170	5/-5	40/-40	65	0	5
AUTOBRAKE 2	2695	175/-190	100/135	-110/375	60/-65	80/-80	90	215	250

Good Reported Braking Action

MAX MANUAL	1480	80/-85	45/60	-60/205	30/-30	35/-35	45	90	200
AUTOBRAKE MAX	1655	80/-85	50/70	-65/220	25/-20	40/-40	65	75	195
AUTOBRAKE 2	2695	175/-190	100/135	-110/375	60/-65	80/-80	90	215	250

Medium Reported Braking Action

MAX MANUAL	2055	130/-135	70/100	-95/345	80/-65	55/-55	60	245	615
AUTOBRAKE MAX	2125	130/-135	75/105	-100/350	75/-60	55/-60	65	255	630
AUTOBRAKE 3	2385	130/-145	80/110	-105/375	50/-45	65/-70	100	130	420

Poor Reported Braking Action

MAX MANUAL	2700	190/-190	105/150	-145/540	195/-135	75/-80	75	530	1490
AUTOBRAKE MAX	2705	190/-190	105/150	-145/540	195/-125	75/-80	80	525	1480
AUTOBRAKE 3	2790	185/-190	105/150	-145/550	175/-115	75/-80	100	475	1445

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Recommended Brake Cooling Schedule

Reference Brake Energy Per Brake (Millions of Foot Pounds)

		WIND CORRECTED BRAKES ON SPEED (KIAS)*																	
		80			100			120			140			160			180		
WEIGHT (1000 KG)	OAT (°C)	PRESSURE ALTITUDE (1000 FT)																	
		0	5	10	0	5	10	0	5	10	0	5	10	0	5	10	0	5	10
80	0	15.3	17.2	19.4	22.9	25.8	29.3	31.7	35.8	40.9	41.5	47.1	54.2	52.2	59.6	69.0	62.4	71.4	83.3
	10	15.8	17.7	20.0	23.6	26.6	30.2	32.7	37.0	42.2	42.8	48.7	55.9	53.9	61.5	71.2	64.4	73.7	86.0
	15	16.0	18.0	20.3	24.0	27.1	30.7	33.2	37.6	42.9	43.5	49.4	56.8	54.7	62.4	72.3	65.3	74.8	87.3
	20	16.3	18.3	20.6	24.4	27.5	31.1	33.7	38.1	43.5	44.1	50.1	57.6	55.6	63.4	73.4	66.3	75.9	88.6
	30	16.7	18.8	21.2	25.0	28.2	32.0	34.6	39.2	44.7	45.4	51.5	59.3	57.1	65.1	75.4	68.2	78.0	91.0
	40	16.8	18.9	21.3	25.2	28.5	32.3	35.0	39.6	45.3	46.0	52.3	60.2	58.0	66.3	77.0	69.5	79.7	93.3
	50	16.8	19.0	21.4	25.3	28.6	32.5	35.2	40.0	45.8	46.4	52.9	61.1	58.8	67.4	78.5	70.7	81.3	95.6
70	0	13.9	15.6	17.6	20.6	23.3	26.3	28.4	32.1	36.5	37.1	42.1	48.2	46.6	53.0	61.2	56.4	64.4	74.8
	10	14.4	16.2	18.2	21.3	24.0	27.2	29.3	33.1	37.7	38.3	43.4	49.7	48.1	54.7	63.1	58.2	66.5	77.2
	15	14.6	16.4	18.5	21.6	24.4	27.6	29.8	33.6	38.3	38.9	44.1	50.5	48.8	55.6	64.1	59.1	67.5	78.4
	20	14.8	16.7	18.8	22.0	24.8	28.0	30.2	34.2	38.9	39.5	44.7	51.3	49.5	56.4	65.1	60.0	68.5	79.6
	30	15.2	17.1	19.3	22.6	25.5	28.8	31.1	35.1	40.0	40.6	46.0	52.7	50.9	58.0	66.9	61.6	70.4	81.8
	40	15.3	17.2	19.4	22.7	25.6	29.1	31.3	35.5	40.4	41.0	46.6	53.5	51.7	58.9	68.1	62.7	71.8	83.6
	50	15.3	17.2	19.4	22.8	25.8	29.2	31.5	35.7	40.8	41.4	47.1	54.2	52.3	59.7	69.3	63.7	73.1	85.4
60	0	12.6	14.1	15.9	18.4	20.7	23.4	25.1	28.3	32.2	32.5	36.9	42.1	40.7	46.3	53.1	49.6	56.5	65.3
	10	13.0	14.6	16.4	19.0	21.4	24.2	25.9	29.2	33.2	33.6	38.0	43.4	42.0	47.7	54.9	51.2	58.3	67.4
	15	13.2	14.8	16.6	19.3	21.7	24.6	26.3	29.7	33.7	34.1	38.6	44.1	42.7	48.5	55.7	51.9	59.2	68.4
	20	13.4	15.0	16.9	19.6	22.1	24.9	26.7	30.1	34.2	34.6	39.2	44.8	43.3	49.2	56.5	52.7	60.1	69.5
	30	13.7	15.4	17.4	20.1	22.7	25.6	27.4	31.0	35.2	35.6	40.3	46.0	44.5	50.6	58.1	54.2	61.7	71.4
	40	13.8	15.5	17.5	20.3	22.8	25.8	27.7	31.3	35.6	36.0	40.8	46.6	45.1	51.3	59.0	55.0	62.8	72.8
	50	13.8	15.5	17.5	20.3	22.9	25.9	27.8	31.5	35.8	36.2	41.1	47.1	45.6	51.9	59.9	55.7	63.8	74.2
50	0	11.2	12.6	14.1	16.2	18.2	20.5	21.8	24.6	27.9	28.0	31.7	36.1	34.8	39.5	45.1	42.1	47.9	55.1
	10	11.6	13.0	14.6	16.7	18.8	21.2	22.5	25.4	28.8	28.9	32.7	37.2	35.9	40.7	46.6	43.5	49.4	56.8
	15	11.7	13.2	14.8	16.9	19.1	21.5	22.8	25.8	29.2	29.4	33.2	37.8	36.5	41.4	47.3	44.2	50.2	57.7
	20	11.9	13.4	15.1	17.2	19.4	21.9	23.2	26.2	29.6	29.8	33.7	38.4	37.0	42.0	48.0	44.8	50.9	58.6
	30	12.3	13.8	15.5	17.7	19.9	22.5	23.8	26.9	30.5	30.7	34.7	39.4	38.1	43.2	49.4	46.1	52.4	60.2
	40	12.3	13.8	15.6	17.8	20.0	22.6	24.0	27.1	30.7	30.9	35.0	39.9	38.5	43.7	50.0	46.7	53.1	61.2
	50	12.3	13.8	15.6	17.8	20.1	22.7	24.1	27.2	30.9	31.1	35.2	40.2	38.8	44.1	50.6	47.2	53.8	62.1
40	0	9.9	11.1	12.5	14.0	15.7	17.7	18.5	20.8	23.5	23.5	26.5	30.1	28.9	32.7	37.3	34.8	39.4	45.1
	10	10.2	11.5	12.9	14.4	16.2	18.2	19.1	21.5	24.3	24.3	27.4	31.1	29.9	33.8	38.5	35.9	40.7	46.5
	15	10.4	11.7	13.1	14.6	16.5	18.5	19.4	21.8	24.7	24.6	27.8	31.5	30.3	34.3	39.1	36.4	41.3	47.2
	20	10.6	11.9	13.3	14.9	16.7	18.8	19.7	22.2	25.1	25.0	28.2	32.0	30.8	34.8	39.7	37.0	41.9	47.9
	30	10.9	12.2	13.7	15.3	17.2	19.3	20.2	22.8	25.8	25.7	29.0	32.9	31.7	35.8	40.8	38.0	43.1	49.3
	40	10.9	12.2	13.7	15.3	17.3	19.5	20.4	22.9	26.0	25.9	29.3	33.2	31.9	36.2	41.2	38.4	43.6	50.0
	50	10.9	12.2	13.8	15.4	17.3	19.5	20.4	23.0	26.1	26.0	29.4	33.4	32.1	36.4	41.6	38.7	44.0	50.5

***To correct for wind, enter table with the brakes on speed minus one half the headwind or plus 1.5 times the tailwind. If ground speed is used for brakes on speed, ignore wind and enter table with sea level, 15°C.**

Adjusted Brake Energy Per Brake (Millions of Foot Pounds)

No Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)								
EVENT		10	20	30	40	50	60	70	80	90
RTO MAX MAN		10	20	30	40	50	60	70	80	90
LANDING	MAX MAN	7.5	15.8	24.6	33.8	43.5	53.5	63.6	73.9	84.2
	MAX AUTO	7.3	15.0	23.2	31.9	41.2	51.0	61.3	72.2	83.7
	AUTOBRAKE 3	7.0	14.2	21.8	29.7	38.1	47.1	56.7	67.1	78.3
	AUTOBRAKE 2	6.6	13.3	20.2	27.3	34.7	42.6	51.0	59.9	69.6
	AUTOBRAKE 1	6.3	12.4	18.6	24.9	31.6	38.6	46.2	54.4	63.5

ADVISORY INFORMATION

Recommended Brake Cooling Schedule
Adjusted Brake Energy Per Brake (Millions of Foot Pounds)
Two Engine Detent Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)								
EVENT		10	20	30	40	50	60	70	80	90
RTO MAX MAN		10	20	30	40	50	60	70	80	90
LANDING	MAX MAN	6.9	14.5	22.7	31.4	40.4	49.7	59.3	68.9	78.5
	MAX AUTO	6.0	12.6	19.8	27.6	36.0	45.1	54.8	65.3	76.5
	AUTOBRAKE 3	4.5	9.5	15.1	21.3	28.1	35.6	43.7	52.5	62.0
	AUTOBRAKE 2	2.6	5.9	9.7	14.1	19.1	24.7	31.0	37.9	45.4
	AUTOBRAKE 1	1.8	3.8	6.3	9.1	12.5	16.4	21.0	26.3	32.5

Cooling Time (Minutes) - Category A Steel and Carbon Brakes

	EVENT ADJUSTED BRAKE ENERGY (MILLIONS OF FOOT POUNDS)								
	16 & BELOW	17	19	20.9	23.5	26.9	29.4	30 TO 41	41 & ABOVE
	BRAKE TEMPERATURE MONITOR SYSTEM INDICATION ON CDS								
	UP TO 2.5	2.6	3	3.3	3.8	4.5	4.9	5.0 TO 7.1	7.1 & ABOVE
INFLIGHT GEAR DOWN	NO SPECIAL PROCEDURE REQUIRED	1	4	5	6	7	7.6	CAUTION	FUSE PLUG MELT ZONE
GROUND		6.7	16.0	24.1	34.2	45.9	53.3		

Observe maximum quick turnaround limit.
Table shows energy per brake added by a single stop with all brakes operating. Energy is assumed to be equally distributed among the operating brakes. Total energy is the sum of residual energy plus energy added.
Add 1.0 million foot pounds per brake for each taxi mile.

When in caution zone, wheel fuse plugs may melt. Delay takeoff and inspect after one hour. If overheat occurs after takeoff, extend gear soon for at least 7 minutes.

When in fuse plug melt zone, clear runway immediately. Unless required, do not set parking brake. Do not approach gear or attempt to taxi for one hour. Tire, wheel and brake replacement may be required. If overheat occurs after takeoff, extend gear soon for at least 12 minutes.

Brake temperature monitor system (BTMS) indication on CDS systems page may be used 10 to 15 minutes after airplane has come to a complete stop or inflight with gear retracted to determine recommended cooling schedule.

ENGINE INOP

Initial Max Continuous %N1

Based on .79M, A/C high and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT)								
	25	27	29	31	33	35	37	39	41
20	96.0	95.8	95.6	95.4	95.1	94.7	94.2	93.9	93.1
15	96.6	96.4	96.1	96.0	95.9	95.4	95.0	94.7	94.0
10	97.2	97.1	96.7	96.6	96.6	96.2	95.7	95.5	94.9
5	97.4	97.8	97.5	97.3	97.3	96.9	96.5	96.3	95.8
0	96.7	98.0	98.4	98.2	98.1	97.7	97.4	97.1	96.7
-5	95.9	97.2	98.4	99.1	99.0	98.5	98.2	98.0	97.7
-10	95.1	96.4	97.6	98.9	99.8	99.4	99.1	98.9	98.6
-15	94.3	95.7	96.9	98.1	99.4	100.3	100.0	99.8	99.6
-20	93.5	94.9	96.1	97.3	98.6	99.8	100.3	100.1	99.9
-25	92.7	94.1	95.3	96.5	97.8	98.9	99.5	99.3	99.1
-30	91.8	93.3	94.5	95.7	96.9	98.1	98.6	98.4	98.2
-35	91.0	92.5	93.6	94.8	96.1	97.2	97.8	97.6	97.4
-40	90.1	91.7	92.8	94.0	95.3	96.4	96.9	96.7	96.5

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)								
	25	27	29	31	33	35	37	39	41
ENGINE ANTI-ICE	-1.2	-1.1	-1.0	-0.9	-0.8	-0.8	-0.8	-0.8	-0.8
ENGINE & WING ANTI-ICE	-4.2	-4.4	-4.5	-4.7	-5.0	-4.8	-4.8	-4.8	-4.8

ENGINE INOP

Max Continuous %N1
37000 FT to 29000 FT Pressure Altitudes

37000 FT PRESS ALT		TAT (°C)											
KIAS	M	-55	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0
160	.51	96.0	96.9	97.8	98.7	99.5	98.9	98.0	96.8	95.5	93.9	92.4	91.1
200	.63	95.3	96.2	97.1	98.0	98.8	99.7	99.4	98.6	97.7	96.7	95.5	94.4
240	.74	94.4	95.3	96.1	97.0	97.9	98.7	99.6	100.0	99.2	98.4	97.6	96.6
280	.86	93.6	94.5	95.4	96.3	97.1	98.0	98.8	99.6	100.4	100.1	99.2	98.4

35000 FT PRESS ALT		TAT (°C)											
KIAS	M	-55	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0
160	.49	95.8	96.7	97.6	98.5	99.4	99.1	98.3	97.2	96.0	94.6	93.2	92.0
200	.60	95.4	96.4	97.2	98.1	99.0	99.9	99.8	98.8	97.9	96.9	95.7	94.6
240	.71	94.3	95.2	96.1	97.0	97.9	98.7	99.6	100.1	99.4	98.8	97.9	96.9
280	.82	93.1	94.0	94.8	95.7	96.5	97.4	98.2	99.0	99.8	99.6	98.8	98.0

33000 FT PRESS ALT		TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
160	.47	96.7	97.6	98.4	99.3	100.1	99.3	98.4	97.2	95.9	94.5	93.1	91.9
200	.58	96.3	97.2	98.1	99.0	99.8	100.7	99.8	98.9	97.9	96.7	95.5	94.4
240	.68	95.2	96.1	97.0	97.8	98.7	99.5	100.4	100.1	99.5	98.6	97.6	96.6
280	.79	93.6	94.4	95.3	96.1	97.0	97.8	98.6	99.4	99.8	99.0	98.1	97.3
320	.89	92.9	93.8	94.7	95.5	96.3	97.2	98.0	98.8	99.6	100.3	100.0	99.1

31000 FT PRESS ALT		TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
160	.45	96.7	97.5	98.4	99.3	100.2	100.3	99.5	98.4	97.2	95.8	94.4	93.1
200	.55	96.4	97.3	98.1	99.0	99.9	100.7	100.9	100.0	99.0	97.9	96.6	95.4
240	.66	94.9	95.8	96.7	97.5	98.4	99.2	100.1	100.6	99.8	99.0	98.0	97.0
280	.76	93.1	94.0	94.8	95.6	96.5	97.3	98.1	98.9	99.7	99.0	98.1	97.2
320	.85	91.7	92.5	93.4	94.2	95.0	95.8	96.6	97.4	98.2	99.0	99.2	98.3

29000 FT PRESS ALT		TAT (°C)											
KIAS	M	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
160	.43	97.4	98.3	99.2	100.0	100.9	100.5	99.5	98.4	97.1	95.6	94.3	93.0
200	.53	96.8	97.7	98.6	99.4	100.3	101.1	100.6	99.6	98.6	97.4	96.2	95.0
240	.63	95.6	96.4	97.3	98.1	99.0	99.8	100.6	100.3	99.4	98.5	97.4	96.5
280	.73	93.5	94.3	95.2	96.0	96.8	97.6	98.4	99.2	99.3	98.4	97.4	96.7
320	.82	91.3	92.2	93.0	93.8	94.6	95.4	96.2	97.0	97.7	98.5	97.7	96.9
360	.91	91.3	92.2	93.0	93.8	94.6	95.4	96.2	97.0	97.7	98.5	99.2	99.3

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)				
	29	31	33	35	37
ENGINE ANTI-ICE ON	-0.9	-0.9	-0.8	-0.8	-0.8
ENGINE & WING ANTI-ICE ON	-4.1	-4.3	-4.5	-4.7	-4.7

ENGINE INOP

Max Continuous %N1

27000 FT to 20000 FT Pressure Altitudes

27000 FT PRESS ALT		TAT (°C)											
KIAS	M	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
160	.41	97.3	98.1	99.0	99.9	100.7	101.5	100.5	99.5	98.3	96.9	95.6	94.3
200	.51	96.2	97.1	98.0	98.8	99.7	100.5	101.0	100.1	99.1	98.0	96.8	95.6
240	.60	94.9	95.8	96.7	97.5	98.3	99.2	100.0	100.6	99.6	98.6	97.6	96.7
280	.70	92.9	93.7	94.6	95.4	96.2	97.0	97.8	98.6	99.4	98.6	97.6	96.8
320	.79	90.8	91.6	92.5	93.3	94.1	94.9	95.6	96.4	97.2	97.9	97.8	97.1
360	.88	90.0	90.9	91.7	92.5	93.4	94.2	95.0	95.7	96.5	97.3	98.0	98.6
25000 FT PRESS ALT		TAT (°C)											
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
160	.39	98.1	98.9	99.8	100.7	101.5	101.6	100.6	99.5	98.3	96.9	95.7	94.4
200	.49	96.7	97.6	98.5	99.3	100.1	100.9	100.8	99.8	98.8	97.6	96.5	95.4
240	.58	95.0	95.8	96.7	97.5	98.3	99.1	99.9	99.7	98.8	97.8	96.8	95.9
280	.67	93.1	94.0	94.8	95.6	96.4	97.2	98.0	98.7	98.8	97.8	96.8	96.1
320	.76	90.8	91.7	92.5	93.3	94.1	94.9	95.7	96.5	97.2	97.8	97.1	96.4
360	.85	89.5	90.3	91.2	92.0	92.9	93.7	94.5	95.3	96.1	96.9	97.6	97.4
24000 FT PRESS ALT		TAT (°C)											
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
160	.38	97.3	98.2	99.1	99.9	100.7	101.5	100.4	99.3	98.1	96.8	95.6	94.4
200	.48	96.1	96.9	97.8	98.6	99.4	100.2	100.6	99.6	98.6	97.4	96.3	95.3
240	.57	94.5	95.3	96.1	96.9	97.8	98.6	99.3	99.7	98.7	97.6	96.7	95.8
280	.66	92.7	93.5	94.3	95.1	95.9	96.7	97.5	98.3	98.8	97.7	96.7	96.0
320	.75	90.2	91.1	91.9	92.7	93.5	94.4	95.2	95.9	96.7	97.5	96.9	96.2
360	.83	88.7	89.6	90.4	91.2	92.1	92.9	93.7	94.5	95.3	96.1	96.9	96.9
22000 FT PRESS ALT		TAT (°C)											
KIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
160	.37	96.7	97.6	98.4	99.2	100.1	100.2	99.0	97.8	96.6	95.5	94.4	93.3
200	.46	95.5	96.4	97.2	98.0	98.8	99.6	99.3	98.1	97.0	96.0	95.0	94.0
240	.55	94.1	94.9	95.8	96.5	97.3	98.1	98.9	98.5	97.3	96.4	95.5	94.7
280	.63	92.5	93.3	94.1	94.9	95.7	96.4	97.2	97.9	97.6	96.7	95.8	95.1
320	.72	90.1	91.0	91.8	92.7	93.5	94.3	95.1	95.9	96.7	96.8	96.0	95.3
360	.80	88.4	89.2	90.1	90.9	91.7	92.6	93.4	94.2	95.0	95.8	96.3	95.8
20000 FT PRESS ALT		TAT (°C)											
KIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
160	.35	95.3	96.1	97.0	97.8	98.6	99.4	98.8	97.4	96.2	95.2	94.2	93.2
200	.44	94.2	95.0	95.8	96.6	97.4	98.2	98.9	97.8	96.4	95.5	94.6	93.7
240	.53	92.8	93.6	94.4	95.2	96.0	96.8	97.5	98.2	97.0	95.9	95.1	94.3
280	.61	91.1	92.0	92.8	93.6	94.4	95.2	96.0	96.8	97.4	96.5	95.6	94.9
320	.69	89.1	90.0	90.8	91.6	92.5	93.3	94.1	94.9	95.7	96.5	95.8	95.1
360	.77	87.4	88.3	89.1	90.0	90.8	91.6	92.4	93.2	94.0	94.8	95.6	95.4

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)				
	20	22	24	25	27
ENGINE ANTI-ICE ON	-0.9	-0.9	-1.0	-1.0	-1.0
ENGINE & WING ANTI-ICE ON	-3.6	-3.8	-3.8	-3.9	-4.0

ENGINE INOP

Max Continuous %N1

18000 FT to 12000 FT Pressure Altitudes

18000 FT PRESS ALT		TAT (°C)											
KIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
160	.34	94.5	95.3	96.1	96.9	97.7	98.4	97.3	95.9	94.9	94.0	93.0	92.1
200	.42	93.4	94.2	95.0	95.8	96.6	97.3	97.6	96.3	95.2	94.4	93.5	92.6
240	.51	91.9	92.7	93.5	94.3	95.1	95.9	96.7	96.7	95.6	94.7	94.0	93.2
280	.59	90.4	91.3	92.1	92.9	93.8	94.6	95.4	96.1	96.1	95.2	94.4	93.7
320	.67	88.9	89.7	90.5	91.4	92.2	93.0	93.8	94.6	95.4	95.5	94.8	94.1
360	.75	87.3	88.2	89.0	89.8	90.7	91.5	92.3	93.1	93.9	94.7	95.1	94.5

16000 FT PRESS ALT		TAT (°C)											
KIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
160	.33	93.0	93.8	94.6	95.4	96.1	96.9	97.2	96.0	94.8	94.0	93.1	92.2
200	.41	91.6	92.4	93.2	94.0	94.8	95.6	96.4	96.1	95.0	94.1	93.3	92.5
240	.49	90.3	91.1	92.0	92.8	93.6	94.4	95.2	96.0	95.4	94.5	93.7	92.9
280	.57	89.0	89.9	90.7	91.5	92.4	93.2	94.0	94.8	95.6	94.9	94.1	93.4
320	.64	87.8	88.6	89.5	90.3	91.1	91.9	92.7	93.5	94.3	95.1	94.5	93.8
360	.72	86.5	87.3	88.2	89.0	89.8	90.6	91.4	92.2	93.0	93.8	94.6	94.2

14000 FT PRESS ALT		TAT (°C)											
KIAS	M	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
160	.31	92.4	93.2	94.1	94.9	95.7	96.4	96.4	95.5	94.6	93.8	92.9	92.0
200	.39	91.0	91.9	92.7	93.5	94.3	95.1	95.9	95.1	94.2	93.4	92.6	91.8
240	.47	90.0	90.9	91.7	92.5	93.3	94.1	94.9	95.4	94.6	93.7	93.0	92.3
280	.54	88.9	89.8	90.6	91.4	92.3	93.1	93.9	94.7	94.9	94.1	93.4	92.7
320	.62	87.8	88.7	89.5	90.3	91.2	92.0	92.8	93.5	94.3	94.5	93.8	93.1
360	.69	86.7	87.5	88.3	89.1	90.0	90.8	91.5	92.3	93.1	93.9	94.2	93.6

12000 FT PRESS ALT		TAT (°C)											
KIAS	M	-20	-15	-10	-5	0	5	10	15	20	25	30	35
160	.30	91.8	92.6	93.4	94.2	95.0	95.8	95.5	94.8	94.0	93.2	92.4	91.5
200	.38	90.7	91.5	92.3	93.1	93.9	94.7	95.2	94.3	93.5	92.7	92.0	91.2
240	.45	89.8	90.7	91.5	92.3	93.1	93.9	94.7	94.7	93.8	93.1	92.4	91.6
280	.52	88.9	89.8	90.6	91.4	92.2	93.0	93.8	94.6	94.2	93.5	92.8	92.1
320	.60	87.9	88.8	89.6	90.4	91.2	92.0	92.8	93.6	94.3	93.9	93.2	92.5
360	.67	86.8	87.7	88.5	89.3	90.1	90.9	91.6	92.4	93.2	93.9	93.5	92.9

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)			
	12	14	16	18
ENGINE ANTI-ICE ON	-0.9	-0.9	-0.9	-0.9
ENGINE & WING ANTI-ICE ON	-3.2	-3.4	-3.4	-3.5

ENGINE INOP

Max Continuous %N1
10000 FT to 1000 FT Pressure Altitudes

10000 FT PRESS ALT		TAT (°C)											
KIAS	M	-20	-15	-10	-5	0	5	10	15	20	25	30	35
160	.29	90.5	91.4	92.2	93.0	93.8	94.6	95.4	94.7	94.1	93.3	92.5	91.7
200	.36	89.6	90.4	91.3	92.1	92.9	93.7	94.5	94.5	93.7	92.9	92.2	91.4
240	.43	88.9	89.7	90.6	91.4	92.2	93.0	93.8	94.5	94.0	93.1	92.4	91.7
280	.51	88.1	89.0	89.8	90.6	91.4	92.2	93.0	93.8	94.4	93.6	92.8	92.2
320	.58	87.2	88.0	88.8	89.6	90.4	91.2	92.0	92.8	93.5	93.9	93.2	92.5
360	.65	86.2	87.0	87.8	88.6	89.4	90.2	91.0	91.7	92.5	93.2	93.6	92.9

5000 FT PRESS ALT		TAT (°C)											
KIAS	M	-10	-5	0	5	10	15	20	25	30	35	40	45
160	.26	89.1	89.9	90.7	91.5	92.3	93.1	93.7	93.5	93.2	92.5	91.8	91.0
200	.33	88.7	89.5	90.3	91.1	91.8	92.6	93.4	93.3	92.9	92.3	91.6	90.8
240	.40	88.1	88.9	89.7	90.5	91.3	92.0	92.8	93.3	92.5	91.8	91.1	90.3
280	.46	87.5	88.3	89.1	89.8	90.6	91.4	92.2	92.9	92.9	92.1	91.4	90.7
320	.53	86.8	87.6	88.3	89.1	89.9	90.7	91.4	92.2	92.9	92.5	91.8	91.1
360	.59	86.0	86.7	87.5	88.3	89.1	89.8	90.6	91.3	92.0	92.8	92.2	91.5

3000 FT PRESS ALT		TAT (°C)											
KIAS	M	-5	0	5	10	15	20	25	30	35	40	45	50
160	.26	88.8	89.6	90.4	91.2	91.9	92.7	93.1	92.9	92.6	91.8	91.1	90.3
200	.32	88.5	89.3	90.0	90.8	91.6	92.3	93.1	92.8	92.5	91.8	91.1	90.3
240	.38	87.9	88.7	89.5	90.3	91.0	91.8	92.5	92.6	91.8	91.0	90.3	89.6
280	.45	87.4	88.1	88.9	89.7	90.5	91.2	92.0	92.7	92.2	91.4	90.7	90.0
320	.51	86.7	87.5	88.3	89.0	89.8	90.5	91.3	92.0	92.5	91.8	91.1	90.4
360	.57	85.9	86.7	87.5	88.2	89.0	89.7	90.5	91.2	91.9	92.2	91.5	90.7

1000 FT PRESS ALT		TAT (°C)											
KIAS	M	-5	0	5	10	15	20	25	30	35	40	45	50
160	.25	87.7	88.5	89.3	90.0	90.8	91.6	92.3	92.3	91.8	91.2	90.5	89.7
200	.31	87.4	88.2	89.0	89.7	90.5	91.3	92.0	92.4	92.0	91.5	90.8	90.0
240	.37	86.9	87.7	88.5	89.3	90.0	90.8	91.5	92.3	91.9	91.2	90.4	89.7
280	.43	86.4	87.2	87.9	88.7	89.5	90.2	90.9	91.7	92.1	91.4	90.7	89.9
320	.49	85.8	86.6	87.4	88.1	88.9	89.6	90.4	91.1	91.8	91.8	91.1	90.3
360	.55	85.1	85.9	86.7	87.4	88.1	88.9	89.6	90.3	91.1	91.8	91.4	90.7

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)			
	1	3	5	10
ENGINE ANTI-ICE ON	-0.6	-0.8	-0.8	-0.8
ENGINE & WING ANTI-ICE ON	-2.9	-3.0	-3.1	-3.2

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

WEIGHT (1000 KG)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFTDOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
85	81	269	14800	12600	10400
80	76	262	17400	15200	12900
75	72	255	19900	18100	15700
70	67	247	22300	20800	18900
65	63	238	24800	23500	21900
60	58	229	27000	25900	24800
55	53	220	29200	28300	27100
50	48	210	31300	30500	29500
45	44	200	33400	32700	31800
40	39	190	35800	35100	34200

Includes APU fuel burn.

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown/LRC Cruise Range Capability

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
138	128	120	112	106	100	95	90	86	82	78
276	256	240	225	212	200	190	180	172	164	157
414	385	359	337	317	300	284	270	257	246	235
552	513	479	449	423	400	379	360	343	328	314
690	641	599	562	529	500	474	450	429	410	392
828	770	719	674	635	600	569	540	515	492	470
966	898	839	787	741	700	663	630	601	573	549
1105	1027	959	899	847	800	758	720	686	655	627
1243	1155	1079	1012	953	900	853	811	772	737	705
1382	1284	1199	1124	1058	1000	948	901	858	819	784
1520	1412	1319	1237	1164	1100	1042	990	944	901	862
1659	1541	1439	1349	1270	1200	1137	1080	1029	983	940
1797	1670	1559	1462	1376	1300	1232	1170	1115	1064	1018
1936	1798	1679	1574	1482	1400	1327	1260	1201	1146	1096
2075	1927	1799	1687	1588	1500	1421	1350	1286	1228	1175
2214	2056	1919	1800	1694	1600	1516	1440	1372	1309	1253
2353	2185	2040	1912	1800	1700	1611	1530	1457	1391	1331
2492	2314	2160	2025	1906	1800	1705	1620	1543	1473	1409

Driftdown/Cruise Fuel and Time

AIR DIST (NM)	FUEL REQUIRED (1000 KG)									TIME (HR:MIN)
	WEIGHT AT START OF DRIFTDOWN (1000 KG)									
	40	45	50	55	60	65	70	75	80	
100	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0:17
200	0.8	0.8	0.9	0.9	1.0	1.0	1.1	1.1	1.2	0:33
300	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	1.9	0:50
400	1.6	1.8	1.9	2.0	2.2	2.3	2.4	2.6	2.7	1:06
500	2.0	2.2	2.4	2.5	2.7	2.9	3.1	3.3	3.5	1:23
600	2.4	2.6	2.8	3.1	3.3	3.5	3.8	4.0	4.2	1:40
700	2.8	3.1	3.3	3.6	3.8	4.1	4.4	4.7	4.9	1:56
800	3.2	3.5	3.8	4.1	4.4	4.7	5.0	5.3	5.6	2:13
900	3.5	3.9	4.2	4.6	4.9	5.3	5.6	6.0	6.4	2:30
1000	3.9	4.3	4.7	5.1	5.5	5.9	6.2	6.7	7.1	2:46
1100	4.3	4.7	5.2	5.6	6.0	6.4	6.9	7.3	7.8	3:03
1200	4.7	5.2	5.6	6.0	6.5	7.0	7.5	8.0	8.5	3:20
1300	5.0	5.6	6.0	6.5	7.0	7.6	8.1	8.6	9.2	3:37
1400	5.4	6.0	6.5	7.0	7.6	8.1	8.7	9.3	9.9	3:54
1500	5.8	6.4	6.9	7.5	8.1	8.7	9.3	9.9	10.6	4:10
1600	6.1	6.8	7.4	8.0	8.6	9.2	9.8	10.5	11.2	4:27
1700	6.5	7.1	7.8	8.4	9.1	9.8	10.4	11.2	11.9	4:44
1800	6.8	7.5	8.2	8.9	9.6	10.3	11.0	11.8	12.6	5:01

Includes APU fuel burn.
Driftdown at optimum driftdown speed and cruise at Long Range Cruise speed.

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Altitude Capability

100 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
75	14500	11700	8900
70	18300	14700	11900
65	21600	18700	15000
60	24600	22600	19500
55	27200	25800	23700
50	29800	28700	27100
45	32100	31300	30100
40	34500	33700	32600

With engine anti-ice on, decrease altitude capability by 2300 ft.
With engine and wing anti-ice on, decrease altitude capability by 7900 ft .

ENGINE INOP

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)								
		10	15	17	19	21	25	27	29	31
85	%N1	90.9								
	MACH	.557								
	KIAS	309								
	FF/ENG	2970								
80	%N1	89.3								
	MACH	.542								
	KIAS	301								
	FF/ENG	2794								
75	%N1	87.7	91.5	93.0						
	MACH	.527	.573	.588						
	KIAS	292	290	286						
	FF/ENG	2618	2608	2581						
70	%N1	85.9	89.8	91.4	92.9	95.2				
	MACH	.510	.557	.576	.590	.607				
	KIAS	282	281	280	276	273				
	FF/ENG	2442	2435	2423	2395	2402				
65	%N1	83.9	87.9	89.5	91.1	92.8				
	MACH	.492	.540	.559	.577	.592				
	KIAS	272	272	272	270	266				
	FF/ENG	2265	2261	2251	2237	2215				
60	%N1	81.9	85.9	87.5	89.1	90.7	95.1			
	MACH	.473	.520	.540	.560	.578	.610			
	KIAS	262	262	262	261	260	253			
	FF/ENG	2088	2086	2077	2067	2055	2066			
55	%N1	79.6	83.6	85.3	86.9	88.6	92.2	94.9	98.4	
	MACH	.455	.499	.519	.539	.559	.593	.610	.631	
	KIAS	251	251	252	251	251	245	242	241	
	FF/ENG	1917	1910	1903	1894	1886	1868	1897	1972	
50	%N1	77.2	81.2	82.8	84.5	86.2	89.5	91.5	94.3	97.9
	MACH	.435	.477	.496	.516	.536	.576	.592	.609	.630
	KIAS	241	240	240	240	240	238	234	232	230
	FF/ENG	1754	1733	1728	1721	1714	1703	1700	1725	1795
45	%N1	74.8	78.5	80.1	81.8	83.5	86.9	88.5	90.5	93.5
	MACH	.416	.454	.471	.490	.511	.552	.572	.589	.606
	KIAS	230	228	228	228	228	228	226	223	220
	FF/ENG	1596	1564	1554	1546	1542	1533	1535	1533	1551
40	%N1	72.1	75.6	77.2	78.8	80.5	83.9	85.6	87.2	89.2
	MACH	.395	.431	.447	.464	.482	.524	.545	.566	.584
	KIAS	218	216	216	215	215	215	215	214	212
	FF/ENG	1442	1402	1388	1376	1367	1364	1366	1368	1366

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Diversion Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
297	272	249	230	214	200	190	180	172	164	157
599	546	500	461	429	400	379	361	344	328	315
902	822	751	693	644	600	569	541	516	492	472
1206	1099	1004	926	859	800	759	722	687	656	629
1513	1377	1257	1158	1074	1000	949	902	859	820	786
1821	1656	1511	1391	1290	1200	1138	1081	1030	983	942
2132	1937	1766	1625	1506	1400	1328	1262	1202	1147	1098
2444	2219	2022	1859	1722	1600	1517	1441	1372	1310	1254
2759	2502	2278	2093	1938	1800	1707	1621	1543	1473	1410

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		18		22		26	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	1.3	0:43	1.2	0:41	1.0	0:39	0.9	0:38	0.9	0:37
400	2.8	1:23	2.5	1:19	2.3	1:15	2.1	1:12	2.0	1:09
600	4.2	2:04	3.8	1:57	3.5	1:51	3.3	1:46	3.1	1:42
800	5.5	2:45	5.1	2:36	4.7	2:27	4.4	2:20	4.2	2:15
1000	6.9	3:27	6.4	3:15	6.0	3:04	5.5	2:55	5.3	2:48
1200	8.3	4:09	7.7	3:54	7.1	3:41	6.7	3:29	6.4	3:22
1400	9.6	4:52	9.0	4:35	8.3	4:18	7.8	4:05	7.4	3:55
1600	10.9	5:35	10.2	5:15	9.5	4:56	8.8	4:40	8.5	4:29
1800	12.3	6:19	11.4	5:56	10.6	5:34	9.9	5:16	9.5	5:03

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	40	50	60	70	80
1	-0.1	-0.1	0.0	0.1	0.3
2	-0.3	-0.1	0.0	0.3	0.6
3	-0.4	-0.2	0.0	0.5	1.0
4	-0.6	-0.3	0.0	0.6	1.4
5	-0.7	-0.4	0.0	0.8	1.7
6	-0.9	-0.4	0.0	1.0	2.1
7	-1.0	-0.5	0.0	1.1	2.4
8	-1.2	-0.6	0.0	1.2	2.7
9	-1.4	-0.7	0.0	1.4	3.0
10	-1.5	-0.8	0.0	1.5	3.3
11	-1.7	-0.8	0.0	1.6	3.6
12	-1.8	-0.9	0.0	1.8	3.9
13	-2.0	-1.0	0.0	1.9	4.2

Includes APU fuel burn

ENGINE INOP

MAX CONTINUOUS THRUST

Holding

Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)							
		1500	5000	10000	15000	20000	25000	30000	35000
80	%N1	79.3	82.2	86.4	90.9				
	KIAS	244	245	246	247				
	FF/ENG	2560	2550	2560	2600				
75	%N1	77.6	80.3	84.6	89.0	94.8			
	KIAS	236	237	238	239	241			
	FF/ENG	2400	2390	2390	2420	2480			
70	%N1	75.7	78.4	82.7	87.0	92.0			
	KIAS	228	229	230	231	232			
	FF/ENG	2240	2230	2220	2240	2270			
65	%N1	73.6	76.5	80.6	84.9	89.5	97.4		
	KIAS	220	220	222	223	224	225		
	FF/ENG	2080	2070	2060	2060	2080	2220		
60	%N1	71.3	74.3	78.3	82.7	87.2	93.4		
	KIAS	211	212	213	213	215	216		
	FF/ENG	1920	1910	1900	1900	1900	1960		
55	%N1	69.0	71.9	76.0	80.3	84.7	89.8		
	KIAS	202	203	203	204	205	206		
	FF/ENG	1770	1750	1740	1730	1720	1750		
50	%N1	66.5	69.2	73.5	77.6	82.1	86.8	94.6	
	KIAS	192	193	194	195	195	197	198	
	FF/ENG	1620	1600	1580	1570	1560	1570	1670	
45	%N1	63.8	66.5	70.6	74.8	79.3	83.8	89.4	
	KIAS	184	184	184	184	185	186	187	
	FF/ENG	1480	1450	1430	1410	1390	1400	1440	
40	%N1	60.6	63.5	67.5	71.8	76.0	80.6	85.3	93.9
	KIAS	177	177	177	177	177	177	177	177
	FF/ENG	1330	1310	1280	1260	1240	1230	1260	1350

This table includes 5% additional fuel for holding in a racetrack pattern.

ENGINE INOP

ADVISORY INFORMATION

Gear Down Landing Rate of Climb Available

Flaps 15

TAT (°C)	RATE OF CLIMB (FT/MIN)						
	PRESSURE ALTITUDE (FT)						
	-2000	0	2000	4000	6000	8000	10000
52	-250	-310					
50	-230	-290	-370				
48	-200	-260	-350				
46	-180	-240	-330	-410			
44	-150	-220	-300	-390			
42	-120	-190	-280	-370	-470		
40	-100	-160	-250	-350	-450		
38	-70	-140	-230	-320	-430	-550	
36	-60	-110	-200	-300	-410	-530	
34	-50	-80	-180	-280	-380	-510	-610
32	-50	-60	-150	-250	-360	-490	-590
30	-50	-60	-130	-230	-340	-470	-570
20	-50	-60	-110	-170	-240	-340	-470
10	-40	-50	-110	-160	-240	-310	-390
0	-40	-50	-110	-160	-240	-310	-390
-20	-30	-50	-110	-160	-240	-320	-400
-40	-30	-50	-110	-160	-240	-330	-410

Rate of climb capability shown is valid for 60000 kg, gear down at VREF15+5.
Decrease rate of climb 100 ft/min per 5000 kg greater than 60000 kg.
Increase rate of climb 150 ft/min per 5000 kg less than 60000 kg.

Flaps 30

TAT (°C)	RATE OF CLIMB (FT/MIN)						
	PRESSURE ALTITUDE (FT)						
	-2000	0	2000	4000	6000	8000	10000
52	-410	-470					
50	-380	-440	-530				
48	-360	-420	-510				
46	-340	-400	-490	-580			
44	-310	-380	-470	-560			
42	-290	-350	-440	-540	-640		
40	-260	-330	-420	-510	-620		
38	-240	-300	-400	-490	-600	-720	
36	-220	-280	-370	-470	-580	-700	
34	-220	-250	-350	-450	-560	-680	-790
32	-220	-230	-320	-420	-540	-660	-770
30	-220	-230	-300	-400	-510	-640	-750
20	-210	-230	-290	-340	-410	-530	-660
10	-210	-230	-290	-340	-420	-490	-580
0	-210	-230	-290	-340	-420	-500	-580
-20	-220	-230	-290	-350	-430	-510	-600
-40	-220	-240	-300	-360	-440	-530	-620

Rate of climb capability shown is valid for 60000 kg, gear down at VREF30+5.
Decrease rate of climb 110 ft/min per 5000 kg greater than 60000 kg.
Increase rate of climb 150 ft/min per 5000 kg less than 60000 kg.

Performance Inflight — Chapter PI

Gear Down — Section 24

GEAR DOWN

Long Range Cruise Altitude Capability

Max Cruise Thrust, 100 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
85	12900	10300	7500
80	16000	13100	10400
75	20400	16300	13300
70	23500	20400	16700
65	26200	24400	20800
60	28700	27200	25400
55	30900	29700	28200
50	33000	32000	30800
45	35200	34200	33100
40	37600	36600	35500

GEAR DOWN

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)									
		10	21	23	25	27	29	31	33	35	37
85	%N1	85.9									
	MACH	.482									
	KIAS	267									
	FF/ENG	2417									
80	%N1	84.2									
	MACH	.468									
	KIAS	259									
	FF/ENG	2266									
75	%N1	82.5	91.7								
	MACH	.454	.554								
	KIAS	251	248								
	FF/ENG	2116	2095								
70	%N1	80.5	89.8	91.7	94.3						
	MACH	.440	.541	.557	.575						
	KIAS	243	242	240	238						
	FF/ENG	1969	1955	1943	1965						
65	%N1	78.5	87.8	89.5	91.5	94.4					
	MACH	.425	.524	.543	.560	.578					
	KIAS	235	234	233	231	229					
	FF/ENG	1826	1807	1800	1797	1826					
60	%N1	76.4	85.6	87.4	89.1	91.2	94.4				
	MACH	.409	.504	.525	.544	.562	.580				
	KIAS	226	225	225	224	222	220				
	FF/ENG	1686	1656	1655	1652	1656	1686				
55	%N1	74.2	83.3	85.0	86.8	88.5	90.8	94.0			
	MACH	.393	.484	.504	.525	.545	.562	.581			
	KIAS	217	216	216	216	215	213	211			
	FF/ENG	1548	1509	1506	1509	1511	1515	1545			
50	%N1	71.7	80.7	82.4	84.2	86.0	87.7	90.0	93.3		
	MACH	.376	.463	.482	.502	.523	.544	.561	.580		
	KIAS	207	206	206	206	206	205	203	201		
	FF/ENG	1412	1364	1361	1362	1368	1371	1373	1401		
45	%N1	68.9	77.9	79.6	81.4	83.1	84.9	86.7	89.0	92.3	
	MACH	.358	.441	.458	.477	.498	.520	.541	.559	.578	
	KIAS	197	196	196	196	196	196	195	193	191	
	FF/ENG	1281	1223	1217	1218	1224	1229	1231	1231	1255	
40	%N1	66.0	74.8	76.5	78.2	80.0	81.7	83.6	85.4	87.5	91.3
	MACH	.340	.417	.434	.452	.471	.491	.513	.535	.554	.573
	KIAS	187	185	185	185	185	185	185	185	183	181
	FF/ENG	1156	1089	1077	1076	1082	1086	1088	1090	1090	1113

GEAR DOWN

Long Range Cruise Enroute Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
324	290	260	236	217	200	188	178	168	160	153
654	583	523	474	435	400	377	357	338	321	307
989	880	787	713	653	600	566	535	507	483	461
1329	1181	1054	953	871	800	754	713	676	643	614
1674	1484	1322	1194	1090	1000	943	891	844	803	766
2024	1791	1593	1436	1310	1200	1131	1069	1013	962	918
2380	2102	1865	1680	1530	1400	1320	1247	1181	1122	1070
2742	2417	2140	1924	1751	1600	1508	1424	1348	1280	1221
3111	2736	2418	2171	1972	1800	1695	1600	1514	1438	1371

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		20		24		28	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	2.4	0:49	2.2	0:47	1.9	0:44	1.7	0:42	1.6	0:41
400	4.9	1:36	4.5	1:31	4.0	1:25	3.7	1:20	3.5	1:17
600	7.3	2:25	6.8	2:17	6.1	2:06	5.7	1:59	5.3	1:54
800	9.7	3:14	9.1	3:03	8.1	2:48	7.6	2:38	7.2	2:31
1000	12.1	4:04	11.2	3:50	10.1	3:31	9.4	3:18	8.9	3:08
1200	14.3	4:56	13.4	4:39	12.0	4:14	11.3	3:59	10.7	3:46
1400	16.6	5:49	15.5	5:28	13.9	4:58	13.1	4:40	12.4	4:24
1600	18.8	6:43	17.5	6:18	15.8	5:44	14.8	5:22	14.0	5:03
1800	20.9	7:38	19.6	7:10	17.6	6:30	16.5	6:05	15.7	5:43

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	40	50	60	70	80
2	-0.3	-0.2	0.0	0.3	0.7
4	-0.7	-0.3	0.0	0.6	1.4
6	-1.0	-0.5	0.0	0.9	2.0
8	-1.4	-0.7	0.0	1.2	2.6
10	-1.7	-0.9	0.0	1.4	3.2
12	-2.1	-1.0	0.0	1.6	3.7
14	-2.4	-1.2	0.0	1.8	4.2
16	-2.8	-1.4	0.0	2.0	4.6
18	-3.2	-1.6	0.0	2.2	5.0
20	-3.5	-1.7	0.0	2.4	5.3
22	-3.9	-1.9	0.0	2.5	5.6

GEAR DOWN

Descent

VREF40 + 70 KIAS

PRESSURE ALTITUDE (FT)	TIME (MIN)	FUEL (KG)	DISTANCE (NM)
41000	21	270	90
39000	21	270	86
37000	20	260	81
35000	19	260	77
33000	19	250	73
31000	18	250	68
29000	17	240	64
27000	16	240	60
25000	15	230	56
23000	15	220	52
21000	14	220	48
19000	13	210	44
17000	12	200	40
15000	11	190	36
10000	9	160	26
5000	6	130	16
1500	4	100	9

Allowances for a straight-in approach are included.

GEAR DOWN

Holding

Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)							
		1500	5000	10000	15000	20000	25000	30000	35000
80	%N1	73.9	76.7	80.8	85.1	89.7			
	KIAS	224	224	224	224	224			
	FF/ENG	2090	2080	2070	2080	2090			
75	%N1	72.2	75.2	79.1	83.5	88.0	94.4		
	KIAS	219	219	219	219	219	219		
	FF/ENG	1980	1960	1950	1950	1950	2020		
70	%N1	70.4	73.4	77.4	81.7	86.2	91.5		
	KIAS	214	214	214	214	214	214		
	FF/ENG	1860	1840	1830	1820	1820	1850		
65	%N1	68.6	71.5	75.6	79.9	84.3	89.0		
	KIAS	209	209	209	209	209	209		
	FF/ENG	1750	1720	1710	1700	1690	1710		
60	%N1	66.7	69.5	73.7	77.8	82.2	86.8	93.9	
	KIAS	203	203	203	203	203	203	203	
	FF/ENG	1630	1610	1590	1580	1560	1570	1650	
55	%N1	64.7	67.4	71.6	75.6	80.0	84.6	90.1	
	KIAS	197	197	197	197	197	197	197	
	FF/ENG	1520	1490	1470	1460	1440	1440	1480	
50	%N1	62.3	65.2	69.2	73.4	77.7	82.2	86.9	
	KIAS	190	190	190	190	190	190	190	
	FF/ENG	1400	1380	1360	1340	1320	1310	1340	
45	%N1	59.9	62.8	66.8	71.1	75.2	79.7	84.3	91.1
	KIAS	184	184	184	184	184	184	184	184
	FF/ENG	1290	1270	1250	1230	1200	1190	1210	1250
40	%N1	57.5	60.2	64.3	68.4	72.7	77.0	81.5	86.5
	KIAS	177	177	177	177	177	177	177	177
	FF/ENG	1180	1160	1140	1120	1090	1070	1090	1100

This table includes 5% additional fuel for holding in a racetrack pattern.

Intentionally
Blank

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

WEIGHT (1000 KG)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFTDOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
75	70	217	400		
70	66	213	3500	1400	
65	62	208	6700	4900	3100
60	57	202	9900	8100	6400
55	52	196	13100	11400	9500
50	48	190	16300	14800	13000
45	43	183	19500	18200	16500
40	38	177	22800	21600	20300

Includes APU fuel burn.

Long Range Cruise Altitude Capability

100 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
60	4500	1600	
55	8900	6600	4300
50	13000	10900	8600
45	17100	15400	13200
40	21400	19900	18100

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)									
		5	7	9	11	13	15	17	19	21	23
60	%N1	90.1									
	MACH	.364									
	KIAS	220									
	FF/ENG	3180									
55	%N1	87.6	89.2	90.9							
	MACH	.351	.362	.374							
	KIAS	212	211	210							
	FF/ENG	2909	2898	2897							
50	%N1	85.1	86.6	88.1	89.8	91.6					
	MACH	.338	.348	.359	.371	.384					
	KIAS	204	203	202	201	200					
	FF/ENG	2652	2632	2618	2616	2624					
45	%N1	82.4	83.8	85.3	86.8	88.5	90.3	92.6			
	MACH	.325	.334	.344	.355	.367	.380	.393			
	KIAS	196	195	193	192	191	190	189			
	FF/ENG	2407	2379	2358	2344	2341	2343	2350			
40	%N1	79.5	80.8	82.2	83.7	85.2	86.9	88.7	90.7	93.9	98.2
	MACH	.311	.320	.329	.339	.349	.361	.374	.387	.402	.417
	KIAS	188	186	184	183	182	181	180	179	179	178
	FF/ENG	2178	2141	2111	2090	2075	2066	2060	2057	2091	2183

GEAR DOWN
ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Diversion Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
172	151	134	120	109	100	93	88	83	78	75
352	308	270	242	219	200	187	175	165	156	148
533	465	408	364	330	300	280	262	246	232	220
716	623	545	486	440	400	373	349	328	309	293
900	783	684	609	551	500	466	436	409	385	365
1086	943	823	733	661	600	559	523	490	462	438
1273	1105	964	856	772	700	652	610	572	538	510
1462	1267	1103	980	883	800	745	696	652	614	581
1652	1430	1244	1103	994	900	838	782	733	690	653
1844	1595	1385	1228	1105	1000	931	868	813	765	724

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)					
	6		10		14	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
100	1.2	0:27	1.1	0:26	1.0	0:26
200	2.6	0:53	2.4	0:50	2.3	0:48
300	3.9	1:18	3.6	1:15	3.5	1:11
400	5.2	1:44	4.9	1:39	4.8	1:35
500	6.5	2:10	6.1	2:04	5.9	1:58
600	7.8	2:37	7.3	2:29	7.1	2:22
700	9.0	3:03	8.5	2:55	8.3	2:46
800	10.3	3:30	9.7	3:20	9.4	3:10
900	11.5	3:58	10.8	3:46	10.5	3:35
1000	12.7	4:25	12.0	4:12	11.6	3:59

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	40	50	60	70	80
1	-0.2	-0.1	0.0	0.1	0.3
2	-0.3	-0.2	0.0	0.3	0.6
3	-0.5	-0.3	0.0	0.5	1.0
4	-0.7	-0.4	0.0	0.7	1.3
5	-0.9	-0.4	0.0	0.9	1.7
6	-1.0	-0.5	0.0	1.1	2.0
7	-1.2	-0.6	0.0	1.2	2.4
8	-1.4	-0.7	0.0	1.4	2.8
9	-1.5	-0.8	0.0	1.6	3.1
10	-1.7	-0.9	0.0	1.8	3.5
11	-1.9	-0.9	0.0	2.0	3.8
12	-2.0	-1.0	0.0	2.1	4.2
13	-2.2	-1.1	0.0	2.3	4.6
14	-2.4	-1.2	0.0	2.5	5.0

Includes APU fuel burn.

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Holding

Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)				
		1500	5000	10000	15000	20000
70	%N1	89.1				
	KIAS	214				
	FF/ENG	3560				
65	%N1	87.1	90.1			
	KIAS	209	209			
	FF/ENG	3310	3330			
60	%N1	84.8	87.8			
	KIAS	203	203			
	FF/ENG	3060	3070			
55	%N1	82.5	85.5	90.0		
	KIAS	197	197	197		
	FF/ENG	2820	2820	2840		
50	%N1	79.9	82.9	87.3	92.4	
	KIAS	190	190	190	190	
	FF/ENG	2580	2570	2580	2630	
45	%N1	77.4	80.2	84.6	89.3	
	KIAS	184	184	184	184	
	FF/ENG	2370	2350	2340	2370	
40	%N1	74.7	77.4	81.8	86.2	91.7
	KIAS	177	177	177	177	177
	FF/ENG	2150	2130	2110	2120	2140

This table includes 5% additional fuel for holding in a racetrack pattern.

Performance Inflight
Chapter PI
Text
Section 26

Introduction

This chapter contains information to supplement performance data from the Flight Management Computer (FMC). In addition, sufficient inflight data is provided to complete a flight with the FMC inoperative. In the event of conflict between data presented in this chapter and that contained in the approved Airplane Flight Manual, the Flight Manual shall always take precedence.

General

Takeoff Speeds

The speeds presented in the Takeoff Speeds table as well as FMC computed takeoff speeds can be used for all performance conditions except where adjustments must be made to V1 for clearway, stopway, anti-skid inoperative, thrust reversers inoperative, improved climb, contaminated runway situations or brake energy limits. 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 will not help this condition as the minimum control speeds are determined at the actual temperature and therefore are not reduced.

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

V1(MCG)

Regulations prohibit scheduling takeoff with a V1 less than minimum V1 for control on the ground, V1(MCG). It is therefore necessary to compare the adjusted V1 to V1(MCG). The V1(MCG) presented in this manual is conservative for all weight and bleed configurations.

To find V1(MCG) enter the V1(MCG) table with the airport pressure altitude and actual OAT. If the adjusted V1 is less than V1(MCG), set V1 equal to V1(MCG). If the adjusted VR is less than V1(MCG), set VR equal to V1(MCG), and determine a new V2 by adding the difference between the normal VR and V1(MCG) to the normal V2. No takeoff weight adjustment is necessary provided that the actual field length exceeds the minimum field length shown in the Field and Climb Limit Weight table in chapter Performance Dispatch.

Clearway and Stopway V1 Adjustments

Maximum allowable clearway limits are provided for guidance when more precise data is not available. Use of clearway is not allowed on wet runways.

Takeoff speed adjustments are to be applied to V1 speed when using takeoff weights based on the use of clearway and stopway.

Adjust V1 speed by the amount shown in the table. The adjusted V1 speed must not exceed VR. If the adjusted V1 speed is greater than VR, reduce V1 to equal VR.

Stab Trim

To find takeoff stabilizer trim setting, enter Stab Trim Setting table with anticipated brake release weight and center of gravity (C.G. % MAC) and read required stabilizer trim units.

VREF

This table contains flaps 40, 30 and 15 reference speeds for a given weight.

With autothrottles disengaged an approach speed wind correction (max 20 knots) of 1/2 steady headwind component + gust increment above steady wind is recommended. Do not apply a wind correction for tailwinds. The maximum command speed should not exceed landing flap placard speed minus 5 knots.

Flap Maneuver Speeds

This table provides flap maneuver speeds for various flap settings. During flap retraction, selection of the next flap position is initiated when reaching the maneuver speed for the existing flap position. During flap retraction, at least adequate maneuver capability or 30° of bank (15° of bank and 15° overshoot) to stick shaker is provided at the flap retraction speed. Full maneuver capability or at least 40° of bank (25° of bank and 15° overshoot) is provided when the airplane has accelerated to the recommended maneuver speed for the selected flap position.

During flap extension, selection of the flaps to the next flap position should be made when approaching, and before decelerating below, the maneuver speed for the existing flap position. The flap extension speed schedule varies with airplane weight and provides full maneuver capability or at least 40° of bank (25° of bank and 15° overshoot) to stick shaker at all weights.

Slush/Standing Water Takeoff

Experience has shown that aircraft performance may deteriorate significantly on runways covered with snow, slush, standing water or ice. Therefore, reductions in field/obstacle limited takeoff weight and revised takeoff speeds are necessary. The tables are intended for guidance in accordance with advisory material and assume an engine failure at the critical point during the takeoff.

The entire runway is assumed to be completely covered by a contaminant of uniform thickness and density. Therefore this information is conservative when operating under typical cold weather conditions where patches of slush exist and some degree of sanding is common. Takeoffs in slush depths greater than 13 mm (0.5 inches) are not recommended because of possible airplane damage as a result of slush impingement on the airplane structure. The use of assumed temperature for reduced thrust is not allowed on contaminated runways. Interpolation for slush/standing water depths between the values shown is permitted.

Takeoff weight determination:

1. Enter the Weight Adjustment table with the dry field/obstacle limit weight to obtain the weight reduction for the slush/standing water depth and airport pressure altitude.
2. Adjust field length available for temperature by amount shown beneath V1(MCG) limit weight table.
3. Enter the V1(MCG) Limit Weight table with the adjusted field length and pressure altitude to obtain the slush/standing water limit weight with respect to minimum field length required for V1(MCG) speed.

4. The maximum allowable takeoff weight in slush/standing water is the lesser of the limit weights found in steps 1 and 3.

Takeoff speed determination:

1. Determine takeoff speeds V1, VR and V2 for actual brake release weight using the Dry Runway Takeoff Speeds table for the appropriate flap setting and thrust rating.
2. If V1(MCG) limited, set V1=V1(MCG). If not limited by V1(MCG) considerations, enter the V1 Adjustment table with actual brake release weight to determine the V1 reduction to apply to V1 speed. If the adjusted V1 is less than V1(MCG), set V1=V1(MCG).

Slippery Runway Takeoff

Airplane braking action is reported as good, medium or poor, depending on existing runway conditions. If braking action is reported as good, conditions should not be expected to be as good as on clean, dry runways. The value “good” is comparative and is intended to mean that airplanes should not experience braking or directional control difficulties when stopping. The performance level used to calculate the “good” data is consistent with wet runway testing done on early Boeing jets. The performance level used to calculate the “poor” data reflects a runway covered with wet ice. Performance is based on a 15 ft screen height at the end of the runway. The tables provided are used in the same manner as the Slush/Standing Water tables.

Anti-Skid Inoperative

When operating with anti-skid inoperative, the field limit weight and V1 must be reduced to account for the effect on accelerate-stop performance. Anti-skid inoperative is only allowed on a dry runway. A simplified method which conservatively accounts for the effects of anti-skid inoperative is to reduce the normal dry field/obstacle limited weight by 7700 kg and the V1 associated with the reduced weight by the amount shown in the table below.

ANTI-SKID INOPERATIVE V1 ADJUSTMENTS

FIELD LENGTH (M)	V1 ADJUSTMENT (KIAS)
2000	-16
2500	-14
3000	-12
3500	-10
4000	-10

If the resulting V1 is less than V1(MCG), takeoff is permitted with V1 set equal to V1(MCG) provided the dry accelerate-stop distance corrected for wind and slope exceeds approximately 2150 m.

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

Thrust Reverser Inoperative

When dispatching on a wet runway with both thrust reversers operative, an operative anti-skid system, and all brakes operating, regulations allow deceleration credit for one thrust reverser in the engine failure case and two thrust reversers in the all engine stop case.

When dispatching on a wet runway with one thrust reverser inoperative, the field/obstacle limited weight and V1 speed must be reduced to account for the effect on accelerate-stop performance. A simplified method, which conservatively accounts for this, is to reduce the normal wet runway/field/obstacle limited weight by 1000 kg and the V1 associated with the reduced weight by 2 knots.

If the resulting V1 is less than minimum V1, takeoff is permitted with V1 set equal to V1(MCG) provided the accelerate-stop distance available adjusted for wind and slope exceeds approximately 1500 m.

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

Takeoff %N1

To find Max Takeoff %N1 based on normal engine bleed for air conditioning packs on, enter Takeoff %N1 Table with airport pressure altitude and airport OAT and read %N1. Apply %N1 adjustments as provided when applicable.

Assumed Temperature Reduced Thrust

Regulations permit the use of up to 25% takeoff thrust reduction for operation with assumed temperature reduced thrust. Use of assumed temperature reduced thrust is not allowed with anti-skid inoperative or on runways contaminated with standing water, ice, slush, or snow. Use of assumed temperature reduced thrust is not recommended if potential windshear conditions exist.

To find the maximum allowable assumed temperature enter the Maximum Assumed Temperature table with airport pressure altitude and OAT. Compare this temperature to that at which the airplane is performance limited as determined from available takeoff performance data. Next, enter the Maximum Takeoff %N1 table with airport pressure altitude and the lower of the two temperatures previously determined, to obtain a maximum takeoff %N1. Do not use an assumed temperature less than the minimum assumed temperature shown. Enter the %N1 Adjustment table with OAT and the difference between the assumed and actual OAT to obtain a %N1 adjustment. Subtract the %N1 adjustment from the maximum takeoff %N1 found previously to determine the assumed temperature reduced thrust %N1.

Apply %N1 adjustments as provided when applicable.

Max Climb %N1

This table shows Max Climb %N1 for a 280/.78 climb speed schedule, normal engine bleed for packs on or off and anti-ice off. Enter the table with airport pressure altitude and TAT and read %N1. %N1 adjustments are shown for anti-ice operation.

Go-around %N1

To find Max Go-around %N1 based on normal engine bleed for packs on (AUTO) and anti-ice on or off, enter the Go-around %N1 table with airport pressure altitude and reported OAT or TAT and read %N1. For packs OFF or HIGH operation, apply the %N1 adjustment shown below the table.

Flight with Unreliable Airspeed / Turbulent Air Penetration

Pitch attitude and average %N1 information is provided for use in all phases of flight in the event of unreliable airspeed/Mach indications resulting from blocking or freezing of the pitot system. Loss of radome or turbulent air may also cause unreliable airspeed/Mach indications. The cruise table in this section may also be used for turbulent air penetration.

Pitch attitude is shown in bold type for emphasis since altitude and/or vertical speed indications may also be unreliable.

All Engines

Long Range Cruise Maximum Operating Altitude

These tables provide the maximum operating altitude in the same manner as the FMC. Maximum altitudes are shown for a given cruise weight and maneuver capability. This table considers both thrust and buffet limits, providing the more limiting of the two. Any data that is thrust limited is denoted by an asterisk and represents only a thrust limited condition in level flight with 100 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 15° may cause the airplane to lose speed and/or altitude. The altitudes shown in the table are limited to the maximum certified altitude of 41000 ft.

Long Range Cruise Control

These tables provide target %N1, Long Range Cruise Mach number, IAS and standard day fuel flow per engine for the airplane weight and pressure altitude. As indicated by the shaded area, at optimum altitude .79M approximates the Long Range Cruise Mach schedule.

Long Range Cruise Enroute Fuel and Time

Long Range Cruise Enroute Fuel and Time tables are provided to determine remaining time and fuel required to destination. The data is based on Long Range Cruise and .78/280/250 descent. Tables are presented for low altitudes and high altitudes.

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

APU Operation During Flight

For APU operation during flight, increase fuel flow according to the table in the Engine Inoperative text section.

Long Range Cruise Wind-Altitude Trade

Wind is a factor which may justify operations considerably below optimum altitude. For example, a favorable wind component may have an effect on ground speed which more than compensates for the loss in air range.

Using this table, it is possible to determine the break-even wind (advantage necessary or disadvantage that can be tolerated) to maintain the same range at another altitude and long range cruise speed. The tables make no allowance for climb or descent time, fuel or distance, and are based on comparing ground fuel mileage.

Descent

Time, fuel, and distance for descent are shown for a .78/280/250 descent speed schedule. Enter the table with top of descent pressure altitude and read distance, time and fuel. Data is based on flight idle thrust descent in zero wind. Allowances are included for a straight-in approach with gear down and landing flaps at the outer marker.

Holding

Target %N1, indicated airspeed and fuel flow per engine information is tabulated for holding with flaps up based on the FMC optimum holding speed schedule. This is the higher of the maximum endurance speed and the maneuvering speed. Small variations in airspeed will not appreciably affect the overall endurance time. Enter the table with weight and pressure altitude to read %N1, IAS and fuel flow per engine.

Advisory Information

Normal Configuration Landing Distance

The normal configuration distance tables are provided as advisory information to help determine the actual landing distance performance of the airplane for different runway surface conditions and brake configurations.

Flaps 15, 30, and 40 landing distances and adjustments are provided for dry runways as well as runways with good, medium, and poor reported braking action, which are commonly referred to as slippery runway conditions.

If the surface is affected by water, snow or ice, and the braking action is reported as "good", conditions should not be expected to be as good as on clean, dry runways. The value "good" is comparative and is intended to mean that airplanes should not experience braking or directional control difficulties when landing. The performance level used to calculate the "good" data is consistent with wet runway testing done on early Boeing jets. The performance level used to calculate "poor" data reflects runways covered with wet ice.

Dry runway landing performance is shown for max manual braking configuration and autobrake settings max, 3, 2, and 1. The autobrake performance may be used to assist in the selection of the most desirable autobrake setting for a given field length. Selection of an autobrake setting results in a constant rate of deceleration. Maximum effort manual braking should achieve shorter landing distance than the max autobrake setting. The reference landing distance is a reference distance from 50 ft above the threshold to stop based on a reference landing weight and normal approach speed for the selected landing flap at sea level, zero wind, zero slope, and two engine detent reverse thrust. Subsequent columns provide adjustments for off-reference landing weight, altitude, wind, slope, temperature, speed, and reverse thrust. Each adjustment is independently added to the reference landing distance.

Non-normal Configuration Landing Distance

Advisory information is provided to support non-normal configurations that affect the landing performance of the airplane. Landing distances and adjustments are provided for dry runways and runways with good, medium, and poor reported braking action.

Enter the table with the applicable non-normal configuration and read the normal approach speed. The reference landing distance is a reference distance from 50 ft above the threshold to stop based on a reference landing weight and speed at sea level, zero wind, and zero slope. Subsequent columns provide adjustments for off-reference landing weight, altitude, wind, slope, and speed conditions. Each adjustment is independently added to the reference landing distance. Landing distance includes the effect of reverse thrust.

Recommended Brake Cooling Schedule

Advisory information is provided to assist in avoiding the problems associated with hot brakes. For normal operation, most landings are at weights below the AFM quick turnaround limit weight.

Use of the recommended cooling schedule will help avoid brake overheat and fuse plug problems that could result from repeated landings at short time intervals or a rejected takeoff.

Enter the Recommended Brake Cooling Schedule table with the airplane weight and brakes on speed, adjusted for wind at the appropriate temperature and altitude condition. Instructions for applying wind adjustments are included below the table. Linear interpolation may be used to obtain intermediate values. The resulting number is the reference brake energy per brake in millions of foot-pounds, and represents the amount of energy absorbed by each brake during a rejected takeoff. Notes providing adjustments for wind are included below the table.

To determine the energy per brake absorbed during landing, enter the appropriate Adjusted Brake Energy Per Brake table (No Reverse Thrust or 2 Engine Reverse) with the reference brake energy per brake and the type of braking used during landing (Max Manual, Max Auto, or Autobrake). The resulting number is the adjusted brake energy per brake and represents the energy absorbed in each brake during the landing.

The recommended cooling time is found in the appropriate (steel or carbon brakes) final table by entering with the adjusted brake energy per brake. Times are provided for ground cooling and inflight gear down cooling.

Brake Temperature Monitor System (BTMS) indications are also shown. If brake cooling is determined from the BTMS, use the hottest brake indication 10 to 15 minutes after the airplane has come to a complete stop, or inflight with gear retracted to determine recommended cooling schedule.

Engine Inoperative

Initial Max Continuous %N1

The Initial Max Continuous %N1 setting for use following an engine failure is shown. The table is based on the typical all engine cruise speed of .79M to provide a target %N1 setting at the start of driftdown. Once driftdown is established, the Max Continuous %N1 table should be used to determine %N1 for the given conditions.

Max Continuous %N1

Power setting is based on one engine operating with one A/C pack operating and all anti-ice bleeds off. Enter the table with pressure altitude, TAT, and IAS or Mach to read %N1.

It is desirable to maintain engine thrust level within the limits of the Max Cruise thrust rating. However, where thrust level in excess of Max Cruise rating is required, such as for meeting terrain clearance, ATC altitude assignments, or to attain maximum range capability, it is permissible to use the thrust needed up to the Max Continuous thrust rating. The Max Continuous thrust rating is intended primarily for emergency use at the discretion of the pilot and is the maximum thrust that may be used continuously.

Driftdown Speed/Level Off Altitude

The table shows optimum driftdown speed as a function of cruise weight at start of driftdown. Also shown are the approximate weight and pressure altitude at which the airplane will level off considering 100 ft/min residual rate of climb.

The level off altitude is dependent on air temperature (ISA deviation).

Driftdown/LRC Range Capability

This table shows the range capability from the start of driftdown. Driftdown is continued to level off altitude. As weight decreases due to fuel burn, the airplane is accelerated to Long Range Cruise speed. Cruise is continued at level off altitude and Long Range Cruise speed.

To determine fuel required, enter the Ground to Air Miles Conversion table with the desired ground distance and adjust for anticipated winds to obtain air distance to destination. Then enter the Driftdown/Cruise Fuel and Time table with air distance and weight at start of driftdown to determine fuel and time required. If altitudes other than the level off altitude is used, fuel and time required may be obtained by using the Engine Inoperative Long Range Cruise Enroute Fuel and Time table.

Long Range Cruise Altitude Capability

The table shows the maximum altitude that can be maintained at a given weight and air temperature (ISA deviation), based on Long Range Cruise speed, Max Continuous thrust, and 100 ft/min residual rate of climb.

Long Range Cruise Control

The table provides target %N1, engine inoperative Long Range Cruise Mach number, IAS and fuel flow for the airplane weight and pressure altitude. The fuel flow values in this table reflect single engine fuel burn.

APU Operation During Flight

For APU operation during flight, increase fuel flow according to the following table. These increments include the APU fuel flow and the effect of increased drag from the APU door.

PRESSURE ALTITUDE (1000 FT)	APU FUEL FLOW (KG/HR)
39	45
35	45
31	50
25	60
20	65
15	75
10	85
5	95

Long Range Cruise Diversion Fuel and Time

Tables are provided for crews to determine the fuel and time required to proceed to an alternate airfield with one engine inoperative. The data is based on single engine Long Range Cruise speed and .78/280/250 descent. Enter with Air Distance as determined from the Ground to Air Miles Conversion table and read Fuel and Time required at the cruise pressure altitude. Adjust the fuel obtained for deviation from the reference weight at checkpoint as required by entering the off reference fuel adjustments table with the fuel required for the reference weight and the actual weight at checkpoint. Read fuel required and time for the actual weight.

Holding

Single engine holding data is provided in the same format as the all engine holding data and is based on the same assumptions.

Gear Down Landing Rate of Climb Available

Rate of climb data is provided as guidance information in the event an engine inoperative landing (manual or autoland) is planned. The tables show gear down rate of climb available for Flaps 15 and Flaps 30. Enter the table with TAT and pressure altitude to read rate of climb available. Apply adjustments shown to correct for weight.

Alternate Mode EEC

Introduction

No takeoff speed adjustments or other performance adjustments are required of Electronic Engine Control (EEC) in the alternate mode (ALTN EEC switch illuminated) for the 7B18, -7B20, -7B22, -7B24 and -7B24A engine thrust ratings.

Operation with derate and/or assumed temperature reduced thrust is not permitted with the EEC in alternate mode.

Gear Down

This section contains performance for airplane operation with the landing gear extended. The data is based on engine bleeds for normal air conditioning.

Note: The Flight Management Computer System (FMCS) does not contain special provisions for operation with landing gear extended. As a result, the FMCS may generate inappropriate enroute speed schedules, display non-conservative predictions of fuel burn, estimated time of arrival (ETA), maximum altitude, and compute overly shallow descent path. An accurate estimated time of arrival (ETA) is available if current speed or Mach is entered into the VNAV cruise page.

Tables for gear down performance in this section are identical in format and used in the same manner as tables for the gear up configuration previously described.

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737-700W CFM56-7B24A+26B2_BUMP C M KG FAA CATF/M HIGH_ALT PAX GAS

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General

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

Serial and tabulation number are supplied by Boeing.

Registry Number	Serial Number	Tabulation Number
B-5277	38381	YN531
B-5279	38384	YN532
B-5278	38383	YN533
B-5280	38385	YN534

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General — Section 30

Takeoff Speeds - Dry Runway

Flaps 1 and 5

V1, VR, V2 for Max Takeoff Thrust

WEIGHT (1000 KG)	FLAPS 1			FLAPS 5		
	V1	VR	V2	V1	VR	V2
72	143	145	151	140	142	147
68	138	140	147	135	137	143
64	133	135	143	130	132	139
60	128	130	138	125	127	135
56	122	124	133	119	122	130
52	116	118	129	113	116	126
48	110	112	123	108	110	121
44	104	106	118	101	104	115
40	97	100	113	94	97	110

Check V1(MCG).

V1, VR, V2 Adjustments*

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

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
84	-3	-1	0	1	2	-2	-1	-1	0	0	1	1	1
76	-2	-1	0	1	1	-2	-1	0	0	0	1	1	1
68	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
60	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
52	-1	0	0	1	1	-1	-1	0	0	0	1	1	1
44	-1	0	0	1	1	-2	-1	0	0	1	1	1	2
40	-1	0	0	1	2	-2	-1	0	0	1	1	2	2

***V1 not to exceed VR.**

V1(MCG)

Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	102	99					
60	140	102	99	97	96			
50	122	104	101	98	96	94	92	90
40	104	109	106	102	99	95	92	90
30	86	112	111	107	103	99	95	92
20	68	112	112	109	107	103	99	96
-60	-76	114	113	110	108	105	102	100

Takeoff Speeds - Dry Runway
Flaps 10, 15 and 25
V1, VR, V2 for Max Takeoff Thrust

WEIGHT (1000 KG)	FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2
76	138	138	144	135	135	140			
72	134	135	140	132	132	138	130	130	136
68	129	131	137	128	128	134	126	126	133
64	125	126	134	124	124	131	122	122	130
60	120	122	130	119	119	127	117	118	126
56	115	117	126	114	115	123	112	113	122
52	110	112	122	109	110	119	107	108	118
48	105	106	117	104	105	115	102	103	114
44	99	101	113	98	99	111	97	98	110
40	93	95	108	92	94	106	91	93	105

Check V1(MCG).

V1, VR, V2 Adjustments*

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

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
76	-3	-1	0	1	1	-2	-1	-1	0	0	1	1	1
68	-2	-1	0	1	1	-2	-1	-1	0	0	1	1	1
60	-2	-1	0	1	1	-2	-1	-1	0	0	1	1	1
52	-2	-1	0	1	1	-2	-1	-1	0	0	1	1	1
44	-1	-1	0	1	1	-2	-2	-1	0	0	1	1	1
40	-1	-1	0	0	1	-2	-2	-1	0	0	1	1	1

***V1 not to exceed VR.**

V1(MCG)
Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	102	99					
60	140	102	99	97	96			
50	122	104	101	98	96	94	92	90
40	104	109	106	102	99	95	92	90
30	86	112	111	107	103	99	95	92
20	68	112	112	109	107	103	99	96
-60	-76	114	113	110	108	105	102	100

Takeoff Speeds - Dry Runway - High Altitudes
V1, VR, V2 for Max Takeoff Thrust

WEIGHT (1000 KG)	FLAPS 1			FLAPS 5			FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
75	154	154	156												
70	148	149	152	145	146	148									
65	142	143	146	138	139	142	132	133	136						
60	134	136	140	131	133	136	125	126	130	123	123	127	121	121	125
55	127	128	133	124	125	130	118	119	124	116	117	121	115	115	120
50	119	121	126	116	118	123	111	112	118	110	110	116	108	109	114
45	111	112	119	108	110	117	103	105	112	103	103	110	101	102	108
40	103	104	112	99	101	109	95	98	106	95	96	104	92	94	102

Check V1(MCG).

V1, VR, V2 Adjustments*

TEMP		V1						VR						V2					
		PRESS ALT (1000 FT)						PRESS ALT (1000 FT)						PRESS ALT (1000 FT)					
°C	°F	10	11	12	13	14	14.5	10	11	12	13	14	14.5	10	11	12	13	14	14.5
50	122	8						6						0					
40	104	6	7	7	8	9	10	4	5	6	7	8	8	0	0	1	1	1	1
30	86	4	5	5	6	7	8	3	4	5	5	6	7	0	0	0	1	1	1
20	68	2	3	4	5	6	6	1	2	3	4	5	5	0	0	1	1	1	1
10	50	0	1	2	3	4	5	0	1	2	3	4	4	0	0	1	1	1	1
0	32	0	1	2	3	4	4	0	1	2	2	3	4	0	0	1	1	1	1
-60	-76	0	1	2	3	4	4	0	1	2	2	3	4	0	0	1	1	1	1

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
75	-3	-2	0	0	0	-1	0	0	0	0	0	0	0
70	-3	-2	0	0	0	-1	0	0	0	0	0	0	0
65	-2	-1	0	1	1	-1	-1	0	0	0	0	0	1
60	-2	-1	0	1	1	-1	-1	0	0	0	0	1	1
55	-2	-1	0	1	1	-1	-1	0	0	0	0	1	1
50	-2	-1	0	1	1	-1	-1	0	0	0	0	1	1
45	-2	-1	0	1	1	-1	-1	0	0	0	0	1	1
40	-2	-1	0	0	1	-1	-1	-1	0	0	0	1	1

***V1 not to exceed VR.**

V1(MCG)
Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)					
°C	°F	10000	11000	12000	13000	14000	14500
50	122	90					
40	104	90	89	88	87	88	87
30	86	92	90	88	87	88	87
20	68	95	94	92	90	88	87
10	50	99	97	95	93	91	90
0	32	99	98	96	94	93	92
-60	-76	100	98	97	95	94	93

Takeoff Speeds - Wet Runway
Flaps 1 and 5
V1, VR, V2 for Max Takeoff Thrust

WEIGHT	FLAPS 1			FLAPS 5		
(1000 KG)	V1	VR	V2	V1	VR	V2
80	146	154	158	142	150	155
76	141	149	154	137	146	151
72	136	145	151	133	142	147
68	131	140	147	128	137	144
64	126	135	143	123	132	140
60	120	130	138	117	127	135
56	114	124	133	111	122	131
52	108	118	129	105	116	126
48	101	112	123	99	110	121
44	94	106	118	92	104	115
40	88	100	113	85	97	110

Check V1(MCG).

V1, VR, V2 Adjustment*

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

Slope and Wind V1 Adjustment*

WEIGHT	SLOPE (%)					WIND (KTS)							
(1000 KG)	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
80	-4	-2	0	3	5	-3	-2	-1	0	1	1	2	3
72	-4	-2	0	2	4	-3	-2	-1	0	1	1	2	2
64	-4	-2	0	2	4	-4	-2	-1	0	1	1	2	3
56	-3	-2	0	2	3	-4	-2	-1	0	1	2	2	3
48	-2	-1	0	2	3	-4	-2	-1	0	1	2	3	4
40	-1	0	0	2	3	-4	-2	-1	0	1	3	4	5

***V1 not to exceed VR.**

V1(MCG)
Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	102	99					
60	140	102	99	97	96			
50	122	104	101	98	96	94	92	90
40	104	109	106	102	99	95	92	90
30	86	112	111	107	103	99	95	92
20	68	112	112	109	107	103	99	96
-60	-76	114	113	110	108	105	102	100

Takeoff Speeds - Wet Runway
Flaps 10, 15 and 25
V1, VR, V2 for Max Takeoff Thrust

WEIGHT (1000 KG)	FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2
76	132	138	144	132	135	140			
72	127	135	140	127	132	138	125	130	136
68	123	131	137	122	128	134	121	126	133
64	118	126	134	118	124	131	116	122	130
60	113	122	130	112	119	127	111	118	126
56	107	117	126	107	115	123	105	113	122
52	102	112	122	101	110	119	100	108	118
48	96	106	117	95	105	115	94	103	114
44	91	101	113	90	99	111	89	98	110
40	85	95	108	84	94	106	83	93	105

Check V1(MCG).

V1, VR, V2 Adjustment*

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

Slope and Wind V1 Adjustment*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
76	-4	-2	0	2	4	-4	-2	-1	0	1	1	2	2
72	-4	-2	0	2	4	-4	-2	-1	0	1	1	2	2
64	-3	-2	0	2	3	-4	-2	-1	0	1	1	2	3
56	-3	-2	0	1	3	-4	-3	-1	0	1	1	2	3
48	-2	-1	0	1	2	-4	-3	-1	0	1	2	3	3
40	-2	-1	0	1	2	-5	-3	-1	0	1	2	3	4

***V1 not to exceed VR.**

V1(MCG)
Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	102	99					
60	140	102	99	97	96			
50	122	104	101	98	96	94	92	90
40	104	109	106	102	99	95	92	90
30	86	112	111	107	103	99	95	92
20	68	112	112	109	107	103	99	96
-60	-76	114	113	110	108	105	102	100

Takeoff Speeds - Wet Runway - High Altitudes

V1, VR, V2 for Max Takeoff Thrust

WEIGHT	FLAPS1			FLAPS5			FLAPS 10			FLAPS 15			FLAPS 25		
(1000 KG)	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
75	148	154	156												
70	142	149	152	139	146	148									
65	135	143	146	132	139	142	126	133	136						
60	127	136	140	124	133	136	119	126	130	118	123	127	117	121	125
55	119	128	133	116	125	130	111	119	124	111	117	121	110	115	120
50	111	121	126	108	118	123	103	112	118	103	110	116	102	109	114
45	102	112	119	99	110	117	96	105	112	95	103	110	94	102	108
40	93	104	112	91	101	109	88	98	106	86	96	104	86	94	102

Check V1(MCG).

V1, VR, V2 Adjustments*

TEMP		V1						VR						V2					
		PRESS ALT (1000 FT)						PRESS ALT (1000 FT)						PRESS ALT (1000 FT)					
°C	°F	10	11	12	13	14	14.5	10	11	12	13	14	14.5	10	11	12	13	14	14.5
50	122	11						6						0					
40	104	8	9	10	12	13	14	4	5	6	7	8	8	0	0	1	1	1	1
30	86	5	6	7	9	10	11	3	4	5	5	6	7	0	0	0	1	1	1
20	68	2	3	5	6	7	8	1	2	3	4	5	5	0	0	1	1	1	1
10	50	0	1	3	4	5	6	0	1	2	3	4	4	0	0	1	1	1	1
0	32	0	1	2	3	4	5	0	1	2	2	3	4	0	0	1	1	1	1
-60	-76	0	1	2	3	4	5	0	1	2	2	3	4	0	0	1	1	1	1

Slope and Wind V1 Adjustments*

WEIGHT	SLOPE (%)					WIND (KTS)							
(1000 KG)	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
75	-6	-3	0	3	5	-2	-1	-1	0	0	1	1	2
70	-5	-3	0	3	5	-2	-1	-1	0	0	1	1	2
65	-5	-2	0	2	5	-2	-2	-1	0	0	1	1	2
60	-4	-2	0	2	4	-3	-2	-1	0	0	1	1	2
55	-4	-2	0	2	4	-3	-2	-1	0	0	1	2	2
50	-4	-2	0	2	4	-3	-2	-1	0	1	1	2	2
45	-3	-2	0	2	3	-3	-2	-1	0	1	1	2	2
40	-3	-1	0	1	3	-3	-2	-1	0	1	1	2	3

***V1 not to exceed VR.**

V1(MCG)

Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)					
°C	°F	10000	11000	12000	13000	14000	14500
50	122	90					
40	104	90	89	88	87	88	87
30	86	92	90	88	87	88	87
20	68	95	94	92	90	88	87
10	50	99	97	95	93	91	90
0	32	99	98	96	94	93	92
-60	-76	100	98	97	95	94	93

Maximum Allowable Clearway

FIELD LENGTH (M)	MAX ALLOWABLE CLEARWAY FOR V1 REDUCTION (M)
1200	140
1800	200
2400	250
3000	310
3600	430
4200	470

Maximum Allowable Clearway - High Altitudes

FIELD LENGTH (M)	MAX ALLOWABLE CLEARWAY FOR V1 REDUCTION (M)
2000	230
2500	270
3000	320
3500	410
4000	450
4500	490

Clearway and Stopway V1 Adjustments

CLEARWAY MINUS STOPWAY (M)	NORMAL V1 (KIAS)							
	DRY RUNWAY				WET RUNWAY			
	100	120	140	160	100	120	140	160
300	-3	-4	-4	-5				
200	-3	-3	-4	-4				
100	-2	-2	-2	-2				
0	0	0	0	0	0	0	0	0
-100	1	1	1	1	2	2	1	1
-200	1	1	1	1	3	3	2	2
-300	1	1	1	1	4	4	3	3

Use of clearway not allowed on wet runways.
V1 not to exceed VR.

Clearway and Stopway V1 Adjustments - High Altitude

CLEARWAY MINUS STOPWAY (M)	NORMAL V1 (KIAS)							
	DRY RUNWAY				WET RUNWAY			
	100	120	140	160	100	120	140	160
300	-4	-3	-3	-3				
200	-4	-3	-2	-2				
100	-2	-1	-1	-1				
0	0	0	0	0	0	0	0	0
-100	2	0	0	0	2	1	1	1
-200	2	0	0	0	3	2	2	2
-300	2	0	0	0	4	3	2	2

Use of clearway not allowed on wet runways.
V1 not to exceed VR.

Stab Trim Setting

Max Takeoff Thrust

Flaps 1 and 5

WEIGHT (1000 KG)	C.G. (%MAC)									
	9	11	13	16	20	24	26	28	30	33
80	8 1/2	8 1/2	8 1/2	7 3/4	6 3/4	6	5 1/2	5 1/4	4 3/4	4 1/4
70	8 1/2	8 1/2	8 1/4	7 1/2	6 3/4	6	5 1/2	5	4 3/4	4
60	8 1/2	8 1/4	7 3/4	7	6 1/4	5 1/2	5	4 1/2	4 1/4	4
50	7 3/4	7 1/4	6 3/4	6	5 1/4	4 1/2	4 1/4	4	4	4
45	6 3/4	6 1/2	6	5 1/2	4 3/4	4 1/4	4	4	4	4

Flaps 10, 15 and 25

WEIGHT (1000 KG)	C.G. (%MAC)									
	9	11	13	16	20	23	26	28	31	33
80	8 1/2	8 1/2	8 1/4	7 1/4	6 1/2	5 3/4	5	4 3/4	4	4
70	8 1/2	8 1/2	8 1/4	7	6 1/4	5 1/2	5	4 1/2	4	4
60	8 1/2	8 1/4	7 1/2	6 1/2	5 3/4	5	4 1/2	4	4	4
50	7 1/2	7	6 1/2	5 1/2	4 3/4	4 1/4	4	4	4	4
45	6 1/4	6	5 1/2	5	4 1/2	4	4	4	4	4

VREF

WEIGHT (1000 KG)	FLAPS		
	40	30	15
85	159	161	167
80	154	156	162
75	149	151	157
70	144	146	152
65	139	141	147
60	133	135	140
55	127	129	134
50	120	123	127
45	114	117	121

Flap Maneuver Speeds

FLAP POSITION	MANEUVER SPEED
UP	VREF40 + 70
1	VREF40 + 50
5	VREF40 + 30
10	VREF40 + 30
15	VREF40 + 20
25	VREF40 + 10
30	VREF30
40	VREF40

ADVISORY INFORMATION

Slush/Standing Water Takeoff

Maximum Reverse Thrust

Weight Adjustments (1000 KG)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-12.1	-14.8	-17.5	-14.7	-17.4	-20.1	-20.2	-22.9	-25.6
85	-10.7	-13.4	-16.1	-12.8	-15.6	-18.3	-17.4	-20.2	-22.9
80	-9.4	-12.1	-14.8	-11.2	-13.9	-16.6	-14.9	-17.6	-20.3
75	-8.2	-10.9	-13.7	-9.6	-12.4	-15.1	-12.6	-15.4	-18.1
70	-7.2	-9.9	-12.6	-8.3	-11.0	-13.7	-10.7	-13.4	-16.1
65	-6.2	-9.0	-11.7	-7.1	-9.8	-12.6	-9.0	-11.7	-14.5
60	-5.4	-8.2	-10.9	-6.1	-8.8	-11.6	-7.6	-10.4	-13.1
55	-4.8	-7.5	-10.2	-5.3	-8.0	-10.7	-6.5	-9.3	-12.0
50	-4.2	-6.9	-9.6	-4.6	-7.3	-10.0	-5.7	-8.4	-11.1
45	-3.6	-6.3	-9.0	-3.9	-6.7	-9.4	-4.9	-7.6	-10.3
40	-3.0	-5.8	-8.5	-3.3	-6.0	-8.7	-4.0	-6.7	-9.5

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1400							34.9		
1600	39.5			42.7			47.8		
1800	53.3	32.4		56.4	35.6		61.2	40.9	
2000	67.6	46.0		70.5	49.1		75.2	54.1	34.2
2200	82.4	60.0	38.8	85.2	63.0	42.0	89.9	67.7	47.1
2400	97.6	74.5	52.6		77.4	55.7		82.1	60.5
2600		89.6	66.8		92.3	69.8		97.0	74.5
2800			81.6			84.4			89.1
3000			96.8			99.4			

1. **Enter Weight Adjustment table with slush/standing water depth and dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -40 m/+35 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-12	-7	-2	-4	0	0	0	0	0
85	-13	-8	-3	-6	-1	0	0	0	0
80	-15	-10	-5	-9	-4	0	0	0	0
75	-16	-11	-6	-11	-6	-1	-2	0	0
70	-17	-12	-7	-13	-8	-3	-4	0	0
65	-19	-14	-9	-15	-10	-5	-6	-1	0
60	-20	-15	-10	-16	-11	-6	-9	-4	0
55	-20	-15	-10	-18	-13	-8	-12	-7	-2
50	-21	-16	-11	-19	-14	-9	-15	-10	-5
45	-23	-18	-13	-21	-16	-11	-17	-12	-7
40	-25	-20	-15	-23	-18	-13	-19	-14	-9

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff

No Reverse Thrust

Weight Adjustments (1000 KG)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-15.1	-18.3	-21.5	-17.8	-21.0	-24.1	-23.3	-26.5	-29.6
85	-13.7	-16.9	-20.0	-15.9	-19.1	-22.3	-20.6	-23.7	-26.9
80	-12.3	-15.5	-18.7	-14.2	-17.3	-20.5	-18.0	-21.1	-24.3
75	-11.1	-14.3	-17.4	-12.5	-15.7	-18.9	-15.6	-18.8	-22.0
70	-9.9	-13.1	-16.3	-11.1	-14.3	-17.4	-13.5	-16.7	-19.9
65	-8.9	-12.1	-15.3	-9.8	-13.0	-16.1	-11.7	-14.9	-18.1
60	-8.0	-11.1	-14.3	-8.7	-11.8	-15.0	-10.2	-13.4	-16.5
55	-7.1	-10.3	-13.5	-7.7	-10.8	-14.0	-8.9	-12.1	-15.2
50	-6.4	-9.6	-12.7	-6.8	-10.0	-13.2	-7.9	-11.0	-14.2
45	-5.8	-8.9	-12.1	-6.2	-9.3	-12.5	-7.1	-10.3	-13.5
40	-5.2	-8.4	-11.6	-5.7	-8.8	-12.0	-6.6	-9.8	-12.9

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
2000							38.5		
2200				35.3			53.2		
2400	39.7			51.9			68.6	44.3	
2600	57.1			69.3	41.9		85.1	59.3	35.6
2800	76.4	46.5		87.7	58.7	32.0		75.1	50.2
3000	97.7	64.6	36.3		76.5	48.5		92.0	65.5
3200		84.7	53.5		95.2	65.7			81.7
3400			72.4			83.9			98.8
3600			93.4						

1. **Enter Weight Adjustment table with slush/standing water depth and dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -50 m/+50 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff

No Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-20	-13	-5	-8	0	0	0	0	0
85	-22	-15	-7	-11	-4	0	0	0	0
80	-24	-17	-9	-15	-8	0	0	0	0
75	-26	-19	-11	-19	-11	-4	0	0	0
70	-28	-21	-13	-22	-14	-7	-3	0	0
65	-30	-22	-15	-25	-17	-10	-10	-3	0
60	-32	-24	-17	-27	-20	-12	-16	-9	-1
55	-33	-26	-18	-30	-22	-15	-22	-14	-7
50	-35	-27	-20	-32	-25	-17	-26	-18	-11
45	-36	-29	-21	-34	-27	-19	-29	-22	-14
40	-38	-30	-23	-36	-29	-21	-32	-25	-17

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff - High Altitudes

Maximum Reverse Thrust

Weight Adjustments (1000 KG)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	10000	12000	14000	10000	12000	14000	10000	12000	14000
90	-17.5	-18.6	-19.7	-20.1	-21.2	-22.3	-25.6	-26.7	-27.8
85	-16.1	-17.2	-18.3	-18.3	-19.4	-20.5	-22.9	-24.0	-25.1
80	-14.8	-15.9	-17.0	-16.6	-17.7	-18.8	-20.3	-21.4	-22.5
75	-13.7	-14.8	-15.8	-15.1	-16.2	-17.3	-18.1	-19.2	-20.3
70	-12.6	-13.7	-14.8	-13.7	-14.8	-15.9	-16.1	-17.2	-18.3
65	-11.7	-12.8	-13.9	-12.6	-13.6	-14.7	-14.5	-15.5	-16.6
60	-10.9	-12.0	-13.1	-11.6	-12.6	-13.7	-13.1	-14.2	-15.3
55	-10.2	-11.3	-12.4	-10.7	-11.8	-12.9	-12.0	-13.1	-14.2
50	-9.6	-10.7	-11.8	-10.0	-11.1	-12.2	-11.1	-12.2	-13.3
45	-9.1	-10.1	-11.2	-9.4	-10.5	-11.6	-10.3	-11.4	-12.5
40	-8.5	-9.6	-10.7	-8.7	-9.8	-10.9	-9.5	-10.6	-11.6

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	10000	12000	14000	10000	12000	14000	10000	12000	14000
2000							34.2		
2200	38.8	30.6		42.0	33.9		47.1	39.2	31.4
2400	52.6	44.1	35.9	55.7	47.3	39.0	60.5	52.3	44.2
2600	66.8	58.1	49.5	69.8	61.1	52.6	74.5	65.9	57.5
2800	81.6	72.5	63.6	84.4	75.4	66.7	89.1	80.1	71.3
3000	96.8	87.5	78.3	99.4	90.3	81.2		94.9	85.9
3200			93.5			96.1			

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 -40 m/+40 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	10000	12000	14000	10000	12000	14000	10000	12000	14000
90	-6	-4	-2	0	0	0	0	0	0
85	-7	-5	-3	0	0	0	0	0	0
80	-9	-7	-5	-3	-1	0	0	0	0
75	-10	-8	-6	-5	-3	-1	0	0	0
70	-11	-9	-7	-7	-5	-3	0	0	0
65	-13	-11	-9	-9	-7	-5	0	0	0
60	-14	-12	-10	-10	-8	-6	-3	-1	0
55	-14	-12	-10	-12	-10	-8	-6	-4	-2
50	-15	-13	-11	-13	-11	-9	-9	-7	-5
45	-17	-15	-13	-15	-13	-11	-11	-9	-7
40	-19	-17	-15	-17	-15	-13	-13	-11	-9

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff - High Altitudes

No Reverse Thrust

Weight Adjustments (1000 KG)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	10000	12000	14000	10000	12000	14000	10000	12000	14000
90	-21.5	-22.7	-24.0	-24.1	-25.4	-26.7	-29.6	-30.9	-32.2
85	-20.0	-21.3	-22.6	-22.3	-23.6	-24.8	-26.9	-28.2	-29.4
80	-18.7	-20.0	-21.2	-20.5	-21.8	-23.1	-24.3	-25.6	-26.8
75	-17.4	-18.7	-20.0	-18.9	-20.2	-21.4	-22.0	-23.2	-24.5
70	-16.3	-17.6	-18.8	-17.4	-18.7	-20.0	-19.9	-21.2	-22.4
65	-15.3	-16.5	-17.8	-16.1	-17.4	-18.7	-18.1	-19.4	-20.6
60	-14.3	-15.6	-16.9	-15.0	-16.3	-17.5	-16.5	-17.8	-19.1
55	-13.5	-14.7	-16.0	-14.0	-15.3	-16.6	-15.2	-16.5	-17.8
50	-12.7	-14.0	-15.3	-13.2	-14.5	-15.7	-14.2	-15.5	-16.8
45	-12.1	-13.4	-14.7	-12.5	-13.8	-15.1	-13.5	-14.7	-16.0
40	-11.6	-12.9	-14.1	-12.0	-13.3	-14.5	-12.9	-14.2	-15.5

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	10000	12000	14000	10000	12000	14000	10000	12000	14000
2600							35.6		
2800				32.0			50.2	40.8	31.6
3000	36.3			48.5	37.9		65.5	55.6	46.1
3200	53.5	42.4	31.6	65.7	54.6	43.9	81.7	71.2	61.1
3400	72.4	60.1	48.6	83.9	72.1	60.8	98.8	87.9	77.1
3600	93.4	79.7	66.9		90.7	78.7			94.0

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 -55 m/+55 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	10000	12000	14000	10000	12000	14000	10000	12000	14000
90	-5	-2	0	0	0	0	0	0	0
85	-7	-4	-1	0	0	0	0	0	0
80	-9	-6	-3	0	0	0	0	0	0
75	-11	-8	-5	-4	-1	0	0	0	0
70	-13	-10	-7	-7	-4	-1	0	0	0
65	-15	-12	-9	-10	-7	-4	0	0	0
60	-17	-14	-11	-12	-9	-6	-1	0	0
55	-18	-15	-12	-15	-12	-9	-7	-4	-1
50	-20	-17	-14	-17	-14	-11	-11	-8	-5
45	-21	-18	-15	-19	-16	-13	-14	-11	-8
40	-23	-20	-17	-21	-18	-15	-17	-14	-11

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff

Maximum Reverse Thrust

Weight Adjustment (1000 KG)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-1.3	-1.3	-1.3	-6.8	-6.8	-6.8	-11.6	-11.6	-11.6
85	-1.4	-1.4	-1.4	-6.4	-6.4	-6.4	-10.7	-10.7	-10.7
80	-1.4	-1.4	-1.4	-6.0	-6.0	-6.0	-9.9	-9.9	-9.9
75	-1.4	-1.4	-1.4	-5.6	-5.6	-5.6	-9.2	-9.2	-9.2
70	-1.4	-1.4	-1.4	-5.3	-5.3	-5.3	-8.4	-8.4	-8.4
65	-1.4	-1.4	-1.4	-4.9	-4.9	-4.9	-7.8	-7.8	-7.8
60	-1.3	-1.3	-1.3	-4.6	-4.6	-4.6	-7.2	-7.2	-7.2
55	-1.3	-1.3	-1.3	-4.2	-4.2	-4.2	-6.6	-6.6	-6.6
50	-1.2	-1.2	-1.2	-3.9	-3.9	-3.9	-6.0	-6.0	-6.0
45	-1.1	-1.1	-1.1	-3.6	-3.6	-3.6	-5.5	-5.5	-5.5
40	-1.1	-1.1	-1.1	-3.2	-3.2	-3.2	-4.9	-4.9	-4.9

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1200	46.0								
1400	67.8	49.5	31.6	30.8					
1600	90.2	71.4	53.1	46.6					
1800		93.9	75.0	63.1	43.1		30.1		
2000			97.5	80.8	59.4	39.6	40.9		
2200				99.5	76.8	55.7	52.0	32.8	
2400					95.3	72.8	63.6	43.6	
2600						91.2	75.9	54.8	35.4
2800							88.9	66.6	46.3
3000								79.0	57.7
3200								92.3	69.6
3400									82.2
3600									95.6

1. **Enter Weight Adjustment table with reported braking action and dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust “Good” field length available by -30 m/+25 m for every 5°C above/below 4°C.**
   Adjust “Medium” field length available by -30 m/+25 m for every 5°C above/below 4°C.
   Adjust “Poor” field length available by -45 m/+40 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-4	-1	0	-12	-9	-7	-22	-19	-17
85	-5	-2	0	-13	-10	-8	-24	-21	-19
80	-5	-3	0	-14	-12	-9	-25	-23	-20
75	-6	-4	-1	-16	-13	-11	-27	-25	-22
70	-7	-5	-2	-17	-14	-12	-29	-27	-24
65	-8	-6	-3	-18	-16	-13	-31	-28	-26
60	-9	-7	-4	-20	-17	-15	-33	-30	-28
55	-10	-8	-5	-21	-19	-16	-34	-32	-29
50	-11	-9	-6	-23	-20	-18	-36	-34	-31
45	-12	-10	-7	-24	-22	-19	-38	-35	-33
40	-13	-11	-8	-26	-23	-21	-39	-37	-34

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff

No Reverse Thrust

Weight Adjustments (1000 KG)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-2.0	-2.4	-2.8	-8.6	-8.9	-9.3	-14.4	-14.8	-15.2
85	-2.3	-2.7	-3.1	-8.4	-8.8	-9.2	-13.8	-14.1	-14.5
80	-2.6	-3.0	-3.3	-8.3	-8.7	-9.1	-13.1	-13.4	-13.8
75	-2.8	-3.1	-3.5	-8.1	-8.5	-8.9	-12.3	-12.7	-13.1
70	-2.8	-3.2	-3.6	-7.8	-8.2	-8.6	-11.5	-11.9	-12.2
65	-2.9	-3.2	-3.6	-7.5	-7.8	-8.2	-10.6	-11.0	-11.4
60	-2.8	-3.2	-3.5	-7.0	-7.4	-7.8	-9.6	-10.0	-10.4
55	-2.6	-3.0	-3.4	-6.4	-6.8	-7.2	-8.6	-9.0	-9.4
50	-2.4	-2.7	-3.1	-5.8	-6.2	-6.6	-7.6	-7.9	-8.3
45	-2.0	-2.4	-2.8	-5.1	-5.5	-5.9	-6.4	-6.8	-7.2
40	-1.6	-2.0	-2.4	-4.3	-4.7	-5.1	-5.2	-5.6	-6.0

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1400	43.0								
1600	73.6	37.9							
1800		69.3	32.7						
2000		96.2	65.0						
2200			92.3	55.0					
2400				81.8	44.2				
2600					72.0	33.3			
2800					97.9	61.9			
3000						88.3			
3200							30.0		
3400							50.8		
3600							71.9	30.6	
3800							93.5	51.3	
4000								72.4	31.1
4200								94.0	51.8
4400									73.0
4600									94.5

1. **Enter Weight Adjustment table with reported braking action and dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -35 m/+35 m for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -35 m/+35 m for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -60 m/+60 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-8	-3	0	-19	-14	-9	-35	-30	-25
85	-8	-3	0	-20	-15	-10	-38	-33	-28
80	-8	-3	0	-21	-16	-11	-41	-36	-31
75	-9	-4	0	-23	-18	-13	-44	-39	-34
70	-10	-5	0	-25	-20	-15	-47	-42	-37
65	-12	-7	-2	-28	-23	-18	-51	-46	-41
60	-14	-9	-4	-31	-26	-21	-55	-50	-45
55	-16	-11	-6	-34	-29	-24	-59	-54	-49
50	-19	-14	-9	-38	-33	-28	-63	-58	-53
45	-23	-18	-13	-43	-38	-33	-67	-62	-57
40	-27	-22	-17	-47	-42	-37	-72	-67	-62

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff- High Altitudes

Maximum Reverse Thrust

Weight Adjustment (1000 KG)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	10000	12000	14000	10000	12000	14000	10000	12000	14000
90	-1.3	-1.3	-1.3	-6.8	-6.8	-6.8	-11.6	-11.6	-11.6
85	-1.4	-1.4	-1.4	-6.4	-6.4	-6.4	-10.7	-10.7	-10.7
80	-1.4	-1.4	-1.4	-6.0	-6.0	-6.0	-9.9	-9.9	-9.9
75	-1.4	-1.4	-1.4	-5.6	-5.6	-5.6	-9.2	-9.2	-9.2
70	-1.4	-1.4	-1.4	-5.3	-5.3	-5.3	-8.4	-8.4	-8.4
65	-1.4	-1.4	-1.4	-4.9	-4.9	-4.9	-7.8	-7.8	-7.8
60	-1.3	-1.3	-1.3	-4.6	-4.6	-4.6	-7.2	-7.2	-7.2
55	-1.3	-1.3	-1.3	-4.2	-4.2	-4.2	-6.6	-6.6	-6.6
50	-1.2	-1.2	-1.2	-3.9	-3.9	-3.9	-6.0	-6.0	-6.0
45	-1.1	-1.1	-1.1	-3.6	-3.6	-3.6	-5.5	-5.5	-5.5
40	-1.1	-1.1	-1.1	-3.2	-3.2	-3.2	-4.9	-4.9	-4.9

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	10000	12000	14000	10000	12000	14000	10000	12000	14000
1400	31.6								
1600	53.1	45.8	38.6						
1800	75.0	67.6	60.2						
2000	97.5	90.0	82.4	39.6	31.9				
2200				55.7	47.8	40.0			
2400				72.8	64.4	56.1			
2600				91.2	82.1	73.3	35.4		
2800						91.6	46.3	38.7	31.1
3000							57.7	49.7	41.9
3200							69.6	61.2	53.0
3400							82.2	73.3	64.7
3600							95.6	86.2	77.1
3800								99.7	90.2

1. **Enter Weight Adjustment table with reported braking action and dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -30 m/+30 m for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -30 m/+30 m for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -40 m/+40 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff- High Altitudes

Maximum Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	10000	12000	14000	10000	12000	14000	10000	12000	14000
90	0	0	0	-6	-4	-2	-16	-14	-12
85	0	0	0	-7	-5	-3	-18	-16	-14
80	0	0	0	-8	-6	-4	-19	-17	-15
75	0	0	0	-10	-8	-6	-21	-19	-17
70	-1	0	0	-11	-9	-7	-23	-21	-19
65	-2	0	0	-12	-10	-8	-25	-23	-21
60	-3	-1	0	-14	-12	-10	-27	-25	-23
55	-4	-2	0	-15	-13	-11	-28	-26	-24
50	-5	-3	-1	-17	-15	-13	-30	-28	-26
45	-6	-4	-2	-18	-16	-14	-32	-30	-28
40	-7	-5	-3	-20	-18	-16	-33	-31	-29

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).**

ADVISORY INFORMATION

Slippery Runway Takeoff- High Altitudes

No Reverse Thrust

Weight Adjustment (1000 KG)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	10000	12000	14000	10000	12000	14000	10000	12000	14000
95	-1.0	-1.0	-1.0	-7.9	-7.9	-7.9	-14.4	-14.4	-14.4
90	-1.5	-1.5	-1.5	-8.1	-8.1	-8.1	-14.1	-14.1	-14.1
85	-2.0	-2.0	-2.0	-8.2	-8.2	-8.2	-13.8	-13.8	-13.8
80	-2.4	-2.4	-2.4	-8.4	-8.4	-8.4	-13.4	-13.4	-13.4
75	-2.8	-2.8	-2.8	-8.4	-8.4	-8.4	-12.9	-12.9	-12.9
70	-3.0	-3.0	-3.0	-8.2	-8.2	-8.2	-12.3	-12.3	-12.3
65	-3.1	-3.1	-3.1	-7.9	-7.9	-7.9	-11.5	-11.5	-11.5
60	-3.1	-3.1	-3.1	-7.5	-7.5	-7.5	-10.5	-10.5	-10.5
55	-3.0	-3.0	-3.0	-6.9	-6.9	-6.9	-9.4	-9.4	-9.4
50	-2.8	-2.8	-2.8	-6.3	-6.3	-6.3	-8.2	-8.2	-8.2
45	-2.4	-2.4	-2.4	-5.4	-5.4	-5.4	-6.8	-6.8	-6.8
40	-2.0	-2.0	-2.0	-4.5	-4.5	-4.5	-5.4	-5.4	-5.4

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	10000	12000	14000	10000	12000	14000	10000	12000	14000
1800	32.7								
2000	65.0	50.9	35.4						
2200	92.3	80.2	67.3						
2400			94.3						
2600				33.3					
2800				61.9	46.4	30.4			
3000				88.3	74.0	59.2			
3200					99.8	85.7			
4000							31.1		
4200							51.8	35.4	
4400							73.0	56.2	39.8
4600							94.5	77.5	60.6
4800								99.1	82.0

1. **Enter Weight Adjustment table with reported braking action and dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -35 m/+35 m for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -35 m/+35 m for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -60 m/+60 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff- High Altitudes
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	10000	12000	14000	10000	12000	14000	10000	12000	14000
90	0	0	0	-9	-7	-5	-25	-23	-21
85	0	0	0	-10	-8	-6	-28	-26	-24
80	0	0	0	-11	-9	-7	-31	-29	-27
75	0	0	0	-13	-11	-9	-34	-32	-30
70	0	0	0	-15	-13	-11	-37	-35	-33
65	-2	0	0	-18	-16	-14	-41	-39	-37
60	-4	-2	0	-21	-19	-17	-45	-43	-41
55	-6	-4	-2	-24	-22	-20	-49	-47	-45
50	-9	-7	-5	-28	-26	-24	-53	-51	-49
45	-13	-11	-9	-33	-31	-29	-57	-55	-53
40	-17	-15	-13	-37	-35	-33	-62	-60	-58

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG).**

Takeoff %N1

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

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
60	90.3	90.8	91.2	91.2	91.1	91.1	91.0	91.1	91.2	91.0	91.2	91.3	91.4
55	91.0	91.6	92.0	92.0	92.0	91.9	91.9	91.9	92.0	91.9	91.7	91.3	90.8
50	91.8	92.4	92.8	92.8	92.8	92.7	92.7	92.7	92.7	92.6	92.6	92.2	91.8
45	92.6	93.2	93.6	93.6	93.6	93.6	93.5	93.5	93.5	93.4	93.3	93.1	92.8
40	93.4	94.0	94.4	94.4	94.4	94.3	94.3	94.2	94.2	94.1	94.1	94.0	93.8
35	94.2	94.8	95.2	95.2	95.2	95.1	95.1	95.0	95.0	94.9	94.8	94.8	94.7
30	93.8	95.0	96.1	96.0	96.0	96.0	95.9	95.8	95.8	95.7	95.7	95.6	95.6
25	93.1	94.3	95.4	95.9	96.4	96.7	96.7	96.6	96.6	96.5	96.4	96.4	96.3
20	92.3	93.5	94.6	95.1	95.7	96.3	96.9	97.6	97.5	97.5	97.4	97.3	97.2
15	91.6	92.7	93.8	94.3	94.9	95.5	96.1	96.8	97.5	98.2	98.6	98.6	98.5
10	90.8	92.0	93.0	93.6	94.1	94.7	95.3	96.0	96.7	97.5	98.2	99.1	100.0
5	90.0	91.2	92.2	92.8	93.3	93.9	94.5	95.2	95.9	96.7	97.4	98.4	99.3
0	89.2	90.4	91.4	92.0	92.5	93.1	93.7	94.4	95.1	95.9	96.7	97.6	98.5
-5	88.4	89.6	90.6	91.2	91.7	92.3	92.9	93.6	94.3	95.1	95.9	96.8	97.7
-10	87.6	88.8	89.8	90.4	90.9	91.5	92.1	92.8	93.5	94.3	95.1	96.1	97.0
-15	86.8	88.0	89.0	89.5	90.0	90.6	91.3	92.0	92.7	93.5	94.3	95.3	96.2
-20	86.0	87.1	88.2	88.7	89.2	89.8	90.5	91.2	91.9	92.6	93.5	94.5	95.4
-25	85.2	86.3	87.3	87.9	88.4	89.0	89.6	90.3	91.0	91.8	92.6	93.7	94.6
-30	84.4	85.5	86.5	87.0	87.5	88.1	88.8	89.5	90.2	91.0	91.8	92.9	93.8
-35	83.5	84.6	85.6	86.2	86.6	87.3	87.9	88.6	89.3	90.1	91.0	92.1	93.0
-40	82.7	83.8	84.8	85.3	85.8	86.4	87.0	87.8	88.5	89.3	90.1	91.2	92.2
-45	81.8	82.9	83.9	84.4	84.9	85.5	86.2	86.9	87.6	88.4	89.3	90.4	91.4
-50	81.0	82.0	83.0	83.5	84.0	84.6	85.3	86.0	86.7	87.5	88.4	89.5	90.5

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.9	1.0

Takeoff %N1 - High Altitudes

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

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)					
	10000	11000	12000	13000	14000	14500
40	93.8					
35	94.7	94.7	94.7			
30	95.6	95.5	95.5	95.5	95.4	95.4
25	96.3	96.3	96.3	96.2	96.1	96.1
20	97.2	97.2	97.1	97.0	97.0	96.9
15	98.5	98.4	98.3	98.2	98.1	98.0
10	100.0	99.7	99.5	99.3	99.1	99.1
5	99.3	99.7	100.2	100.3	100.0	99.8
0	98.5	99.0	99.4	99.8	100.1	100.3
-5	97.7	98.2	98.7	99.1	99.4	99.5
-10	97.0	97.4	97.9	98.3	98.6	98.7
-15	96.2	96.7	97.1	97.5	97.8	98.0
-20	95.4	95.9	96.3	96.7	97.0	97.2
-25	94.6	95.1	95.5	95.9	96.2	96.4
-30	93.8	94.3	94.7	95.1	95.4	95.5
-35	93.0	93.5	93.9	94.3	94.6	94.7
-40	92.2	92.6	93.1	93.5	93.7	93.9
-45	91.4	91.8	92.2	92.6	92.9	93.0
-50	90.5	91.0	91.4	91.8	92.0	92.2

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)					
	10000	11000	12000	13000	14000	14500
PACKS OFF	1.0	1.1	1.1	1.2	1.2	1.2
ENGINE ANTI-ICE	0.0	-0.7	-1.4	-1.4	-1.4	-1.4

Assumed Temperature Reduced Thrust

Maximum Assumed Temperature (Table 1 of 3)

Based on 25% Takeoff Thrust Reduction

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
55	73	71	69	67								
50	73	71	69	67	65	63						
45	73	71	69	67	65	63	61	59	57			
40	73	71	69	67	65	63	61	59	57	55		
35	67	67	67	67	65	63	61	59	57	55	53	
30	64	61	62	61	61	61	61	59	57	55	53	51
25	64	61	59	57	56	56	57	57	57	55	53	51
20	64	61	59	57	56	54	53	53	53	53	52	51
15	64	61	59	57	56	54	53	52	50	49	48	47
10 & BELOW	64	61	59	57	56	54	53	52	50	48	45	43

Takeoff %N1 (Table 2 of 3)

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

ASSUMED TEMP (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
75	88.3	88.6	89.1	89.6	90.2	90.8	91.5	92.2	92.7	93.1	93.3	93.4
70	89.1	89.5	89.4	89.3	89.6	90.1	90.8	91.6	92.0	92.5	92.6	92.7
65	90.0	90.4	90.3	90.2	90.2	90.1	90.2	90.9	91.4	91.8	91.9	92.1
60	90.8	91.2	91.2	91.1	91.1	91.0	91.1	91.2	91.0	91.2	91.3	91.4
55	91.6	92.0	92.0	92.0	91.9	91.9	91.9	92.0	91.9	91.7	91.3	90.8
50	92.4	92.8	92.8	92.8	92.7	92.7	92.7	92.7	92.6	92.6	92.2	91.8
45	93.2	93.6	93.6	93.6	93.6	93.5	93.5	93.5	93.4	93.3	93.1	92.8
40	94.0	94.4	94.4	94.4	94.3	94.3	94.2	94.2	94.1	94.1	94.0	93.8
35	94.8	95.2	95.2	95.2	95.1	95.1	95.0	95.0	94.9	94.8	94.8	94.7
30	95.0	96.1	96.0	96.0	96.0	95.9	95.8	95.8	95.7	95.7	95.6	95.6
25	94.3	95.4	95.9	96.4	96.7	96.7	96.6	96.6	96.5	96.4	96.4	96.3
20	93.5	94.6	95.1	95.7	96.3	96.9	97.6	97.5	97.5	97.4	97.3	97.2
15	92.7	93.8	94.3	94.9	95.5	96.1	96.8	97.5	98.2	98.6	98.6	98.5
10	92.0	93.0	93.6	94.1	94.7	95.3	96.0	96.7	97.5	98.2	99.1	100.0
MINIMUM ASSUMED TEMP (°C)	32	30	28	26	24	22	20	18	16	15	12	10

With engine bleed for packs off, increase %N1 by 1.0

Assumed Temperature Reduced Thrust

%N1 Adjustment for Temperature Difference (Table 3 of 3)

ASSUMED TEMP MINUS OAT (°C)	OUTSIDE AIR TEMPERATURE (°C)													
	-40	-20	0	5	10	15	20	25	30	35	40	45	50	55
110	12.1													
100	11.3	8.5												
90	11.7	8.9												
80	12.5	8.0	5.5											
70	11.3	8.4	5.9	5.6	4.0									
60	9.7	9.2	4.8	4.7	4.4	4.2	2.6							
50	7.8	7.9	5.3	3.5	3.3	3.6	3.0	2.7	1.2					
40		6.4	6.0	5.5	3.7	3.2	3.7	3.0	2.8	3.0	3.7			
30		4.6	4.6	4.6	4.5	4.3	4.2	4.0	4.1	4.0	3.9	3.8	3.7	
20			3.1	3.1	3.1	3.0	2.9	2.9	2.8	2.7	2.7	2.6	2.6	2.5
10			1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.3	1.3
0			0	0	0	0	0	0	0	0	0	0	0	0

1. **Determine Maximum Assumed Temperature allowed from Table 1.**
2. **Find Maximum %N1 from Table 2 using the desired assumed temperature (no greater than temperature from Table 1).**
3. **Use the difference between assumed temperature and OAT to determine the %N1 adjustment from Table 3.**
4. **Subtract %N1 adjustment from Maximum %N1 in Table 2.**

Assumed Temperature Reduced Thrust - High Altitudes

Maximum Assumed Temperature (Table 1 of 3)

Based on 25% Takeoff Thrust Reduction

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)					
	10000	11000	12000	13000	14000	14500
40	56					
35	56	54	52			
30	56	54	52	50	48	47
25	54	54	52	50	48	47
20	51	51	52	50	48	47
15	47	47	48	49	48	47
10	43	44	44	45	46	46
5	43	42	42	42	43	43
0 & BELOW	43	42	42	42	41	41

Maximum Takeoff %N1 (Table 2 of 3)

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

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)					
	10000	11000	12000	13000	14000	14500
60	91.4					
55	90.8	91.5	92.3	93.2		
50	91.8	91.9	92.0	92.5	93.2	93.5
45	92.8	92.8	92.9	93.1	93.2	93.2
40	93.8	93.8	93.8	93.9	93.9	94.0
35	94.7	94.7	94.7	94.7	94.7	94.7
30	95.6	95.5	95.5	95.5	95.4	95.4
25	96.3	96.3	96.3	96.2	96.1	96.1
20	97.2	97.2	97.1	97.0	97.0	96.9
15	98.5	98.4	98.3	98.2	98.1	98.0
10	100.0	99.7	99.5	99.3	99.1	99.1
5		99.7	100.2	100.3	100.0	99.8
0				99.8	100.1	100.3
MINIMUM ASSUMED TEMP (°C)	10	8	6	4	2	1

%N1 Adjustment for Engine Bleed

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)					
	10000	11000	12000	13000	14000	14500
PACKS OFF	1.0	1.1	1.1	1.2	1.2	1.2
ENGINE ANTI-ICE	0.0	-0.7	-1.4	-1.4	-1.4	-1.4

Assumed Temperature Reduced Thrust - High Altitudes

%N1 Adjustment for Temperature Difference (Table 3 of 3)

ASSUMED TEMP MINUS OAT (°C)	OUTSIDE AIR TEMPERATURE (°C)										
	-60	-40	-20	0	5	10	15	20	25	30	35
110	15.9										
100	15.9										
90	14.8	12.5									
80	13.4	12.5									
70	11.2	11.3	9.2								
60		9.8	9.2								
50		7.8	7.9	6.0							
40			6.4	6.0	4.6	4.5	4.4	4.3			
30			4.6	4.7	4.6	4.5	4.4	4.3	2.9	2.9	2.8
20				3.1	3.1	3.1	3.0	3.0	2.9	2.9	2.8
10				1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.4
0					0	0	0	0	0	0	0

1. **Determine Maximum Assumed Temperature allowed from Table 1.**
2. **Find Maximum %N1 from Table 2 using the desired assumed temperature (no greater than temperature from Table 1).**
3. **Use the difference between assumed temperature and OAT to determine the %N1 adjustment from Table 3.**
4. **Subtract %N1 adjustment from Maximum %N1 in Table 2.**

Takeoff Speeds - Dry Runway (26B2 Bump)

Flaps 1 and 5

V1, VR, V2

WEIGHT (1000 KG)	FLAPS 1			FLAPS 5		
	V1	VR	V2	V1	VR	V2
85	156	159	165	152	155	161
80	149	152	159	146	149	155
75	144	147	154	141	143	150
70	139	141	149	136	138	146
65	132	135	144	129	132	141
60	125	128	138	122	125	135
55	118	121	132	115	118	129
50	111	114	126	108	111	123
45	103	106	120	101	103	117
40	95	98	113	92	95	110

Check V1(MCG) and Minimum Takeoff Weight. Takeoff using 26B2 Bump takeoff thrust at weights less than 56699 kg may be limited.

V1, VR, V2 Adjustments*

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

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
85	-3	-2	0	2	3	-2	-1	0	0	1	1	1	2
80	-3	-1	0	2	3	-2	-1	-1	0	0	1	1	2
75	-3	-1	0	2	3	-2	-1	-1	0	0	1	1	1
70	-3	-1	0	1	2	-2	-1	-1	0	0	1	1	1
65	-2	-1	0	1	2	-2	-1	-1	0	0	1	1	2
60	-2	-1	0	1	2	-2	-1	0	0	0	1	1	2
55	-1	-1	0	1	2	-2	-1	0	0	1	1	2	2
50	-1	0	0	1	2	-2	-1	0	0	1	1	2	2
45	0	0	0	1	2	-2	-1	0	0	1	2	2	2
40	0	1	0	2	2	-2	-1	0	0	1	2	3	3

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	F	-2000	0	2000	4000	6000	8000	10000
70	158	107	100					
60	140	112	107	103	102			
50	122	117	114	110	107	103	100	96
40	104	122	120	116	112	107	103	100
30	86	122	122	120	115	111	107	103
20	68	123	122	121	117	113	108	104
-60	-76	125	124	122	118	114	110	106

Takeoff Speeds - Dry Runway (26B2 Bump)
Flaps 10, 15 and 25
V1, VR, V2

WEIGHT (1000 KG)	FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2
85	145	147	153	145	144	150			
80	139	141	148	139	138	144	135	136	142
75	135	136	143	134	133	140	131	132	139
70	129	132	140	128	129	137	126	127	135
65	124	127	135	122	124	133	121	122	131
60	118	121	131	116	118	128	115	117	127
55	111	114	125	110	112	123	109	111	122
50	105	108	120	104	106	118	103	105	117
45	99	101	114	97	100	113	96	98	111
40	91	94	109	90	93	107	89	91	106

Check V1(MCG) and Minimum Takeoff Weight. Takeoff using 26B2 Bump takeoff thrust at weights less than 56699 kg may be limited.

V1, VR, V2 Adjustments*

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

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
85	-3	-2	0	1	3	-2	-1	-1	0	0	1	1	1
80	-3	-2	0	1	3	-2	-1	-1	0	0	1	1	1
75	-3	-1	0	1	2	-2	-1	-1	0	0	1	1	1
70	-2	-1	0	1	2	-2	-1	-1	0	0	1	1	1
65	-2	-1	0	1	2	-2	-1	-1	0	0	1	1	1
60	-2	-1	0	1	2	-2	-1	-1	0	0	1	1	2
55	-2	-1	0	1	2	-2	-1	-1	0	0	1	1	2
50	-2	-1	0	1	1	-2	-2	-1	0	0	1	1	2
45	-1	-1	0	0	1	-2	-2	-1	0	0	1	1	2
40	-1	-1	0	0	1	-3	-2	-1	0	0	1	1	2

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	107	100					
60	140	112	107	103	102			
50	122	117	114	110	107	103	100	96
40	104	122	120	116	112	107	103	100
30	86	122	122	120	115	111	107	103
20	68	123	122	121	117	113	108	104
-60	-76	125	124	122	118	114	110	106

Takeoff Speeds - Dry Runway - High Altitudes (26B2 Bump)

V1, VR, V2

WEIGHT	FLAPS 1			FLAPS 5			FLAPS 10			FLAPS 15			FLAPS 25		
(1000 KG)	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
75	152	153	156	148	149	152									
70	147	149	152	143	145	148									
65	141	143	147	137	139	143	131	132	136						
60	134	136	141	131	133	137	124	126	130	123	123	127	121	121	126
55	126	129	134	123	126	131	118	119	124	116	116	122	115	115	120
50	119	121	127	116	118	124	111	112	119	110	110	116	108	109	115
45	111	113	120	108	110	118	104	105	112	103	103	111	101	102	109
40	102	104	113	99	102	110	96	98	107	95	97	105	94	95	104

Check V1(MCG) and Minimum Takeoff Weight. Takeoff using 26B2 Bump takeoff thrust at weights less than 45812 kg may be limited.

V1, VR, V2 Adjustments*

TEMP		V1						VR						V2					
		PRESS ALT (1000 FT)						PRESS ALT (1000 FT)						PRESS ALT (1000 FT)					
°C	°F	10	11	12	13	14	14.5	10	11	12	13	14	14.5	10	11	12	13	14	14.5
50	122	4						2						-1					
40	104	2	2	3	4	6	5	2	2	2	3	4	3	-1	-1	0	-1	0	-1
30	86	1	1	2	3	4	4	1	1	2	2	3	3	0	0	0	-1	0	-1
20	68	0	1	2	2	3	4	0	1	2	2	3	3	0	0	0	-1	-1	-1
10	50	0	0	1	2	3	3	0	1	1	2	2	3	0	0	0	0	-1	-1
0	32	0	0	1	2	3	3	0	1	1	2	2	2	0	0	0	0	0	0
-60	-76	0	0	1	2	3	3	0	1	1	2	2	2	0	0	0	0	0	0

Slope and Wind V1 Adjustments*

WEIGHT	SLOPE (%)					WIND (KTS)							
(1000 KG)	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
75	-2	-1	0	1	2	-1	-1	0	0	0	0	1	2
70	-2	-1	0	1	2	-1	-1	0	0	0	0	1	1
65	-2	-1	0	1	1	-1	-1	0	0	0	0	1	1
60	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
55	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
50	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
45	-2	-1	0	1	1	-1	-1	-1	0	0	1	1	1
40	-1	-1	0	1	1	-2	-1	-1	0	0	1	1	1

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)					
°C	°F	10000	11000	12000	13000	14000	14500
50	122	96					
40	104	100	98	97	95	94	93
30	86	103	101	99	97	95	94
20	68	104	102	100	98	96	95
10	50	105	103	101	99	98	97
0	32	106	104	102	101	99	98
-60	-76	106	105	103	102	100	99

Takeoff Speeds - Wet Runway (26B2 Bump)
Flaps 1 and 5
V1, VR, V2

WEIGHT	FLAPS 1			FLAPS 5		
(1000 KG)	V1	VR	V2	V1	VR	V2
85	150	159	165	146	155	161
80	143	152	159	139	149	155
75	137	147	154	133	143	150
70	131	141	149	127	138	146
65	124	135	144	121	132	141
60	116	128	138	113	125	135
55	109	121	132	106	118	129
50	101	114	126	99	111	123
45	93	106	120	91	103	117
40	85	98	113	82	95	110

Check V1(MCG) and Minimum Takeoff Weight. Takeoff using 26B2 Bump takeoff thrust at weights less than 56699 kg may be limited.

V1, VR, V2 Adjustment*

TEMP		V1							VR							V2						
		PRESS ALT (1000 FT)							PRESS ALT (1000 FT)							PRESS ALT (1000 FT)						
°C	°F	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10	-2	0	2	4	6	8	10
70	158	18	22						10	9						0	-2					
60	140	9	11	12	16				5	5	6	8				-1	-1	-1	-1			
50	122	2	4	6	9	12	15	15	1	3	4	6	7	9	9	-1	-1	-1	-1	0	1	-1
40	104	0	0	3	5	7	10	12	0	1	2	4	5	7	8	0	0	0	0	0	0	0
30	86	0	0	1	3	5	7	10	0	0	1	3	4	6	7	0	0	0	0	0	0	0
20	68	0	0	0	2	4	6	9	0	0	1	2	4	5	7	0	0	0	0	0	0	0
-60	-76	0	0	0	2	5	7	9	0	0	1	2	4	5	6	0	0	0	0	0	1	1

Slope and Wind V1 Adjustment*

WEIGHT	SLOPE (%)					WIND (KTS)							
(1000 KG)	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
85	-5	-2	0	3	6	-4	-2	-1	0	1	2	2	3
80	-4	-2	0	3	5	-4	-2	-1	0	1	2	2	3
75	-4	-2	0	2	5	-4	-2	-1	0	1	2	2	3
70	-4	-2	0	2	4	-4	-2	-1	0	1	2	2	3
65	-4	-2	0	2	4	-4	-2	-1	0	1	2	2	3
60	-3	-1	0	2	4	-4	-2	-1	0	1	2	3	3
55	-3	-1	0	2	3	-4	-3	-1	0	1	2	3	4
50	-2	-1	0	2	3	-4	-3	-1	0	1	3	3	4
45	-1	0	0	2	3	-4	-3	-1	0	1	3	4	5
40	-1	0	0	2	3	-5	-3	-1	0	2	4	5	6

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	107	100					
60	140	112	107	103	102			
50	122	117	114	110	107	103	100	96
40	104	122	120	116	112	107	103	100
30	86	122	122	120	115	111	107	103
20	68	123	122	121	117	113	108	104
-60	-76	125	124	122	118	114	110	106

Takeoff Speeds - Wet Runway (26B2 Bump)

Flaps 10, 15 and 25

V1, VR, V2

WEIGHT (1000 KG)	FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2
85	140	147	153	141	144	150			
80	133	141	148	133	138	144	130	136	142
75	128	136	143	127	133	140	125	132	139
70	122	132	140	121	129	137	120	127	135
65	116	127	135	115	124	133	114	122	131
60	110	121	131	109	118	128	107	117	127
55	103	114	125	102	112	123	101	111	122
50	96	108	120	95	106	118	94	105	117
45	89	101	114	88	100	113	87	98	111
40	82	94	109	81	93	107	80	91	106

Check V1(MCG) and Minimum Takeoff Weight. Takeoff using 26B2 Bump takeoff thrust at weights less than 56699 kg may be limited.

V1, VR, V2 Adjustment*

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

Slope and Wind V1 Adjustment*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
85	-5	-2	0	2	4	-3	-2	-1	0	1	1	2	2
80	-4	-2	0	2	4	-3	-2	-1	0	1	1	2	2
75	-4	-2	0	2	4	-4	-2	-1	0	1	1	2	3
70	-4	-2	0	2	4	-4	-2	-1	0	1	1	2	3
65	-3	-2	0	2	3	-4	-2	-1	0	1	2	2	3
60	-3	-2	0	2	3	-4	-3	-1	0	1	2	2	3
55	-3	-1	0	1	3	-4	-3	-1	0	1	2	3	3
50	-3	-1	0	1	2	-5	-3	-1	0	1	2	3	3
45	-2	-1	0	1	2	-5	-3	-2	0	1	2	3	4
40	-2	-1	0	1	2	-5	-4	-2	0	1	2	3	4

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	107	100					
60	140	112	107	103	102			
50	122	117	114	110	107	103	100	96
40	104	122	120	116	112	107	103	100
30	86	122	122	120	115	111	107	103
20	68	123	122	121	117	113	108	104
-60	-76	125	124	122	118	114	110	106

Takeoff Speeds - Wet Runway - High Altitudes (26B2 Bump)

V1, VR, V2

WEIGHT	FLAPS 1			FLAPS 5			FLAPS 10			FLAPS 15			FLAPS 25		
(1000 KG)	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
75	147	153	156	142	149	152									
70	141	149	152	137	145	148									
65	135	143	147	131	139	143									
60	127	136	141	123	133	137	118	126	130	118	123	127	116	121	126
55	119	129	134	116	126	131	111	119	124	110	117	122	109	115	120
50	111	121	127	108	118	125	103	112	119	103	110	116	101	109	115
45	102	113	120	99	110	118	96	105	113	95	103	111	94	102	110
40	93	105	113	91	102	111	88	98	107	87	97	105	86	95	104

Check V1(MCG) and Minimum Takeoff Weight. Takeoff using 26B2 Bump takeoff thrust at weights less than 45812 kg may be limited.

V1, VR, V2 Adjustments*

TEMP		V1						VR						V2					
		PRESSALT(1000 FT)						PRESSALT(1000 FT)						PRESSALT(1000 FT)					
°C	°F	10	11	12	13	14	14.5	10	11	12	13	14	14.5	10	11	12	13	14	14.5
50	122	5						2						-1					
40	104	3	3	4	5	6	6	2	2	2	3	2	2	-1	-1	-1	0	-2	-3
30	86	1	2	3	4	5	5	1	1	2	3	3	3	0	0	-1	-1	-1	-2
20	68	0	1	2	3	4	4	0	1	2	2	3	3	0	0	0	-1	-1	-1
10	50	0	1	2	2	3	4	0	1	1	2	3	3	0	0	0	0	-1	-1
0	32	0	1	1	2	3	4	0	1	1	2	2	2	0	0	0	0	0	0
-60	-76	0	1	1	2	3	4	0	1	1	2	2	2	0	0	0	0	0	0

Slope and Wind V1 Adjustments*

WEIGHT	SLOPE (%)					WIND (KTS)							
(1000 KG)	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
75	-4	-2	0	2	4	-3	-2	-1	0	0	1	2	2
70	-4	-2	0	2	4	-3	-2	-1	0	0	1	2	2
65	-4	-2	0	2	4	-3	-2	-1	0	1	1	2	2
60	-4	-2	0	2	4	-3	-2	-1	0	1	1	2	2
55	-3	-2	0	2	3	-3	-2	-1	0	1	1	2	2
50	-3	-2	0	2	3	-3	-2	-1	0	1	1	2	2
45	-3	-1	0	1	3	-3	-2	-1	0	1	1	2	3
40	-2	-1	0	1	2	-4	-3	-1	0	1	1	2	3

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)					
°C	°F	10000	11000	12000	13000	14000	14500
50	122	96					
40	104	100	98	97	95	94	93
30	86	103	101	99	97	95	94
20	68	104	102	100	98	96	95
10	50	105	103	101	99	98	97
0	32	106	104	102	101	99	98
-60	-76	106	105	103	102	100	99

Maximum Allowable Clearway (26B2 Bump)

FIELD LENGTH (M)	MAX ALLOWABLE CLEARWAY FOR V1 REDUCTION (M)
1200	140
1800	200
2400	250
3000	310
3600	430
4200	470

Maximum Allowable Clearway - High Altitudes (26B2 Bump)

FIELD LENGTH (M)	MAX ALLOWABLE CLEARWAY FOR V1 REDUCTION (M)
2000	220
2500	270
3000	320
3500	390
4000	460
4500	480

Clearway and Stopway V1 Adjustments (26B2 Bump)

CLEARWAY MINUS STOPWAY (M)	NORMAL V1 (KIAS)							
	DRY RUNWAY				WET RUNWAY			
	100	120	140	160	100	120	140	160
300	-4	-4	-3	-2				
200	-5	-3	-2	-1				
100	-4	-2	-1	-1				
0	0	0	0	0	0	0	0	0
-100	1	2	2	0	1	2	2	0
-200	0	2	2	1	3	4	3	1
-300	0	2	2	0	5	5	4	2

Use of clearway not allowed on wet runways.
V1 not to exceed VR.

Clearway and Stopway V1 Adjustments - High Altitudes (26B2 Bump)

CLEARWAY MINUS STOPWAY (M)	NORMAL V1 (KIAS)							
	DRY RUNWAY				WET RUNWAY			
	100	120	140	160	100	120	140	160
300	-4	-4	-3	-3				
200	-4	-3	-2	-1				
100	-4	-2	-1	-1				
0	0	0	0	0	0	0	0	0
-100	0	2	2	0	1	2	2	1
-200	0	2	2	0	3	4	3	2
-300	0	2	2	0	5	5	4	2

Use of clearway not allowed on wet runways.
V1 not to exceed VR.

Stab Trim Setting (26B2 Bump)

Flaps 1 and 5

WEIGHT (1000 KG)	C.G. (%MAC)									
	9	11	13	16	20	23	26	28	30	33
80	8 1/2	8 1/2	8 1/2	7 3/4	6 3/4	6 1/4	5 3/4	5 1/4	5	4 1/4
70	8 1/2	8 1/2	8 1/4	7 1/4	6 1/2	5 3/4	5 1/4	4 3/4	4 1/2	4
60	8 1/2	8 1/4	7 1/2	6 1/2	5 3/4	5 1/4	4 1/2	4 1/4	4	4
50	7 1/2	7	6 1/2	5 1/2	5	4 1/4	4	4	4	4
45	6 1/4	6	5 1/2	5	4 1/4	4	4	4	4	4

Flaps 10, 15 and 25

WEIGHT (1000 KG)	C.G. (%MAC)									
	9	12	14	16	18	23	26	28	31	33
80	8 1/2	8 1/2	8 1/2	7 1/2	7	5 3/4	5 1/4	4 3/4	4	4
70	8 1/2	8 1/4	7 1/2	6 3/4	6 1/4	5	4 1/4	4	4	4
60	8 1/2	7 1/4	6 1/4	5 3/4	5 1/4	4 1/4	4	4	4	4
50	7	5 1/2	5 1/4	4 3/4	4 1/4	4	4	4	4	4
45	5 1/2	5	4 1/2	4 1/4	4	4	4	4	4	4

ADVISORY INFORMATION

Slush/Standing Water Takeoff (26B2 Bump)
Maximum Reverse Thrust
Weight Adjustments (1000 KG)

26B2 BUMP DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-9.9	-13.3	-16.7	-12.2	-15.6	-19.0	-17.1	-20.5	-23.9
85	-9.1	-12.5	-15.9	-11.0	-14.4	-17.8	-15.1	-18.5	-21.9
80	-8.3	-11.7	-15.1	-9.9	-13.3	-16.7	-13.3	-16.7	-20.1
75	-7.6	-11.0	-14.4	-8.8	-12.2	-15.6	-11.5	-14.9	-18.3
70	-6.8	-10.2	-13.6	-7.8	-11.2	-14.6	-10.0	-13.4	-16.8
65	-6.1	-9.5	-12.9	-6.9	-10.3	-13.7	-8.5	-11.9	-15.3
60	-5.3	-8.7	-12.1	-5.9	-9.3	-12.7	-7.2	-10.6	-14.0
55	-4.6	-8.0	-11.4	-5.1	-8.5	-11.9	-6.1	-9.5	-12.9
50	-3.9	-7.3	-10.7	-4.3	-7.7	-11.1	-5.1	-8.5	-11.9
45	-3.3	-6.7	-10.1	-3.5	-6.9	-10.3	-4.2	-7.6	-11.0
40	-2.6	-6.0	-9.4	-2.8	-6.2	-9.6	-3.5	-6.9	-10.3

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1600				31.4			35.9		
1800	38.6			41.5			46.1		
2000	48.7	31.0		51.8	33.9		56.6	38.5	
2200	59.3	41.1		62.5	44.0		67.4	48.7	30.8
2400	70.4	51.3	33.5	73.8	54.4	36.4	78.6	59.3	41.0
2600	82.2	62.0	43.6	85.6	65.3	46.6	90.0	70.2	51.3
2800	94.5	73.3	54.0	97.8	76.7	57.1	101.6	81.4	62.0
3000		85.3	64.8		88.7	68.1		92.9	72.9
3200		97.6	76.2		100.9	79.6			84.3
3400			88.4			91.7			95.8
3600			100.7						

1. **Enter Weight Adjustment table with slush/standing water depth and 26B2 Bump dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -50 m/+50 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (26B2 Bump)

Maximum Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-14	-9	-4	-7	-2	0	0	0	0
85	-15	-10	-5	-9	-4	0	0	0	0
80	-17	-12	-7	-11	-6	-1	0	0	0
75	-18	-13	-8	-13	-8	-3	-2	0	0
70	-19	-14	-9	-15	-10	-5	-5	0	0
65	-20	-15	-10	-17	-12	-7	-9	-4	0
60	-21	-16	-11	-18	-13	-8	-12	-7	-2
55	-22	-17	-12	-20	-15	-10	-14	-9	-4
50	-23	-18	-13	-21	-16	-11	-17	-12	-7
45	-24	-19	-14	-22	-17	-12	-19	-14	-9
40	-25	-20	-15	-23	-18	-13	-21	-16	-11

1. **Obtain V1, VR and V2 for the actual weight using the 26B2 Bump Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (26B2 Bump)

No Reverse Thrust

Weight Adjustments (1000 KG)

26B2 BUMP DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-13.4	-17.1	-20.7	-15.7	-19.4	-23.1	-20.6	-24.2	-27.9
85	-12.4	-16.1	-19.8	-14.4	-18.0	-21.7	-18.4	-22.1	-25.8
80	-11.5	-15.1	-18.8	-13.1	-16.7	-20.4	-16.4	-20.1	-23.8
75	-10.5	-14.2	-17.9	-11.8	-15.5	-19.2	-14.5	-18.2	-21.9
70	-9.6	-13.3	-17.0	-10.6	-14.3	-18.0	-12.8	-16.5	-20.2
65	-8.7	-12.4	-16.1	-9.5	-13.2	-16.9	-11.3	-14.9	-18.6
60	-7.8	-11.5	-15.2	-8.5	-12.1	-15.8	-9.8	-13.5	-17.2
55	-7.0	-10.7	-14.3	-7.5	-11.2	-14.8	-8.6	-12.3	-15.9
50	-6.1	-9.8	-13.5	-6.6	-10.3	-13.9	-7.5	-11.2	-14.8
45	-5.3	-9.0	-12.7	-5.7	-9.4	-13.1	-6.5	-10.2	-13.9
40	-4.5	-8.2	-11.9	-5.0	-8.6	-12.3	-5.8	-9.4	-13.1

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
2200							34.3		
2400							45.5		
2600	30.6			41.1			56.9	34.3	
2800	41.9			52.5			68.6	45.5	
3000	53.4	30.6		64.7	41.1		80.6	56.9	34.3
3200	65.9	41.9		77.8	52.5		92.7	68.6	45.5
3400	79.6	53.4	30.6	91.8	64.7	41.1		80.6	56.9
3600	94.5	65.9	41.9		77.8	52.5		92.7	68.6
3800		79.6	53.4		91.8	64.7			80.6
4000		94.5	65.9			77.8			92.7
4200			79.6			91.8			
4400			94.5						

1. **Enter Weight Adjustment table with slush/standing water depth and 26B2 Bump dry field/ obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -65 m/+65 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (26B2 Bump)
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-23	-13	-3	-12	-2	0	0	0	0
85	-25	-15	-5	-16	-6	0	0	0	0
80	-27	-17	-7	-19	-9	0	0	0	0
75	-29	-19	-9	-22	-12	-2	-5	0	0
70	-31	-21	-11	-25	-15	-5	-11	-1	0
65	-33	-23	-13	-28	-18	-8	-16	-6	0
60	-34	-24	-14	-31	-21	-11	-21	-11	-1
55	-36	-26	-16	-33	-23	-13	-26	-16	-6
50	-38	-28	-18	-35	-25	-15	-29	-19	-9
45	-39	-29	-19	-37	-27	-17	-33	-23	-13
40	-41	-31	-21	-39	-29	-19	-36	-26	-16

1. **Obtain V1, VR and V2 for the actual weight using the 26B2 Bump 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).**

ADVISORY INFORMATION

Slush/Standing Water Takeoff - High Altitudes (26B2 Bump)

Maximum Reverse Thrust

Weight Adjustments (1000 KG)

26B2 BUMP DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	10000	12000	14000	10000	12000	14000	10000	12000	14000
90	-16.7	-18.0	-19.4	-19.0	-20.3	-21.7	-23.9	-25.2	-26.6
85	-15.9	-17.3	-18.6	-17.8	-19.2	-20.5	-21.9	-23.3	-24.7
80	-15.1	-16.5	-17.8	-16.7	-18.1	-19.4	-20.1	-21.4	-22.8
75	-14.4	-15.7	-17.1	-15.6	-17.0	-18.4	-18.3	-19.7	-21.1
70	-13.6	-15.0	-16.3	-14.6	-16.0	-17.3	-16.8	-18.1	-19.5
65	-12.9	-14.2	-15.6	-13.7	-15.0	-16.4	-15.3	-16.7	-18.1
60	-12.1	-13.5	-14.9	-12.7	-14.1	-15.5	-14.0	-15.4	-16.8
55	-11.4	-12.8	-14.2	-11.9	-13.2	-14.6	-12.9	-14.3	-15.6
50	-10.7	-12.1	-13.5	-11.1	-12.4	-13.8	-11.9	-13.2	-14.6
45	-10.1	-11.4	-12.8	-10.3	-11.7	-13.0	-11.0	-12.4	-13.7
40	-9.4	-10.7	-12.1	-9.6	-11.0	-12.3	-10.3	-11.6	-13.0

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	10000	12000	14000	10000	12000	14000	10000	12000	14000
2200							30.8		
2400	33.5			36.4			41.0	33.9	
2600	43.6	36.6		46.6	39.4	32.4	51.3	44.1	36.9
2800	54.0	46.7	39.6	57.1	49.7	42.5	62.0	54.5	47.2
3000	64.8	57.2	49.8	68.1	60.3	52.8	72.9	65.2	57.7
3200	76.2	68.2	60.4	79.6	71.5	63.6	84.3	76.3	68.5
3400	88.4	79.8	71.6	91.7	83.2	74.9	95.8	87.7	79.7
3600		92.1	83.4		95.4	86.8		99.3	91.2
3800			95.7			99.0			

1. **Enter Weight Adjustment table with slush/standing water depth and 26B2 Bump dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -50 m /+50 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff - High Altitudes (26B2 Bump)

Maximum Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	10000	12000	14000	10000	12000	14000	10000	12000	14000
90	-4	-2	0	0	0	0	0	0	0
85	-5	-3	-1	0	0	0	0	0	0
80	-7	-5	-3	-1	0	0	0	0	0
75	-8	-6	-4	-3	-1	0	0	0	0
70	-9	-7	-5	-5	-3	-1	0	0	0
65	-10	-8	-6	-7	-5	-3	0	0	0
60	-11	-9	-7	-8	-6	-4	-2	0	0
55	-12	-10	-8	-10	-8	-6	-4	-2	0
50	-13	-11	-9	-11	-9	-7	-7	-5	-3
45	-14	-12	-10	-12	-10	-8	-9	-7	-5
40	-15	-13	-11	-13	-11	-9	-11	-9	-7

1. **Obtain V1, VR and V2 for the actual weight using the 26B2 Bump Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff - High Altitudes (26B2 Bump)

No Reverse Thrust

Weight Adjustments (1000 KG)

26B2 BUMP DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	10000	12000	14000	10000	12000	14000	10000	12000	14000
90	-20.7	-22.2	-23.7	-23.1	-24.5	-26.0	-27.9	-29.4	-30.9
85	-19.8	-21.2	-22.7	-21.7	-23.2	-24.7	-25.8	-27.3	-28.7
80	-18.8	-20.3	-21.8	-20.4	-21.9	-23.3	-23.8	-25.2	-26.7
75	-17.9	-19.3	-20.8	-19.2	-20.6	-22.1	-21.9	-23.4	-24.8
70	-17.0	-18.4	-19.9	-18.0	-19.4	-20.9	-20.2	-21.6	-23.1
65	-16.1	-17.5	-19.0	-16.9	-18.3	-19.8	-18.6	-20.1	-21.5
60	-15.2	-16.7	-18.1	-15.8	-17.3	-18.8	-17.2	-18.7	-20.1
55	-14.3	-15.8	-17.3	-14.8	-16.3	-17.8	-15.9	-17.4	-18.9
50	-13.5	-15.0	-16.4	-13.9	-15.4	-16.9	-14.8	-16.3	-17.8
45	-12.7	-14.1	-15.6	-13.1	-14.6	-16.0	-13.9	-15.4	-16.8
40	-11.9	-13.3	-14.8	-12.3	-13.8	-15.2	-13.1	-14.6	-16.0

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	10000	12000	14000	10000	12000	14000	10000	12000	14000
3000							34.3		
3200							45.5	36.5	
3400	30.6			41.1	32.1		56.9	47.8	38.8
3600	41.9	32.9		52.5	43.3	34.4	68.6	59.3	50.1
3800	53.4	44.1	35.1	64.7	54.9	45.6	80.6	71.0	61.6
4000	65.9	55.8	46.4	77.8	67.3	57.3	92.7	83.0	73.4
4200	79.6	68.5	58.3	91.8	80.5	69.8		95.2	85.4
4400	94.5	82.5	71.2		94.7	83.3			97.6
4600		97.5	85.5			97.5			

1. **Enter Weight Adjustment table with slush/standing water depth and 26B2 Bump dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -65 m/+65 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff - High Altitudes (26B2 Bump)

No Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	10000	12000	14000	10000	12000	14000	10000	12000	14000
90	-3	0	0	0	0	0	0	0	0
85	-5	-1	0	0	0	0	0	0	0
80	-7	-3	0	0	0	0	0	0	0
75	-9	-5	-1	-2	0	0	0	0	0
70	-11	-7	-3	-5	-1	0	0	0	0
65	-13	-9	-5	-8	-4	0	0	0	0
60	-14	-10	-6	-11	-7	-3	-1	0	0
55	-16	-12	-8	-13	-9	-5	-6	-2	0
50	-18	-14	-10	-15	-11	-7	-9	-5	-1
45	-19	-15	-11	-17	-13	-9	-13	-9	-5
40	-21	-17	-13	-19	-15	-11	-16	-12	-8

1. **Obtain V1, VR and V2 for the actual weight using the 26B2 Bump 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).**

ADVISORY INFORMATION

Slippery Runway Takeoff (26B2 Bump)

Maximum Reverse Thrust

Weight Adjustment (1000 KG)

26B2 BUMP DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-0.2	-0.5	-0.8	-5.2	-5.5	-5.8	-9.6	-9.9	-10.2
85	-0.5	-0.8	-1.1	-5.2	-5.5	-5.9	-9.3	-9.6	-10.0
80	-0.7	-1.0	-1.4	-5.2	-5.5	-5.9	-9.0	-9.3	-9.7
75	-0.9	-1.2	-1.6	-5.1	-5.5	-5.8	-8.6	-8.9	-9.3
70	-1.0	-1.4	-1.7	-5.0	-5.3	-5.6	-8.2	-8.5	-8.8
65	-1.1	-1.4	-1.7	-4.8	-5.1	-5.4	-7.6	-7.9	-8.3
60	-1.1	-1.4	-1.7	-4.5	-4.8	-5.1	-7.0	-7.3	-7.6
55	-1.0	-1.3	-1.6	-4.1	-4.4	-4.8	-6.3	-6.6	-7.0
50	-0.8	-1.2	-1.5	-3.7	-4.0	-4.3	-5.5	-5.9	-6.2
45	-0.6	-0.9	-1.3	-3.2	-3.5	-3.8	-4.7	-5.0	-5.3
40	-0.3	-0.7	-1.0	-2.6	-2.9	-3.3	-3.8	-4.1	-4.4

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1200	30.9								
1400	49.1								
1600	67.6	42.2		33.3					
1800	86.4	60.6	35.4	46.1					
2000		79.4	53.7	59.6	38.1		32.1		
2200		98.2	72.3	73.9	51.1	30.2	40.7		
2400			91.1	89.4	64.8	42.9	49.3	31.0	
2600					79.6	56.1	58.4	39.6	
2800					95.4	70.2	68.2	48.2	
3000						85.5	78.7	57.3	38.5
3200						101.3	90.0	66.9	47.1
3400							101.6	77.3	56.1
3600								88.6	65.7
3800								100.1	76.0
4000									87.2
4200									98.7

1. **Enter Weight Adjustment table with reported braking action and 26B2 Bump dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust “Good” field length available by -35 m/+35 m for every 5°C above/below 4°C.**
   Adjust “Medium” field length available by -35 m/+35 m for every 5°C above/below 4°C.
   Adjust “Poor” field length available by -50 m/+50 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (26B2 Bump)

Maximum Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-3	0	0	-12	-7	-2	-24	-19	-14
85	-5	0	0	-14	-9	-4	-26	-21	-16
80	-6	-1	0	-16	-11	-6	-28	-23	-18
75	-7	-2	0	-17	-12	-7	-30	-25	-20
70	-8	-3	0	-19	-14	-9	-32	-27	-22
65	-9	-4	0	-20	-15	-10	-33	-28	-23
60	-10	-5	0	-21	-16	-11	-35	-30	-25
55	-10	-5	0	-22	-17	-12	-36	-31	-26
50	-11	-6	-1	-24	-19	-14	-38	-33	-28
45	-12	-7	-2	-25	-20	-15	-39	-34	-29
40	-13	-8	-3	-26	-21	-16	-40	-35	-30

1. **Obtain V1, VR and V2 for the actual weight using the 26B2 Bump Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (26B2 Bump)

No Reverse Thrust

Weight Adjustments (1000 KG)

26B2 BUMP DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-1.3	-1.7	-2.1	-7.6	-8.1	-8.5	-13.2	-13.7	-14.1
85	-1.9	-2.3	-2.7	-7.9	-8.4	-8.8	-13.0	-13.4	-13.9
80	-2.4	-2.8	-3.2	-8.1	-8.6	-9.0	-12.7	-13.1	-13.5
75	-2.7	-3.1	-3.5	-8.1	-8.5	-8.9	-12.1	-12.5	-12.9
70	-2.8	-3.2	-3.6	-7.8	-8.2	-8.6	-11.3	-11.7	-12.1
65	-2.7	-3.2	-3.6	-7.3	-7.7	-8.1	-10.3	-10.7	-11.1
60	-2.5	-2.9	-3.4	-6.5	-7.0	-7.4	-9.0	-9.4	-9.9
55	-2.1	-2.5	-3.0	-5.6	-6.0	-6.4	-7.6	-8.0	-8.4
50	-1.5	-1.9	-2.4	-4.4	-4.8	-5.2	-5.9	-6.3	-6.7
45	-0.7	-1.2	-1.6	-3.0	-3.4	-3.8	-4.0	-4.4	-4.8
40	0.0	-0.2	-0.6	-1.3	-1.7	-2.2	-1.9	-2.4	-2.8

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1600	43.9								
1800	68.6	37.5							
2000	91.5	62.7	31.1						
2200		85.9	56.6						
2400			80.2	44.4					
2600			102.8	65.2	36.7				
2800				86.1	57.4				
3000					78.2	49.6			
3200					99.2	70.4			
3400						91.3			
3600							34.8		
3800							49.9		
4000							65.3	36.7	
4200							81.1	51.8	
4400							97.2	67.3	38.6
4600								83.1	53.7
4800								99.2	69.2
5000									85.1
5200									101.2

1. **Enter Weight Adjustment table with reported braking action and 26B2 Bump dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -45 m/+45 m for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -45 m/+45 m for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -65 m/+65 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (26B2 Bump)
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-6	-1	0	-19	-14	-9	-38	-33	-28
85	-7	-2	0	-21	-16	-11	-42	-37	-32
80	-9	-4	0	-23	-18	-13	-45	-40	-35
75	-10	-5	0	-26	-21	-16	-49	-44	-39
70	-12	-7	-2	-28	-23	-18	-52	-47	-42
65	-13	-8	-3	-31	-26	-21	-55	-50	-45
60	-15	-10	-5	-34	-29	-24	-58	-53	-48
55	-17	-12	-7	-36	-31	-26	-62	-57	-52
50	-18	-13	-8	-39	-34	-29	-65	-60	-55
45	-20	-15	-10	-42	-37	-32	-68	-63	-58
40	-22	-17	-12	-46	-41	-36	-71	-66	-61

1. **Obtain V1, VR and V2 for the actual weight using the 26B2 Bump Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff - High Altitudes (26B2 Bump)

Maximum Reverse Thrust

Weight Adjustment (1000 KG)

26B2 BUMP DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	10000	12000	14000	10000	12000	14000	10000	12000	14000
90	-0.8	-0.9	-1.1	-5.8	-6.0	-6.1	-10.2	-10.4	-10.5
85	-1.1	-1.2	-1.4	-5.9	-6.0	-6.1	-10.0	-10.1	-10.2
80	-1.4	-1.5	-1.6	-5.9	-6.0	-6.1	-9.7	-9.8	-9.9
75	-1.6	-1.7	-1.8	-5.8	-5.9	-6.0	-9.3	-9.4	-9.5
70	-1.7	-1.8	-1.9	-5.6	-5.8	-5.9	-8.8	-8.9	-9.1
65	-1.7	-1.9	-2.0	-5.4	-5.5	-5.7	-8.3	-8.4	-8.5
60	-1.7	-1.9	-2.0	-5.1	-5.3	-5.4	-7.6	-7.8	-7.9
55	-1.6	-1.8	-1.9	-4.8	-4.9	-5.0	-7.0	-7.1	-7.2
50	-1.5	-1.6	-1.8	-4.3	-4.5	-4.6	-6.2	-6.3	-6.4
45	-1.3	-1.4	-1.5	-3.8	-4.0	-4.1	-5.3	-5.5	-5.6
40	-1.0	-1.1	-1.2	-3.3	-3.4	-3.5	-4.4	-4.6	-4.7

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	10000	12000	14000	10000	12000	14000	10000	12000	14000
1800	35.4								
2000	53.7	43.6	33.6						
2200	72.3	62.0	51.9	30.2					
2400	91.1	80.8	70.4	42.9	34.6				
2600		99.6	89.3	56.1	47.4	39.1			
2800				70.2	60.9	52.1			
3000				85.5	75.4	65.9	38.5	31.3	
3200					91.0	80.8	47.1	39.8	32.5
3400						96.5	56.1	48.4	41.1
3600							65.7	57.5	49.8
3800							76.0	67.2	58.9
4000							87.2	77.6	68.7
4200							98.7	88.9	79.2
4400									90.6

1. **Enter Weight Adjustment table with reported braking action and 26B2 Bump dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust “Good” field length available by -35 m/+35 m for every 5°C above/below 4°C.**
   Adjust “Medium” field length available by -35 m/+35 m for every 5°C above/below 4°C.
   Adjust “Poor” field length available by -50 m/+50 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff - High Altitudes (26B2 Bump)

Maximum Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	10000	12000	14000	10000	12000	14000	10000	12000	14000
90	0	0	0	-2	0	0	-14	-12	-10
85	0	0	0	-4	-2	0	-16	-14	-12
80	0	0	0	-6	-4	-2	-18	-16	-14
75	0	0	0	-7	-5	-3	-20	-18	-16
70	0	0	0	-9	-7	-5	-22	-20	-18
65	0	0	0	-10	-8	-6	-23	-21	-19
60	0	0	0	-11	-9	-7	-25	-23	-21
55	0	0	0	-12	-10	-8	-26	-24	-22
50	-1	0	0	-14	-12	-10	-28	-26	-24
45	-2	0	0	-15	-13	-11	-29	-27	-25
40	-3	-1	0	-16	-14	-12	-30	-28	-26

1. **Obtain V1, VR and V2 for the actual weight using the 26B2 Bump Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff - High Altitudes (26B2 Bump)

No Reverse Thrust

Weight Adjustment (1000 KG)

26B2_BUMP DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	10000	12000	14000	10000	12000	14000	10000	12000	14000
90	-2.1	-2.3	-2.5	-8.5	-8.7	-8.8	-14.1	-14.3	-14.4
85	-2.7	-2.9	-3.0	-8.8	-9.0	-9.1	-13.9	-14.0	-14.2
80	-3.2	-3.4	-3.5	-9.0	-9.1	-9.3	-13.5	-13.7	-13.8
75	-3.5	-3.7	-3.9	-8.9	-9.1	-9.3	-12.9	-13.1	-13.3
70	-3.6	-3.8	-4.0	-8.6	-8.8	-9.0	-12.1	-12.3	-12.5
65	-3.6	-3.8	-3.9	-8.1	-8.3	-8.5	-11.1	-11.3	-11.5
60	-3.4	-3.5	-3.7	-7.4	-7.6	-7.7	-9.9	-10.0	-10.2
55	-3.0	-3.1	-3.3	-6.4	-6.6	-6.8	-8.4	-8.6	-8.8
50	-2.4	-2.5	-2.7	-5.2	-5.4	-5.6	-6.7	-6.9	-7.1
45	-1.6	-1.8	-1.9	-3.8	-4.0	-4.1	-4.8	-5.0	-5.2
40	-0.6	-0.8	-1.0	-2.2	-2.3	-2.5	-2.8	-3.0	-3.1

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	10000	12000	14000	10000	12000	14000	10000	12000	14000
2000	31.1								
2200	56.6	43.9	31.1						
2400	80.2	68.6	56.6						
2600		91.5	80.2						
3000				49.6	38.2				
3200				70.4	58.9	47.5			
3400				91.3	79.8	68.3			
3600						89.2			
4400							38.6		
4600							53.7	42.3	31.1
4800							69.2	57.6	46.1
5000							85.1	73.2	61.4
5200								89.1	77.1
5400									93.1

1. **Enter Weight Adjustment table with reported braking action and 26B2 Bump dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -45 m/+45 m for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -45 m/+45 m for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -65 m/+65 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff - High Altitudes (26B2 Bump)

No Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	10000	12000	14000	10000	12000	14000	10000	12000	14000
90	0	0	0	-9	-7	-5	-28	-26	-24
85	0	0	0	-11	-9	-7	-32	-30	-28
80	0	0	0	-13	-11	-9	-35	-33	-31
75	0	0	0	-16	-14	-12	-39	-37	-35
70	-2	0	0	-18	-16	-14	-42	-40	-38
65	-3	-1	0	-21	-19	-17	-45	-43	-41
60	-5	-3	-1	-24	-22	-20	-48	-46	-44
55	-7	-5	-3	-26	-24	-22	-52	-50	-48
50	-8	-6	-4	-29	-27	-25	-55	-53	-51
45	-10	-8	-6	-32	-30	-28	-58	-56	-54
40	-12	-10	-8	-36	-34	-32	-61	-59	-57

1. **Obtain V1, VR and V2 for the actual weight using the 26B2 Bump Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Takeoff %N1 - (26B2 Bump)

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

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
55	96.5	96.9	97.1										
50	97.8	98.2	98.5	98.4	98.3								
45	98.6	99.3	99.8	99.6	99.5	99.6	99.8	99.8					
40	98.9	99.8	100.6	100.6	100.5	100.5	100.5	100.5	100.6	100.6			
35	98.3	99.6	101.1	101.4	101.5	101.5	101.5	101.4	101.4	101.5	101.5	101.5	101.5
30	97.5	98.8	100.2	101.5	102.4	102.2	102.2	102.3	102.1	102.1	102.3	102.2	102.4
25	96.8	98.1	99.5	100.9	102.3	102.4	102.4	102.4	102.4	102.4	102.5	102.5	102.5
20	96.0	97.3	98.7	100.2	101.6	101.8	102.1	102.4	102.4	102.4	102.5	102.5	102.5
15	95.2	96.5	98.0	99.4	100.8	101.1	101.4	101.7	102.0	102.3	102.5	102.5	102.5
10	94.4	95.7	97.2	98.7	100.1	100.4	100.7	100.9	101.2	101.5	101.8	102.1	102.5
5	93.6	94.9	96.4	97.9	99.4	99.6	99.9	100.2	100.5	100.8	101.1	101.4	101.7
0	92.8	94.2	95.6	97.1	98.6	98.9	99.2	99.4	99.7	100.0	100.3	100.6	100.9
-5	92.0	93.3	94.8	96.3	97.9	98.1	98.4	98.7	99.0	99.3	99.6	99.9	100.2
-10	91.2	92.5	94.0	95.6	97.1	97.4	97.6	97.9	98.2	98.5	98.8	99.1	99.4
-15	90.4	91.7	93.2	94.8	96.3	96.6	96.9	97.1	97.4	97.7	98.0	98.3	98.6
-20	89.5	90.9	92.4	94.0	95.5	95.8	96.1	96.3	96.6	96.9	97.2	97.5	97.8
-25	88.7	90.0	91.6	93.2	94.7	95.0	95.3	95.5	95.8	96.1	96.4	96.7	97.0
-30	87.9	89.2	90.7	92.3	93.9	94.2	94.5	94.7	95.0	95.3	95.6	95.9	96.2
-35	87.0	88.3	89.9	91.5	93.1	93.4	93.7	93.9	94.2	94.5	94.7	95.0	95.3
-40	86.1	87.5	89.0	90.7	92.3	92.6	92.8	93.1	93.3	93.6	93.9	94.2	94.5
-45	85.2	86.6	88.1	89.8	91.5	91.7	92.0	92.2	92.5	92.8	93.1	93.3	93.6
-50	84.3	85.7	87.3	88.9	90.6	90.9	91.2	91.4	91.7	91.9	92.2	92.5	92.8
-55	83.4	84.8	86.4	88.1	89.8	90.0	90.3	90.5	90.8	91.1	91.3	91.6	91.9

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.9	1.0

Takeoff %N1 - High Altitudes (26B2 Bump)

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

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)					
	10000	11000	12000	13000	14000	14500
35	101.5					
30	102.4	102.2	102.2			
25	102.5	102.5	102.4	102.4	102.2	102.2
20	102.5	102.5	102.4	102.4	102.3	102.2
15	102.5	102.5	102.4	102.4	102.3	102.3
10	102.5	102.5	102.4	102.4	102.3	102.3
5	101.7	102.4	102.4	102.4	102.3	102.3
0	100.9	101.6	102.3	102.4	102.3	102.3
-5	100.2	100.8	101.5	101.8	102.0	102.1
-10	99.4	100.0	100.7	101.0	101.2	101.3
-15	98.6	99.2	99.9	100.2	100.4	100.5
-20	97.8	98.4	99.1	99.3	99.5	99.6
-25	97.0	97.6	98.2	98.5	98.7	98.8
-30	96.2	96.8	97.4	97.7	97.9	98.0
-35	95.3	95.9	96.6	96.8	97.0	97.1
-40	94.5	95.1	95.7	96.0	96.2	96.3
-45	93.6	94.2	94.9	95.1	95.3	95.4
-50	92.8	93.4	94.0	94.2	94.4	94.5
-55	91.9	92.5	93.1	93.4	93.6	93.7

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)					
	10000	11000	12000	13000	14000	14500
PACKS OFF	1.0	1.1	1.1	1.2	1.2	1.2
ENGINE ANTI-ICE	0.0	-0.7	-1.4	-1.4	-1.4	-1.4

Takeoff Speeds - Dry Runway (22K Derate)

Flaps 1 and 5

V1, VR, V2

WEIGHT (1000 KG)	FLAPS 1			FLAPS 5		
	V1	VR	V2	V1	VR	V2
80	153	154	157	150	150	153
76	149	150	154	146	147	151
72	145	146	151	142	143	147
68	140	141	147	137	138	143
64	135	136	143	132	134	139
60	130	131	138	127	128	135
56	124	125	133	121	123	130
52	118	119	128	115	117	126
48	112	113	123	109	111	121
44	106	107	118	103	105	115
40	99	101	112	96	99	110

Check V1(MCG).

V1, VR, V2 Adjustments*

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

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
80	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
72	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
64	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
56	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
48	-1	0	0	1	1	-2	-1	0	0	0	1	1	1
40	0	0	0	1	1	-2	-1	0	0	1	1	1	1

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	98	96					
60	140	98	96	95	93			
50	122	100	98	95	93	91	89	87
40	104	105	103	99	96	92	89	87
30	86	108	108	104	100	97	92	89
20	68	108	108	106	104	101	96	93
-60	-76	110	109	107	105	103	100	98

Takeoff Speeds - Dry Runway (22K Derate)

Flaps 10, 15 and 25

V1, VR, V2

WEIGHT (1000 KG)	FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2
72	135	135	140	132	132	137			
68	131	131	137	129	129	134			
64	126	127	133	125	125	131	123	123	129
60	122	123	129	120	120	127	119	119	126
56	117	118	125	115	116	123	114	114	122
52	111	113	121	110	111	119	109	109	118
48	106	107	117	105	106	115	104	104	114
44	100	102	112	99	100	110	98	99	109
40	95	96	108	93	95	106	92	94	105

Check V1(MCG).

V1, VR, V2 Adjustments*

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

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
72	-2	-1	0	1	1	0	0	1	0	1	1	1	1
68	-2	-1	0	1	1	0	0	0	0	0	1	1	1
64	-2	-1	0	1	1	0	0	0	0	0	1	1	1
60	-2	-1	0	1	1	-1	0	0	0	0	1	1	1
56	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
52	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
48	-1	-1	0	1	1	-2	-1	-1	0	0	1	1	1
44	-1	-1	0	1	1	-2	-1	-1	0	0	1	1	1
40	-1	0	0	1	1	-2	-1	-1	0	0	1	1	1

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	98	96					
60	140	98	96	95	93			
50	122	100	98	95	93	91	89	87
40	104	105	103	99	96	92	89	87
30	86	108	108	104	100	97	92	89
20	68	108	108	106	104	101	96	93
-60	-76	110	109	107	105	103	100	98

Takeoff Speeds - Dry Runway - High Altitude (22K Derate)

V1, VR, V2

WEIGHT	FLAPS1			FLAPS5			FLAPS 10			FLAPS 15			FLAPS 25		
(1000 KG)	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
68	147	147	150	144	144	146									
64	142	142	145	138	139	141									
60	136	137	140	132	133	136									
56	130	131	135	126	128	131	121	122	125	119	119	123			
52	123	125	129	120	122	126	115	116	120	113	113	118	112	112	117
48	117	118	124	114	116	121	109	110	115	108	108	113	106	107	112
44	110	112	118	108	109	115	103	104	110	102	102	108	101	101	107
40	103	105	112	100	102	109	97	98	106	97	97	103	95	96	102

Check V1(MCG).

V1, VR, V2 Adjustments*

TEMP		V1						VR						V2					
		PRESS ALT (1000 FT)						PRESS ALT (1000 FT)						PRESS ALT (1000 FT)					
°C	°F	10	11	12	13	14	14.5	10	11	12	13	14	14.5	10	11	12	13	14	14.5
50	122	7						6						0					
40	104	5	6	7	8	9	9	5	5	6	7	7	8	0	0	0	1	1	1
30	86	4	5	6	6	7	8	3	4	5	6	6	7	0	0	0	1	1	1
20	68	2	3	4	5	6	6	2	3	3	4	5	5	0	0	1	1	1	1
10	50	0	1	2	3	4	5	0	1	2	3	4	4	0	0	1	1	1	1
0	32	0	1	2	2	3	4	0	1	2	2	3	3	0	0	1	1	1	1
-60	-76	0	1	2	2	3	4	0	1	2	2	3	3	0	0	1	1	1	1

Slope and Wind V1 Adjustments*

WEIGHT	SLOPE (%)					WIND (KTS)							
(1000 KG)	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
68	-3	-2	0	0	0	-1	-1	0	0	0	0	0	0
64	-2	-1	0	0	0	-1	-1	0	0	0	0	0	0
60	-2	-1	0	0	0	-1	-1	0	0	0	0	0	0
56	-2	-1	0	1	1	-1	-1	0	0	0	0	0	1
52	-2	-1	0	1	1	-1	-1	0	0	0	0	0	1
48	-2	-1	0	1	1	-1	-1	0	0	0	0	0	1
44	-2	-1	0	0	1	-1	-1	0	0	0	0	0	1
40	-1	-1	0	0	0	-1	-1	0	0	0	0	0	0

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)					
°C	°F	10000	11000	12000	13000	14000	14500
50	122	87					
40	104	87	86	85	84	85	85
30	86	89	87	85	84	85	85
20	68	93	91	89	87	86	85
10	50	97	95	93	91	89	88
0	32	97	95	94	93	91	91
-60	-76	98	96	95	93	92	91

Takeoff Speeds - Wet Runway (22K Derate)

Flaps 1 and 5

V1, VR, V2

WEIGHT (1000 KG)	FLAPS 1			FLAPS 5		
	V1	VR	V2	V1	VR	V2
80	148	154	157	146	150	153
76	144	150	154	140	147	151
72	139	146	151	135	143	147
68	134	141	147	130	138	143
64	128	136	143	125	134	139
60	123	131	138	119	128	135
56	116	125	133	113	123	130
52	110	119	128	107	117	126
48	103	113	123	101	111	121
44	97	107	118	94	105	115
40	90	101	112	87	99	110

Check V1(MCG).

V1, VR, V2 Adjustment*

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

Slope and Wind V1 Adjustment*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
80	-5	-2	0	3	5	-2	-1	0	0	1	2	2	2
72	-4	-2	0	3	5	-3	-2	-1	0	1	1	2	2
64	-4	-2	0	2	4	-3	-2	-1	0	1	1	2	2
56	-3	-2	0	2	3	-3	-2	-1	0	1	1	2	3
48	-2	-1	0	2	3	-4	-2	-1	0	1	2	3	3
40	-1	0	0	2	3	-4	-2	-1	0	1	3	4	4

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	98	96					
60	140	98	96	95	93			
50	122	100	98	95	93	91	89	87
40	104	105	103	99	96	92	89	87
30	86	108	108	104	100	97	92	89
20	68	108	108	106	104	101	96	93
-60	-76	110	109	107	105	103	100	98

Takeoff Speeds - Wet Runway (22K Derate)
Flaps 10, 15 and 25
V1, VR, V2

WEIGHT (1000 KG)	FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2
72	129	135	140	130	132	137			
68	125	131	137	125	129	134			
64	120	127	133	120	125	131	118	123	129
60	115	123	129	115	120	127	113	119	126
56	110	118	125	109	116	123	108	114	122
52	104	113	121	103	111	119	102	109	118
48	98	107	117	97	106	115	96	104	114
44	92	102	112	92	100	110	91	99	109
40	86	96	108	86	95	106	85	94	105

Check V1(MCG).

V1, VR, V2 Adjustment*

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

Slope and Wind V1 Adjustment*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
72	-4	-2	0	2	3	-3	-2	-1	0	0	1	2	2
68	-4	-2	0	1	3	-4	-2	-1	0	1	1	2	2
64	-4	-2	0	1	3	-4	-2	-1	0	1	1	2	2
60	-3	-2	0	1	3	-4	-2	-1	0	1	1	2	2
56	-3	-2	0	1	3	-4	-2	-1	0	1	1	2	3
52	-3	-1	0	1	3	-4	-3	-1	0	1	1	2	3
48	-3	-1	0	1	2	-4	-3	-1	0	1	2	2	3
44	-2	-1	0	1	2	-4	-3	-1	0	1	2	2	3
40	-2	-1	0	1	2	-5	-3	-1	0	1	2	3	4

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	98	96					
60	140	98	96	95	93			
50	122	100	98	95	93	91	89	87
40	104	105	103	99	96	92	89	87
30	86	108	108	104	100	97	92	89
20	68	108	108	106	104	101	96	93
-60	-76	110	109	107	105	103	100	98

Takeoff Speeds - Wet Runway High Altitude (22K Derate)

V1, VR, V2

WEIGHT (1000 KG)	FLAPS1			FLAPS5			FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
68	141	147	150	139	144	146									
64	136	142	145	132	139	141									
60	129	137	140	126	133	136									
56	123	131	135	119	128	131	115	122	125	114	119	123			
52	116	125	129	113	122	126	108	116	120	108	113	118	107	112	117
48	109	118	124	106	116	121	102	110	115	102	108	113	100	107	112
44	102	112	118	100	109	115	96	104	110	95	102	108	94	101	107
40	95	105	112	93	102	109	90	98	106	88	97	103	87	96	102

Check V1(MCG).

V1, VR, V2 Adjustments*

TEMP		V1						VR						V2					
		PRESS ALT (1000 FT)						PRESS ALT (1000 FT)						PRESS ALT (1000 FT)					
°C	°F	10	11	12	13	14	14.5	10	11	12	13	14	14.5	10	11	12	13	14	14.5
50	122	11						6						0					
40	104	8	9	11	12	13	15	5	5	6	7	7	8	0	0	0	1	1	1
30	86	5	7	8	9	10	11	3	4	5	6	6	7	0	0	0	1	1	1
20	68	3	4	5	6	7	8	2	3	3	4	5	5	0	0	1	1	1	1
10	50	0	1	3	4	5	6	0	1	2	3	4	4	0	0	1	1	1	1
0	32	0	1	2	3	4	4	0	1	2	2	3	3	0	0	1	1	1	1
-60	-76	0	1	2	3	4	4	0	1	2	2	3	3	0	0	1	1	1	1

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
68	-5	-3	0	2	5	-2	-1	-1	0	0	1	1	2
64	-5	-2	0	2	5	-2	-2	-1	0	0	1	1	2
60	-4	-2	0	2	4	-2	-2	-1	0	0	1	1	2
56	-4	-2	0	2	4	-3	-2	-1	0	0	1	1	2
52	-4	-2	0	2	4	-3	-2	-1	0	0	1	2	2
48	-4	-2	0	2	3	-3	-2	-1	0	1	1	2	2
44	-3	-2	0	1	3	-3	-2	-1	0	1	1	2	2
40	-3	-2	0	1	3	-3	-2	-1	0	1	1	2	2

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)					
°C	°F	10000	11000	12000	13000	14000	14500
50	122	87					
40	104	87	86	85	84	85	85
30	86	89	87	85	84	85	85
20	68	93	91	89	87	86	85
10	50	97	95	93	91	89	88
0	32	97	95	94	93	91	91
-60	-76	98	96	95	93	92	91

Maximum Allowable Clearway (22K Derate)

FIELD LENGTH (M)	MAX ALLOWABLE CLEARWAY FOR V1 REDUCTION (M)
1200	140
1600	190
2000	230
2400	270
2800	320
3200	360

Maximum Allowable Clearway - High Altitude (22K Derate)

FIELD LENGTH (M)	MAX ALLOWABLE CLEARWAY FOR V1 REDUCTION (M)
2000	230
2500	280
3000	330
3500	380
4000	430
4500	480

Clearway and Stopway V1 Adjustments (22K Derate)

CLEARWAY MINUS STOPWAY (M)	NORMAL V1 (KIAS)					
	DRY RUNWAY			WET RUNWAY		
	100	120	140	100	120	140
300	-4	-4	-4			
200	-4	-4	-3			
100	-3	-2	-2			
0	0	0	0	0	0	0
-100	1	1	1	2	2	1
-200	1	1	1	4	2	2
-300	1	1	1	4	3	3

Use of clearway not allowed on wet runways.
V1 not to exceed VR.

Clearway and Stopway V1 Adjustments - High Altitudes (22K Derate)

CLEARWAY MINUS STOPWAY (M)	NORMAL V1 (KIAS)					
	DRY RUNWAY			WET RUNWAY		
	100	120	140	100	120	140
300	-3	-3	-3			
200	-3	-2	-2			
100	-2	-1	-1			
0	0	0	0	0	0	0
-100	1	0	0	2	1	1
-200	1	0	0	3	2	2
-300	1	0	0	3	3	3

Use of clearway not allowed on wet runways.
V1 not to exceed VR.

Stab Trim Setting (22K Derate)

Flaps 1 and 5

WEIGHT (1000 KG)	C.G. (%MAC)									
	9	11	13	16	20	24	28	30	32	33
80	8 1/2	8 1/2	8 1/2	7 3/4	7	6 1/4	5 1/2	5	4 3/4	4 1/2
70	8 1/2	8 1/2	8 1/2	7 3/4	7	6	5 1/4	5	4 1/2	4 1/4
60	8 1/2	8 1/4	7 3/4	7 1/4	6 1/4	5 1/2	4 3/4	4 1/2	4	4
50	7 3/4	7 1/2	7	6 1/4	5 3/4	5	4 1/4	4	4	4
45	7	6 3/4	6 1/2	6	5 1/4	4 1/2	4	4	4	4

Flaps 10, 15 and 25

WEIGHT (1000 KG)	C.G. (%MAC)									
	9	11	13	16	20	24	28	30	32	33
80	8 1/2	8 1/2	8 1/2	7 1/2	6 3/4	5 3/4	5	4 1/2	4	4
70	8 1/2	8 1/2	8 1/4	7 1/2	6 1/2	5 3/4	4 3/4	4 1/2	4	4
60	8 1/2	8 1/4	7 3/4	6 3/4	6	5	4 1/4	4	4	4
50	7 1/2	7 1/4	6 3/4	6	5 1/4	4 1/4	4	4	4	4
45	6 3/4	6 1/4	6	5 1/2	4 3/4	4	4	4	4	4

ADVISORY INFORMATION

Slush/Standing Water Takeoff (22K Derate)

Maximum Reverse Thrust

Weight Adjustments (1000 KG)

22K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-13.2	-16.4	-19.6	-16.3	-19.4	-22.6	-24.2	-27.3	-30.5
85	-11.5	-14.7	-17.9	-14.1	-17.2	-20.4	-20.4	-23.6	-26.8
80	-10.0	-13.1	-16.3	-12.0	-15.2	-18.4	-17.0	-20.2	-23.3
75	-8.6	-11.8	-14.9	-10.2	-13.4	-16.5	-14.0	-17.2	-20.3
70	-7.4	-10.5	-13.7	-8.6	-11.8	-15.0	-11.4	-14.6	-17.8
65	-6.3	-9.5	-12.7	-7.3	-10.5	-13.6	-9.3	-12.5	-15.7
60	-5.4	-8.6	-11.8	-6.2	-9.4	-12.5	-7.7	-10.9	-14.0
55	-4.8	-7.9	-11.1	-5.3	-8.5	-11.7	-6.5	-9.7	-12.8
50	-4.2	-7.4	-10.5	-4.6	-7.8	-11.0	-5.6	-8.8	-12.0
45	-3.7	-6.8	-10.0	-4.0	-7.2	-10.3	-4.8	-8.0	-11.2
40	-3.1	-6.3	-9.5	-3.3	-6.5	-9.7	-4.0	-7.2	-10.4

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1400	31.1			34.0			38.5		
1600	44.9			47.7			52.0	33.6	
1800	59.3	39.8		61.9	42.5		65.9	47.0	
2000	74.3	53.9	34.7	76.8	56.6	37.5	80.1	60.7	42.0
2200	90.1	68.7	48.6	92.3	71.2	51.3	94.7	74.8	55.6
2400		84.1	63.1		86.5	65.7		89.3	69.5
2600			78.3			80.7			83.8
2800			94.2			96.4			98.4

1. **Enter Weight Adjustment table with slush/standing water depth and 22K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -40 m/+35 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (22K Derate)
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
85	-11	-9	-6	-3	-1	0	0	0	0
80	-13	-10	-8	-6	-3	-1	0	0	0
75	-14	-12	-9	-8	-6	-3	0	0	0
70	-15	-13	-10	-11	-8	-6	0	0	0
65	-17	-14	-12	-13	-10	-8	-4	-1	0
60	-18	-15	-13	-15	-12	-10	-7	-4	-2
55	-19	-17	-14	-16	-14	-11	-10	-8	-5
50	-20	-18	-15	-18	-15	-13	-13	-10	-8
45	-21	-19	-16	-20	-17	-15	-15	-13	-10
40	-22	-20	-17	-21	-18	-16	-18	-15	-13

1. **Obtain V1, VR and V2 for the actual weight using the 22K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (22K Derate)

No Reverse Thrust

Weight Adjustments (1000 KG)

22K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-15.6	-18.3	-21.0	-18.6	-21.3	-24.0	-24.9	-27.6	-30.4
85	-13.7	-16.4	-19.1	-16.2	-18.9	-21.6	-21.4	-24.2	-26.9
80	-11.9	-14.7	-17.4	-14.0	-16.7	-19.4	-18.2	-20.9	-23.7
75	-10.4	-13.1	-15.8	-12.0	-14.7	-17.4	-15.4	-18.1	-20.8
70	-9.0	-11.7	-14.4	-10.3	-13.0	-15.7	-13.0	-15.7	-18.4
65	-7.8	-10.5	-13.2	-8.8	-11.5	-14.2	-10.9	-13.6	-16.4
60	-6.8	-9.5	-12.2	-7.5	-10.3	-13.0	-9.2	-12.0	-14.7
55	-6.0	-8.7	-11.4	-6.5	-9.3	-12.0	-8.0	-10.7	-13.4
50	-5.3	-8.0	-10.7	-5.7	-8.5	-11.2	-7.0	-9.7	-12.4
45	-4.6	-7.4	-10.1	-5.0	-7.7	-10.4	-6.1	-8.8	-11.5
40	-4.0	-6.7	-9.4	-4.2	-6.9	-9.6	-5.1	-7.8	-10.6

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1600							33.7		
1800	30.3			37.5			47.9		
2000	46.5			53.2			62.8	39.3	
2200	63.2	36.7		69.4	43.7		78.4	53.8	30.9
2400	80.7	53.1		86.3	59.6	34.4	94.9	68.9	45.0
2600	98.7	70.1	43.2		76.1	50.0		85.0	59.7
2800		87.9	59.8		93.2	66.1			75.2
3000			77.1			82.9			91.6
3200			95.1						

1. **Enter Weight Adjustment table with slush/standing water depth and 22K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -55 m/+55 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (22K Derate)

No Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-15	-7	0	-2	0	0	0	0	0
85	-16	-9	-1	-5	0	0	0	0	0
80	-18	-10	-3	-9	-1	0	0	0	0
75	-20	-12	-5	-12	-4	0	0	0	0
70	-21	-13	-6	-15	-7	0	0	0	0
65	-22	-15	-7	-17	-10	-2	-5	0	0
60	-24	-16	-9	-20	-12	-5	-10	-2	0
55	-25	-17	-10	-22	-14	-7	-14	-6	0
50	-26	-19	-11	-24	-16	-9	-17	-10	-2
45	-27	-20	-12	-25	-18	-10	-20	-13	-5
40	-28	-21	-13	-26	-19	-11	-23	-15	-8

1. **Obtain V1, VR and V2 for the actual weight using the 22K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff - High Altitudes (22K Derate)

Maximum Reverse Thrust

Weight Adjustments (1000 KG)

22K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	10000	12000	14000	10000	12000	14000	10000	12000	14000
90	-19.6	-20.8	-22.1	-22.6	-23.9	-25.1	-30.5	-31.8	-33.0
85	-17.9	-19.2	-20.4	-20.4	-21.7	-22.9	-26.8	-28.0	-29.3
80	-16.3	-17.6	-18.9	-18.4	-19.6	-20.9	-23.3	-24.6	-25.9
75	-14.9	-16.2	-17.5	-16.5	-17.8	-19.1	-20.3	-21.6	-22.9
70	-13.7	-15.0	-16.3	-15.0	-16.2	-17.5	-17.8	-19.1	-20.3
65	-12.7	-13.9	-15.2	-13.6	-14.9	-16.2	-15.7	-17.0	-18.2
60	-11.8	-13.1	-14.3	-12.5	-13.8	-15.1	-14.0	-15.3	-16.6
55	-11.1	-12.4	-13.6	-11.7	-12.9	-14.2	-12.8	-14.1	-15.4
50	-10.5	-11.8	-13.1	-11.0	-12.3	-13.5	-12.0	-13.3	-14.5
45	-10.0	-11.3	-12.5	-10.3	-11.6	-12.9	-11.2	-12.5	-13.7
40	-9.5	-10.7	-12.0	-9.7	-10.9	-12.2	-10.4	-11.6	-12.9

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	10000	12000	14000	10000	12000	14000	10000	12000	14000
2000	34.6			37.4	30.0		41.9	34.6	
2200	48.6	40.8	33.3	51.3	43.6	36.1	55.5	48.0	40.6
2400	63.1	55.0	47.2	65.7	57.7	49.9	69.5	61.8	54.2
2600	78.3	69.8	61.6	80.7	72.4	64.2	83.8	75.9	68.1
2800	94.1	85.4	76.7	96.3	87.7	79.2	98.4	90.4	82.4
3000			92.6			94.8			97.0

1. **Enter Weight Adjustment table with slush/standing water depth and 22K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -40 m/+40 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	10000	12000	14000	10000	12000	14000	10000	12000	14000
85	-6	-5	-4	0	0	0	0	0	0
80	-8	-7	-6	-1	0	0	0	0	0
75	-9	-8	-7	-3	-2	-1	0	0	0
70	-10	-9	-8	-6	-5	-4	0	0	0
65	-12	-11	-10	-8	-7	-6	0	0	0
60	-13	-12	-11	-10	-9	-8	-2	-1	0
55	-14	-13	-12	-11	-10	-9	-5	-4	-3
50	-15	-14	-13	-13	-12	-11	-8	-7	-6
45	-16	-15	-14	-15	-14	-13	-10	-9	-8
40	-17	-16	-15	-16	-15	-14	-13	-12	-11

1. **Obtain V1, VR and V2 for the actual weight using the 22K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff - High Altitudes (22K Derate)

No Reverse Thrust

Weight Adjustments (1000 KG)

22K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	10000	12000	14000	10000	12000	14000	10000	12000	14000
90	-21.5	-22.7	-23.9	-24.5	-25.6	-26.8	-30.8	-32.0	-33.2
85	-19.6	-20.8	-22.0	-22.1	-23.3	-24.4	-27.3	-28.5	-29.7
80	-17.8	-19.0	-20.2	-19.9	-21.0	-22.2	-24.1	-25.3	-26.5
75	-16.3	-17.4	-18.6	-17.9	-19.1	-20.2	-21.3	-22.5	-23.7
70	-14.9	-16.1	-17.2	-16.1	-17.3	-18.5	-18.9	-20.0	-21.2
65	-13.7	-14.9	-16.0	-14.7	-15.8	-17.0	-16.8	-18.0	-19.2
60	-12.7	-13.8	-15.0	-13.4	-14.6	-15.8	-15.1	-16.3	-17.5
55	-11.8	-13.0	-14.2	-12.4	-13.6	-14.8	-13.9	-15.0	-16.2
50	-11.2	-12.4	-13.5	-11.6	-12.8	-14.0	-12.9	-14.1	-15.3
45	-10.5	-11.7	-12.9	-10.9	-12.0	-13.2	-12.0	-13.1	-14.3
40	-9.9	-11.1	-12.2	-10.1	-11.3	-12.5	-11.0	-12.2	-13.4

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	10000	12000	14000	10000	12000	14000	10000	12000	14000
2200							33.0		
2400				36.7			47.2	38.5	
2600	45.6	35.7		52.4	42.8	33.3	62.0	52.9	44.0
2800	62.4	52.1	42.0	68.6	58.6	48.9	77.6	68.0	58.7
3000	79.8	69.1	58.6	85.5	75.1	65.0	94.1	84.0	74.1
3200	97.8	86.8	75.9		92.2	81.7			90.4
3400			93.8			98.9			

1. **Enter Weight Adjustment table with slush/standing water depth and 22K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -45 m/+45 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	10000	12000	14000	10000	12000	14000	10000	12000	14000
85	-6	-4	-2	0	0	0	0	0	0
80	-8	-6	-4	0	0	0	0	0	0
75	-10	-8	-6	-2	0	0	0	0	0
70	-11	-9	-7	-5	-3	-1	0	0	0
65	-12	-10	-8	-7	-5	-3	0	0	0
60	-14	-12	-10	-10	-8	-6	0	0	0
55	-15	-13	-11	-12	-10	-8	-4	-2	0
50	-16	-14	-12	-14	-12	-10	-7	-5	-3
45	-17	-15	-13	-15	-13	-11	-10	-8	-6
40	-18	-16	-14	-16	-14	-12	-13	-11	-9

1. **Obtain V1, VR and V2 for the actual weight using the 22K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG).V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (22K Derate)

Maximum Reverse Thrust

Weight Adjustment (1000 KG)

22K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-1.6	-1.6	-1.6	-6.9	-6.9	-6.9	-11.8	-11.8	-11.8
85	-1.5	-1.5	-1.5	-6.4	-6.4	-6.4	-10.8	-10.8	-10.8
80	-1.3	-1.3	-1.3	-5.9	-5.9	-5.9	-9.8	-9.8	-9.8
75	-1.2	-1.2	-1.2	-5.4	-5.4	-5.4	-9.0	-9.0	-9.0
70	-1.1	-1.1	-1.1	-5.0	-5.0	-5.0	-8.2	-8.2	-8.2
65	-1.1	-1.1	-1.1	-4.7	-4.7	-4.7	-7.6	-7.6	-7.6
60	-1.1	-1.1	-1.1	-4.4	-4.4	-4.4	-7.0	-7.0	-7.0
55	-1.1	-1.1	-1.1	-4.1	-4.1	-4.1	-6.5	-6.5	-6.5
50	-1.2	-1.2	-1.2	-3.9	-3.9	-3.9	-6.1	-6.1	-6.1
45	-1.3	-1.3	-1.3	-3.7	-3.7	-3.7	-5.8	-5.8	-5.8
40	-1.4	-1.4	-1.4	-3.6	-3.6	-3.6	-5.6	-5.6	-5.6

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1200	50.3	32.0							
1400	72.5	53.9	35.5	35.2					
1600	95.0	76.1	57.4	51.3	31.7				
1800		98.7	79.7	68.4	47.6		34.3		
2000				86.9	64.5	44.1	45.1		
2200					82.7	60.7	56.5	36.9	
2400						78.6	68.6	47.8	
2600						97.8	81.6	59.4	39.6
2800							95.6	71.7	50.6
3000								85.0	62.4
3200								99.1	74.9
3400									88.4

1. **Enter Weight Adjustment table with reported braking action and 22K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -25 m/+25 m for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -25 m/+25 m for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -40 m/+35 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (22K Derate)
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
85	-4	-2	0	-12	-9	-7	-21	-19	-16
80	-5	-2	0	-13	-10	-8	-23	-20	-18
75	-6	-3	-1	-14	-12	-9	-25	-22	-20
70	-6	-4	-1	-15	-13	-10	-27	-24	-22
65	-7	-5	-2	-17	-14	-12	-28	-26	-23
60	-8	-6	-3	-18	-16	-13	-30	-28	-25
55	-9	-7	-4	-20	-17	-15	-32	-30	-27
50	-10	-8	-5	-21	-19	-16	-34	-31	-29
45	-12	-9	-7	-23	-20	-18	-36	-33	-31
40	-13	-10	-8	-25	-22	-20	-38	-35	-33

1. **Obtain V1, VR and V2 for the actual weight using the 22K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (22K Derate)

No Reverse Thrust

Weight Adjustments (1000 KG)

22K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-2.6	-2.9	-3.3	-9.5	-9.8	-10.2	-15.7	-16.0	-16.4
85	-2.6	-2.9	-3.3	-8.9	-9.3	-9.7	-14.5	-14.9	-15.2
80	-2.6	-2.9	-3.3	-8.4	-8.8	-9.2	-13.4	-13.7	-14.1
75	-2.6	-2.9	-3.3	-8.0	-8.4	-8.7	-12.3	-12.7	-13.0
70	-2.6	-3.0	-3.3	-7.6	-7.9	-8.3	-11.3	-11.7	-12.0
65	-2.6	-3.0	-3.3	-7.2	-7.5	-7.9	-10.3	-10.7	-11.1
60	-2.6	-3.0	-3.3	-6.8	-7.2	-7.5	-9.4	-9.8	-10.2
55	-2.6	-3.0	-3.3	-6.5	-6.8	-7.2	-8.6	-9.0	-9.3
50	-2.6	-3.0	-3.3	-6.2	-6.5	-6.9	-7.8	-8.2	-8.5
45	-2.6	-3.0	-3.3	-5.9	-6.3	-6.6	-7.1	-7.4	-7.8
40	-2.6	-3.0	-3.3	-5.6	-6.0	-6.4	-6.4	-6.7	-7.1

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT(FT)			PRESS ALT(FT)			PRESS ALT(FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1400	52.8								
1600	80.5								
1800		51.2							
2000		79.3		39.8					
2200			49.6	68.4					
2400			78.0	94.0	56.0				
2600					82.8	42.9			
2800						71.1			
3000						96.5			
3200							46.7		
3400							68.1	43.5	
3600							89.5	64.9	40.3
3800								86.3	61.7
4000									83.0

1. **Enter Weight Adjustment table with reported braking action and 22K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust “Good” field length available by -35 m/+35 m for every 5°C above/below 4°C.**
   Adjust “Medium” field length available by -35 m/+35 m for every 5°C above/below 4°C.
   Adjust “Poor” field length available by -55 m/+55 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (22K Derate)
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-8	-3	0	-18	-13	-8	-31	-26	-21
85	-8	-3	0	-19	-14	-9	-34	-29	-24
80	-8	-3	0	-19	-14	-9	-37	-32	-27
75	-8	-3	0	-21	-16	-11	-40	-35	-30
70	-9	-4	0	-23	-18	-13	-43	-38	-33
65	-11	-6	-1	-25	-20	-15	-47	-42	-37
60	-12	-7	-2	-28	-23	-18	-50	-45	-40
55	-14	-9	-4	-31	-26	-21	-54	-49	-44
50	-17	-12	-7	-35	-30	-25	-58	-53	-48
45	-20	-15	-10	-39	-34	-29	-62	-57	-52
40	-24	-19	-14	-44	-39	-34	-66	-61	-56

1. **Obtain V1, VR and V2 for the actual weight using the 22K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff - High Altitudes (22K Derate)

Maximum Reverse Thrust

Weight Adjustment (1000 KG)

22K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	10000	12000	14000	10000	12000	14000	10000	12000	14000
90	-1.6	-1.6	-1.6	-6.9	-6.9	-6.9	-11.8	-11.8	-11.8
85	-1.5	-1.5	-1.5	-6.4	-6.4	-6.4	-10.8	-10.8	-10.8
80	-1.3	-1.3	-1.3	-5.9	-5.9	-5.9	-9.8	-9.8	-9.8
75	-1.2	-1.2	-1.2	-5.4	-5.4	-5.4	-9.0	-9.0	-9.0
70	-1.1	-1.1	-1.1	-5.0	-5.0	-5.0	-8.2	-8.2	-8.2
65	-1.1	-1.1	-1.1	-4.7	-4.7	-4.7	-7.6	-7.6	-7.6
60	-1.1	-1.1	-1.1	-4.4	-4.4	-4.4	-7.0	-7.0	-7.0
55	-1.1	-1.1	-1.1	-4.1	-4.1	-4.1	-6.5	-6.5	-6.5
50	-1.2	-1.2	-1.2	-3.9	-3.9	-3.9	-6.1	-6.1	-6.1
45	-1.3	-1.3	-1.3	-3.7	-3.7	-3.7	-5.8	-5.8	-5.8
40	-1.4	-1.4	-1.4	-3.6	-3.6	-3.6	-5.6	-5.6	-5.6

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	10000	12000	14000	10000	12000	14000	10000	12000	14000
1600	48.6	40.4	32.2						
1800	72.7	64.6	56.6						
2000	96.5	88.5	80.6						
2200				36.2					
2400				56.6	46.6	36.7			
2600				78.0	67.5	57.1			
2800					89.3	78.5			
3200							31.4		
3400							45.3	35.5	
3600							60.0	49.6	39.7
3800							75.6	64.5	54.0
4000							92.3	80.4	69.2
4200								97.4	85.4

1. **Enter Weight Adjustment table with reported braking action and 22K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -25 m/+25 m for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -25 m/+25 m for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -40 m/+40 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff - High Altitudes (22K Derate)

Maximum Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	10000	12000	14000	10000	12000	14000	10000	12000	14000
85	0	0	0	-7	-6	-5	-16	-15	-14
80	0	0	0	-8	-7	-6	-18	-17	-16
75	-1	0	0	-9	-8	-7	-20	-19	-18
70	-1	0	0	-10	-9	-8	-22	-21	-20
65	-2	-1	0	-12	-11	-10	-23	-22	-21
60	-3	-2	-1	-13	-12	-11	-25	-24	-23
55	-4	-3	-2	-15	-14	-13	-27	-26	-25
50	-5	-4	-3	-16	-15	-14	-29	-28	-27
45	-7	-6	-5	-18	-17	-16	-31	-30	-29
40	-8	-7	-6	-20	-19	-18	-33	-32	-31

1. **Obtain V1, VR and V2 for the actual weight using the 22K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff - High Altitudes (22K Derate)

No Reverse Thrust

Weight Adjustment (1000 KG)

22K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	10000	12000	14000	10000	12000	14000	10000	12000	14000
85	-2.2	-2.2	-2.2	-8.2	-8.2	-8.2	-13.5	-13.5	-13.5
80	-2.1	-2.1	-2.1	-7.6	-7.6	-7.6	-12.3	-12.3	-12.3
75	-2.0	-2.0	-2.0	-7.0	-7.0	-7.0	-11.2	-11.2	-11.2
70	-1.9	-1.9	-1.9	-6.5	-6.5	-6.5	-10.2	-10.2	-10.2
65	-1.9	-1.9	-1.9	-6.1	-6.1	-6.1	-9.3	-9.3	-9.3
60	-1.8	-1.8	-1.8	-5.7	-5.7	-5.7	-8.6	-8.6	-8.6
55	-1.8	-1.8	-1.8	-5.3	-5.3	-5.3	-8.0	-8.0	-8.0
50	-1.8	-1.8	-1.8	-5.1	-5.1	-5.1	-7.5	-7.5	-7.5
45	-1.8	-1.8	-1.8	-4.9	-4.9	-4.9	-7.1	-7.1	-7.1
40	-1.9	-1.9	-1.9	-4.7	-4.7	-4.7	-6.9	-6.9	-6.9

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	10000	12000	14000	10000	12000	14000	10000	12000	14000
1600	48.6	40.4	32.2						
1800	72.7	64.6	56.6						
2000	96.5	88.5	80.6						
2200				36.2					
2400				56.6	46.6	36.7			
2600				78.0	67.5	57.1			
2800					89.3	78.5			
3400							41.0	30.5	
3600							55.4	44.4	33.8
3800							70.7	59.0	47.8
4000							87.0	74.5	62.6
4200								91.1	78.3
4400									95.2

1. **Enter Weight Adjustment table with reported braking action and 22K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -30 m/+30 m for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -30 m/+30 m for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -50 m/+50 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff - High Altitudes (22K Derate)
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	10000	12000	14000	10000	12000	14000	10000	12000	14000
85	0	0	0	-10	-9	-8	-24	-23	-22
80	-1	0	0	-11	-10	-9	-27	-26	-25
75	-2	-1	0	-13	-12	-11	-29	-28	-27
70	-3	-2	-1	-15	-14	-13	-32	-31	-30
65	-4	-3	-2	-17	-16	-15	-34	-33	-32
60	-5	-4	-3	-18	-17	-16	-36	-35	-34
55	-6	-5	-4	-20	-19	-18	-38	-37	-36
50	-8	-7	-6	-22	-21	-20	-41	-40	-39
45	-9	-8	-7	-24	-23	-22	-43	-42	-41
40	-11	-10	-9	-26	-25	-24	-45	-44	-43

1. **Obtain V1, VR and V2 for the actual weight using the 22K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Takeoff %N1 (22K Derate)

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

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
60	87.7	88.3	88.7	88.8	88.9	89.1	89.2	89.2	89.1	88.6	88.3	88.7	89.2
55	88.5	89.1	89.5	89.7	89.8	89.9	90.0	90.0	90.0	89.5	89.0	88.8	88.6
50	89.3	89.8	90.4	90.5	90.6	90.7	90.9	90.8	90.8	90.4	89.9	89.7	89.6
45	90.2	90.7	91.2	91.3	91.4	91.5	91.7	91.6	91.6	91.2	90.8	90.7	90.5
40	91.1	91.6	92.1	92.2	92.3	92.4	92.5	92.4	92.4	92.1	91.7	91.6	91.5
35	91.9	92.5	93.0	93.1	93.2	93.2	93.3	93.3	93.2	92.9	92.5	92.5	92.4
30	91.5	92.6	93.8	93.9	94.0	94.0	94.1	94.0	93.9	93.7	93.4	93.3	93.2
25	90.8	91.9	93.1	93.7	94.4	94.8	94.9	94.8	94.8	94.4	94.0	94.0	94.0
20	90.0	91.1	92.3	93.0	93.6	94.3	95.0	95.6	95.6	95.3	94.9	94.8	94.7
15	89.3	90.4	91.6	92.2	92.8	93.6	94.3	94.8	95.3	95.9	96.1	95.9	95.5
10	88.5	89.6	90.8	91.4	92.1	92.8	93.5	94.0	94.5	95.1	95.7	96.4	97.1
5	87.8	88.9	90.0	90.7	91.3	92.0	92.7	93.2	93.7	94.3	94.9	95.6	96.3
0	87.0	88.1	89.2	89.9	90.5	91.2	91.9	92.4	92.9	93.5	94.1	94.8	95.5
-5	86.2	87.3	88.4	89.1	89.7	90.4	91.1	91.6	92.1	92.7	93.3	94.0	94.7
-10	85.4	86.5	87.6	88.3	88.9	89.6	90.3	90.8	91.3	91.9	92.5	93.2	93.9
-15	84.6	85.7	86.8	87.5	88.1	88.8	89.4	90.0	90.5	91.1	91.7	92.4	93.1
-20	83.8	84.9	86.0	86.6	87.3	87.9	88.6	89.1	89.7	90.3	90.8	91.6	92.3
-25	83.0	84.1	85.2	85.8	86.4	87.1	87.8	88.3	88.8	89.4	90.0	90.7	91.5
-30	82.2	83.3	84.4	85.0	85.6	86.3	86.9	87.4	88.0	88.6	89.2	89.9	90.6
-35	81.4	82.4	83.5	84.1	84.7	85.4	86.1	86.6	87.1	87.7	88.3	89.0	89.8
-40	80.6	81.6	82.7	83.3	83.9	84.5	85.2	85.7	86.2	86.8	87.4	88.2	88.9
-45	79.7	80.7	81.8	82.4	83.0	83.7	84.3	84.8	85.3	86.0	86.6	87.3	88.0
-50	78.9	79.9	80.9	81.5	82.1	82.8	83.4	83.9	84.5	85.1	85.7	86.4	87.2

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.9	0.9	0.9

Takeoff %N1 - High Altitudes (22K Derate)

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

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)					
	10000	11000	12000	13000	14000	14500
40	91.5					
35	92.4	92.4	92.3			
30	93.2	93.2	93.2	93.2	93.2	93.3
25	94.0	94.0	93.9	93.9	93.9	93.9
20	94.7	94.7	94.6	94.5	94.5	94.5
15	95.5	95.5	95.4	95.3	95.3	95.2
10	97.1	96.8	96.5	96.4	96.4	96.4
5	96.3	96.8	97.3	97.8	97.7	97.7
0	95.5	96.0	96.6	97.4	98.2	98.5
-5	94.7	95.3	95.8	96.6	97.4	97.8
-10	93.9	94.4	95.0	95.8	96.6	97.0
-15	93.1	93.6	94.2	95.0	95.9	96.2
-20	92.3	92.8	93.3	94.2	95.1	95.4
-25	91.5	92.0	92.5	93.4	94.3	94.6
-30	90.6	91.1	91.7	92.6	93.5	93.8
-35	89.8	90.3	90.8	91.8	92.7	93.0
-40	88.9	89.4	90.0	91.0	91.8	92.2
-45	88.0	88.6	89.1	90.1	91.0	91.4
-50	87.2	87.7	88.3	89.2	90.2	90.5

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)					
	10000	11000	12000	13000	14000	14500
PACKS OFF	0.9	0.9	1.0	1.0	1.0	1.0
ENGINE ANTI-ICE	0.0	-0.7	-1.4	-1.4	-1.4	-1.4

Assumed Temperature Reduced Thrust (22K Derate)

Maximum Assumed Temperature (Table 1 of 3)

Based on 25% Takeoff Thrust Reduction

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
55	73	71	69	67								
50	73	71	69	67	65	63						
45	73	71	69	67	65	63	61	59	57			
40	72	71	69	67	65	63	61	59	57	55		
35	66	66	66	66	65	63	61	59	57	55	53	
30	63	61	61	61	61	61	61	59	57	55	53	51
25	63	61	59	57	56	56	56	56	56	55	53	51
20	63	61	59	57	55	53	51	51	51	50	50	50
15	63	61	59	57	55	53	51	50	47	45	45	45
10 & BELOW	63	61	59	57	55	53	51	50	47	45	43	41

Takeoff %N1 (Table 2 of 3)

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

ASSUMED TEMP (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
75	85.7	86.0	86.7	87.4	88.2	88.9	89.5	90.1	90.2	90.2	90.6	91.1
70	86.6	87.0	87.1	87.1	87.5	88.3	88.9	89.4	89.5	89.6	90.0	90.4
65	87.4	87.8	88.0	88.0	88.2	88.3	88.3	88.8	88.9	88.9	89.4	89.8
60	88.3	88.7	88.8	88.9	89.1	89.2	89.2	89.1	88.6	88.3	88.7	89.2
55	89.1	89.5	89.7	89.8	89.9	90.0	90.0	90.0	89.5	89.0	88.8	88.6
50	89.8	90.4	90.5	90.6	90.7	90.9	90.8	90.8	90.4	89.9	89.7	89.6
45	90.7	91.2	91.3	91.4	91.5	91.7	91.6	91.6	91.2	90.8	90.7	90.5
40	91.6	92.1	92.2	92.3	92.4	92.5	92.4	92.4	92.1	91.7	91.6	91.5
35	92.5	93.0	93.1	93.2	93.2	93.3	93.3	93.2	92.9	92.5	92.5	92.4
30	92.6	93.8	93.9	94.0	94.0	94.1	94.0	93.9	93.7	93.4	93.3	93.2
25	91.9	93.1	93.7	94.4	94.8	94.9	94.8	94.8	94.4	94.0	94.0	94.0
20	91.1	92.3	93.0	93.6	94.3	95.0	95.6	95.6	95.3	94.9	94.8	94.7
15	90.4	91.6	92.2	92.8	93.6	94.3	94.8	95.3	95.9	96.1	95.9	95.5
10	89.6	90.8	91.4	92.1	92.8	93.5	94.0	94.5	95.1	95.7	96.4	97.1
MINIMUM ASSUMED TEMP (°C)	32	30	28	26	24	22	20	18	16	15	12	10

With engine bleed for packs off, increase %N1 by 0.9.

Assumed Temperature Reduced Thrust (22K Derate)

%N1 Adjustment for Temperature Difference (Table 3 of 3)

ASSUMED TEMP MINUS OAT (°C)	OUTSIDE AIR TEMPERATURE (°C)													
	-40	-20	0	5	10	15	20	25	30	35	40	45	50	55
110	11.6													
100	10.3	7.9												
90	10.8	8.4												
80	12.2	7.1	5.0											
70	11.0	7.6	5.4	5.2	3.5									
60	9.6	9.0	4.1	4.0	3.9	3.8	2.1							
50	8.0	7.7	4.5	2.8	2.6	2.7	2.6	2.4	0.8					
40		6.2	5.9	4.7	3.0	2.6	2.7	2.8	2.6	2.5	2.9			
30		4.7	4.6	4.5	4.4	4.2	4.1	4.0	4.0	3.9	3.8	3.7	3.6	
20			3.1	3.0	3.0	3.0	2.9	2.8	2.7	2.7	2.6	2.6	2.5	2.4
10			1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.3	1.3	1.3
0			0	0	0	0	0	0	0	0	0	0	0	0

1. **Determine Maximum Assumed Temperature allowed from Table 1.**
2. **Find Maximum %N1 from Table 2 using the desired assumed temperature (no greater than temperature from Table 1).**
3. **Use the difference between assumed temperature and OAT to determine the %N1 adjustment from Table 3.**
4. **Subtract %N1 adjustment from Maximum %N1 in Table 2.**

Assumed Temperature Reduced Thrust - High Altitudes (22K Derate)

Maximum Assumed Temperature (Table 1 of 3)

Based on 25% Takeoff Thrust Reduction

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)					
	10000	11000	12000	13000	14000	14500
40	56					
35	56	54	52			
30	56	54	52	50	48	47
25	54	54	52	50	48	47
20	50	50	51	50	48	47
15	45	46	46	47	48	47
10	41	42	42	43	44	45
5	41	40	39	39	40	41
0 & BELOW	41	40	39	38	38	38

Maximum Takeoff %N1 (Table 2 of 3)

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

ASSUMED TEMP (°C)	AIRPORT PRESSURE ALTITUDE (FT)					
	10000	11000	12000	13000	14000	14500
60	89.2					
55	88.6	89.2	89.9	90.9		
50	89.6	89.6	89.7	90.3	91.3	91.8
45	90.5	90.5	90.6	90.9	91.2	91.4
40	91.5	91.5	91.5	91.7	91.9	92.1
35	92.4	92.4	92.3	92.4	92.6	92.7
30	93.2	93.2	93.2	93.2	93.2	93.3
25	94.0	94.0	93.9	93.9	93.9	93.9
20	94.7	94.7	94.6	94.5	94.5	94.5
15	95.5	95.5	95.4	95.3	95.3	95.2
10	97.1	96.8	96.5	96.4	96.4	96.4
5		96.8	97.3	97.8	97.7	97.7
0				97.4	98.2	98.5
MINIMUM ASSUMED TEMP (°C)	10	8	6	4	2	1

%N1 Adjustment for Engine Bleed

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)					
	10000	11000	12000	13000	14000	14500
PACKS OFF	0.9	0.9	1.0	1.0	1.0	1.0
ENGINE ANTI-ICE	0.0	-0.7	-1.4	-1.4	-1.4	-1.4

Assumed Temperature Reduced Thrust - High Altitudes (22K Derate)
%N1 Adjustment for Temperature Difference (Table 3 of 3)

ASSUMED TEMP MINUS OAT (°C)	OUTSIDE AIR TEMPERATURE (°C)										
	-60	-40	-20	0	5	10	15	20	25	30	35
110	15.6										
100	15.6										
90	14.6	12.2									
80	13.4	12.2									
70	11.7	11.1	9.0								
60		9.8	9.0								
50		8.2	7.8	5.9							
40			6.4	5.9	4.5	4.4	4.3	4.3			
30			4.8	4.6	4.5	4.4	4.3	4.3	2.8	2.8	2.8
20				3.1	3.1	3.0	3.0	2.9	2.8	2.8	2.8
10				1.6	1.6	1.5	1.5	1.5	1.5	1.4	1.4
0					0	0	0	0	0	0	0

1. **Determine Maximum Assumed Temperature allowed from Table 1.**
2. **Find Maximum %N1 from Table 2 using the desired assumed temperature (no greater than temperature from Table 1).**
3. **Use the difference between assumed temperature and OAT to determine the %N1 adjustment from Table 3.**
4. **Subtract %N1 adjustment from Maximum %N1 in Table 2.**

Takeoff Speeds - Dry Runway (20K Derate)

Flaps 1 and 5

V1, VR, V2

WEIGHT (1000 KG)	FLAPS 1			FLAPS 5		
	V1	VR	V2	V1	VR	V2
72	147	147	150	144	144	147
68	143	143	147	140	140	143
64	138	138	142	135	135	139
60	132	133	138	129	130	135
56	127	127	133	124	125	130
52	121	121	128	118	119	125
48	114	115	123	112	113	120
44	108	109	118	105	107	115
40	101	102	112	99	100	110

Check V1(MCG).

V1, VR, V2 Adjustments*

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

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
72	-2	-1	0	0	0	-1	0	0	0	0	0	0	0
68	-2	-1	0	0	0	-1	0	0	0	0	0	0	0
64	-2	-1	0	0	0	-1	-1	0	0	0	0	0	0
60	-2	-1	0	0	0	-1	-1	0	0	0	0	0	0
56	-2	-1	0	0	0	-1	-1	0	0	0	0	0	0
52	-2	-1	0	1	1	-1	-1	0	0	0	0	0	1
48	-1	0	0	1	1	-1	-1	0	0	0	1	1	1
44	-1	0	0	1	1	-1	-1	0	0	0	1	1	1
40	0	0	0	1	1	-1	-1	0	0	0	1	1	1

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	93	91					
60	140	93	91	92	93			
50	122	95	93	92	93	91	88	84
40	104	100	98	97	96	92	88	84
30	86	103	103	102	101	97	92	86
20	68	103	103	102	101	99	96	90
-60	-76	105	104	104	102	100	97	95

Takeoff Speeds - Dry Runway (20K Derate)
Flaps 10, 15 and 25
V1, VR, V2

WEIGHT (1000 KG)	FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2
64	128	128	133						
60	124	124	129	121	122	126	120	120	125
56	119	119	125	117	117	122	115	115	121
52	113	114	121	112	112	118	110	111	117
48	108	109	116	107	107	114	105	106	113
44	102	103	112	101	102	110	100	100	109
40	96	98	107	95	96	105	94	95	104

Check V1(MCG).

V1, VR, V2 Adjustments*

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

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
64	-2	-1	0	0	0	-1	-1	0	0	0	0	0	0
60	-2	-1	0	0	0	-1	-1	0	0	0	0	0	0
56	-2	-1	0	0	0	-1	-1	0	0	0	0	0	0
52	-1	-1	0	0	0	-1	-1	0	0	0	0	0	0
48	-1	-1	0	0	0	-1	-1	0	0	0	0	0	0
44	-1	0	0	1	1	-2	-1	0	0	0	1	1	1
40	-1	0	0	1	1	-2	-1	0	0	0	1	1	1

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	93	91					
60	140	93	91	92	93			
50	122	95	93	92	93	91	88	84
40	104	100	98	97	96	92	88	84
30	86	103	103	102	101	97	92	86
20	68	103	103	102	101	99	96	90
-60	-76	105	104	104	102	100	97	95

Takeoff Speeds - Dry Runway High Altitude (20K Derate)

V1, VR, V2

WEIGHT	FLAPS 1			FLAPS 5			FLAPS 10			FLAPS 15			FLAPS 25		
(1000 KG)	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
64	143	143	145	139	139	141									
60	137	137	140	134	134	136									
56	131	132	135	128	129	131									
52	125	126	129	122	123	126	117	117	120	114	114	118	113	113	117
48	119	119	124	116	117	121	111	111	115	109	109	113	108	108	112
44	112	113	118	109	111	115	105	105	110	103	103	108	102	102	107
40	105	106	112	102	104	109	98	99	105	98	98	103	96	97	102

Check V1(MCG).

V1, VR, V2 Adjustments*

TEMP		V1						VR						V2					
		PRESS ALT (1000 FT)						PRESS ALT (1000 FT)						PRESS ALT (1000 FT)					
°C	°F	10	11	12	13	14	14.5	10	11	12	13	14	14.5	10	11	12	13	14	14.5
50	122	5						5						0					
40	104	4	5	6	6	6	7	4	5	6	6	6	6	0	0	0	1	1	1
30	86	3	4	5	5	6	6	3	4	4	5	6	6	0	0	0	1	1	1
20	68	2	3	3	4	5	5	2	2	3	4	5	5	0	0	0	1	1	1
10	50	0	1	2	3	4	4	0	1	2	3	4	4	0	0	1	1	1	1
0	32	0	0	1	2	2	3	0	1	1	2	2	3	0	0	1	1	1	1
-60	-76	0	0	1	2	2	3	0	1	1	2	2	3	0	0	1	1	1	1

Slope and Wind V1 Adjustments*

WEIGHT	SLOPE (%)					WIND (KTS)							
(1000 KG)	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
64	-2	-1	0	0	0	-1	0	0	0	0	0	0	0
60	-2	-1	0	0	0	-1	0	0	0	0	0	0	0
56	-2	-1	0	0	0	-1	0	0	0	0	0	0	0
52	-2	-1	0	0	0	-1	-1	0	0	0	0	0	0
48	-2	-1	0	0	0	-1	-1	0	0	0	0	0	0
44	-2	-1	0	0	0	-1	-1	0	0	0	0	0	0
40	-1	-1	0	0	0	-1	-1	0	0	0	0	0	0

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)					
°C	°F	10000	11000	12000	13000	14000	14500
50	122	84					
40	104	84	83	82	82	83	82
30	86	86	84	83	82	83	82
20	68	90	88	86	85	83	83
10	50	94	92	90	89	87	86
0	32	94	93	92	91	90	89
-60	-76	95	94	92	91	90	90

Takeoff Speeds - Wet Runway (20K Derate)

Flaps 1 and 5

V1, VR, V2

WEIGHT (1000 KG)	FLAPS 1			FLAPS 5		
	V1	VR	V2	V1	VR	V2
72	142	147	150	139	144	147
68	137	143	147	134	140	143
64	132	138	142	128	135	139
60	126	133	138	123	130	135
56	120	127	133	117	125	130
52	113	121	128	110	119	125
48	107	115	123	104	113	120
44	100	109	118	98	107	115
40	93	102	112	91	100	110

Check V1(MCG).

V1, VR, V2 Adjustments*

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

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
72	-4	-2	0	2	5	-3	-2	-1	0	1	1	2	2
68	-4	-2	0	2	4	-3	-2	-1	0	1	1	2	2
64	-4	-2	0	2	4	-3	-2	-1	0	1	1	2	2
60	-4	-2	0	2	4	-3	-2	-1	0	1	1	2	2
56	-3	-2	0	2	4	-3	-2	-1	0	1	1	2	3
52	-3	-1	0	2	3	-3	-2	-1	0	1	2	2	3
48	-3	-1	0	2	3	-3	-2	-1	0	1	2	2	3
44	-2	-1	0	2	3	-4	-2	-1	0	1	2	3	4
40	-2	-1	0	2	3	-4	-2	-1	0	1	2	3	4

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	93	91					
60	140	93	91	92	93			
50	122	95	93	92	93	91	88	84
40	104	100	98	97	96	92	88	84
30	86	103	103	102	101	97	92	86
20	68	103	103	102	101	99	96	90
-60	-76	105	104	104	102	100	97	95

Takeoff Speeds - Wet Runway (20K Derate)

Flaps 10, 15 and 25

V1, VR, V2

WEIGHT (1000 KG)	FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2
64	124	128	133						
60	118	124	129	118	122	126	117	120	125
56	112	119	125	112	117	122	111	115	121
52	107	114	121	106	112	118	105	111	117
48	101	109	116	100	107	114	99	106	113
44	95	103	112	94	102	110	93	100	109
40	89	98	107	88	96	105	87	95	104

Check V1(MCG).

V1, VR, V2 Adjustments*

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

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
64	-3	-2	0	2	3	-3	-2	-1	0	1	1	2	2
60	-3	-2	0	2	3	-3	-2	-1	0	1	1	2	2
56	-3	-1	0	2	3	-3	-2	-1	0	1	1	2	3
52	-3	-1	0	2	3	-3	-2	-1	0	1	1	2	3
48	-2	-1	0	1	3	-4	-2	-1	0	1	2	2	3
44	-2	-1	0	1	3	-4	-2	-1	0	1	2	2	3
40	-2	-1	0	1	2	-4	-3	-1	0	1	2	3	3

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	93	91					
60	140	93	91	92	93			
50	122	95	93	92	93	91	88	84
40	104	100	98	97	96	92	88	84
30	86	103	103	102	101	97	92	86
20	68	103	103	102	101	99	96	90
-60	-76	105	104	104	102	100	97	95

Takeoff Speeds - Wet Runway High Altitude (20K Derate)

V1, VR, V2

WEIGHT (1000 KG)	FLAPS 1			FLAPS 5			FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
64	138	143	145	134	139	141									
60	132	137	140	128	134	136									
56	125	132	135	122	129	131									
52	119	126	129	115	123	126	111	117	120	111	114	118	109	113	117
48	112	119	124	109	117	121	104	111	115	104	109	113	103	108	112
44	104	113	118	102	111	115	98	105	110	97	103	108	96	102	107
40	97	106	112	94	104	109	91	99	105	90	98	103	89	97	102

Check V1(MCG).

V1, VR, V2 Adjustments*

TEMP		V1						VR						V2					
		PRESS ALT (1000 FT)						PRESS ALT (1000 FT)						PRESS ALT (1000 FT)					
°C	°F	10	11	12	13	14	14.5	10	11	12	13	14	14.5	10	11	12	13	14	14.5
50	122	11						5						0					
40	104	8	9	10	12	13	14	4	5	6	6	6	6	0	0	0	1	1	1
30	86	5	6	8	9	10	11	3	4	4	5	6	6	0	0	0	1	1	1
20	68	2	4	5	6	7	8	2	2	3	4	5	5	0	0	0	1	1	1
10	50	0	1	2	4	5	5	0	1	2	3	4	4	0	0	1	1	1	1
0	32	0	1	1	2	3	3	0	1	1	2	2	3	0	0	1	1	1	1
-60	-76	0	1	1	2	3	3	0	1	1	2	2	3	0	0	1	1	1	1

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
64	-5	-2	0	2	5	-2	-1	-1	0	0	1	1	2
60	-5	-2	0	2	4	-2	-2	-1	0	0	1	1	2
56	-4	-2	0	2	4	-3	-2	-1	0	0	1	1	2
52	-4	-2	0	2	4	-3	-2	-1	0	0	1	1	2
48	-4	-2	0	2	3	-3	-2	-1	0	0	1	2	2
44	-3	-2	0	2	3	-3	-2	-1	0	1	1	2	2
40	-3	-1	0	1	3	-3	-2	-1	0	1	1	2	3

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)					
°C	°F	10000	11000	12000	13000	14000	14500
50	122	84					
40	104	84	83	82	82	83	82
30	86	86	84	83	82	83	82
20	68	90	88	86	85	83	83
10	50	94	92	90	89	87	86
0	32	94	93	92	91	90	89
-60	-76	95	94	92	91	90	90

Maximum Allowable Clearway (20K Derate)

FIELD LENGTH (M)	MAX ALLOWABLE CLEARWAY FOR V1 REDUCTION (M)
1200	140
1800	200
2400	250
3000	310
3600	430
4200	470

Maximum Allowable Clearway - High Altitudes (20K Derate)

FIELD LENGTH (M)	MAX ALLOWABLE CLEARWAY FOR V1 REDUCTION (M)
2000	230
2500	290
3000	350
3500	410
4000	470
4500	530

Clearway and Stopway V1 Adjustments (20K Derate)

CLEARWAY MINUS STOPWAY (M)	NORMAL V1 (KIAS)					
	DRY RUNWAY			WET RUNWAY		
	100	120	140	100	120	140
300	-4	-4	-4			
200	-4	-3	-3			
100	-3	-2	-2			
0	0	0	0	0	0	0
-100	1	0	0	2	2	1
-200	1	0	0	4	3	2
-300	1	0	0	4	3	2

Use of clearway not allowed on wet runways.
V1 not to exceed VR.

Clearway and Stopway V1 Adjustments- High Altitudes (20K Derate)

CLEARWAY MINUS STOPWAY (M)	NORMAL V1 (KIAS)					
	DRY RUNWAY			WET RUNWAY		
	100	120	140	100	120	140
300	-3	-3	-3			
200	-3	-2	-2			
100	-1	-1	-1			
0	0	0	0	0	0	0
-100	0	0	0	1	1	1
-200	0	0	0	2	2	2
-300	0	0	0	2	2	2

Use of clearway not allowed on wet runways.
V1 not to exceed VR.

Stab Trim Setting (20K Derate)

Flaps 1 and 5

WEIGHT (1000 KG)	C.G. (%MAC)									
	9	11	13	16	20	24	27	30	32	33
80	8 1/2	8 1/2	8 1/2	8 1/4	7 1/2	6 3/4	6	5 1/2	5	5
70	8 1/2	8 1/2	8 1/2	8	7 1/4	6 1/2	6	5 1/4	5	4 3/4
60	8 1/2	8 1/2	8	7 1/2	6 3/4	6	5 1/4	4 3/4	4 1/4	4
50	8	7 3/4	7 1/4	6 3/4	6	5 1/4	4 1/2	4	4	4
45	7 3/4	7 1/4	6 3/4	6 1/4	5 1/2	4 3/4	4 1/4	4	4	4

Flaps 10, 15 and 25

WEIGHT (1000 KG)	C.G. (%MAC)									
	9	11	13	16	20	24	27	30	32	33
80	8 1/2	8 1/2	8 1/2	7 3/4	6 3/4	5 3/4	5 1/4	4 1/2	4 1/4	4
70	8 1/2	8 1/2	8 1/4	7 1/2	6 3/4	5 3/4	5 1/4	4 1/2	4	4
60	8 1/2	8 1/4	7 3/4	7	6 1/4	5 1/2	4 3/4	4	4	4
50	8	7 1/2	7	6 1/4	5 1/2	4 3/4	4 1/4	4	4	4
45	7 1/4	6 3/4	6 1/2	6	5 1/4	4 1/2	4	4	4	4

ADVISORY INFORMATION

Slush/Standing Water Takeoff (20K Derate)

Maximum Reverse Thrust

Weight Adjustments (1000 KG)

20K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-15.5	-17.8	-20.1	-19.0	-21.3	-23.6	-29.9	-32.1	-34.4
85	-13.3	-15.5	-17.8	-16.2	-18.5	-20.7	-24.9	-27.1	-29.4
80	-11.2	-13.4	-15.7	-13.6	-15.8	-18.1	-20.2	-22.5	-24.8
75	-9.3	-11.6	-13.9	-11.3	-13.5	-15.8	-16.3	-18.5	-20.8
70	-7.8	-10.1	-12.3	-9.3	-11.6	-13.8	-13.0	-15.2	-17.5
65	-6.5	-8.8	-11.1	-7.7	-9.9	-12.2	-10.3	-12.5	-14.8
60	-5.5	-7.8	-10.0	-6.4	-8.6	-10.9	-8.2	-10.5	-12.8
55	-4.8	-7.0	-9.3	-5.4	-7.7	-10.0	-6.9	-9.1	-11.4
50	-4.2	-6.5	-8.8	-4.7	-7.0	-9.3	-6.0	-8.3	-10.5
45	-3.7	-6.0	-8.3	-4.1	-6.3	-8.6	-5.2	-7.4	-9.7
40	-3.2	-5.5	-7.7	-3.4	-5.7	-7.9	-4.3	-6.6	-8.9

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1200							30.7		
1400	37.9			40.3			44.1		
1600	52.8			55.1	30.7		58.6	35.0	
1800	68.4	42.7		70.5	45.0		74.5	48.7	
2000	84.7	57.8	32.8	86.7	60.0	35.3	92.2	63.6	39.3
2200		73.6	47.5		75.6	49.8		80.1	53.4
2400		90.2	62.9		92.1	65.0		98.2	68.7
2600			78.9			80.9			85.9
2800			95.6			97.5			

1. **Enter Weight Adjustment table with slush/standing water depth and 20K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -35 m/+30 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (20K Derate)

Maximum Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-7	-2	0	0	0	0	0	0	0
85	-9	-4	0	0	0	0	0	0	0
80	-10	-5	0	-1	0	0	0	0	0
75	-12	-7	-2	-4	0	0	0	0	0
70	-13	-8	-3	-7	-2	0	0	0	0
65	-14	-9	-4	-9	-4	0	0	0	0
60	-15	-10	-5	-12	-7	-2	-3	0	0
55	-17	-12	-7	-14	-9	-4	-7	-2	0
50	-18	-13	-8	-16	-11	-6	-10	-5	0
45	-19	-14	-9	-17	-12	-7	-13	-8	-3
40	-20	-15	-10	-18	-13	-8	-15	-10	-5

1. **Obtain V1, VR and V2 for the actual weight using the 20K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (20K Derate)

No Reverse Thrust

Weight Adjustments (1000 KG)

20K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-18.0	-20.3	-22.6	-21.6	-23.8	-26.1	-30.2	-32.5	-34.7
85	-15.5	-17.8	-20.1	-18.5	-20.8	-23.0	-25.5	-27.8	-30.1
80	-13.2	-15.5	-17.8	-15.6	-17.9	-20.2	-21.2	-23.5	-25.8
75	-11.2	-13.5	-15.7	-13.1	-15.4	-17.7	-17.5	-19.8	-22.1
70	-9.5	-11.7	-14.0	-11.0	-13.3	-15.5	-14.4	-16.6	-18.9
65	-8.0	-10.3	-12.6	-9.2	-11.5	-13.8	-11.8	-14.0	-16.3
60	-6.9	-9.1	-11.4	-7.8	-10.1	-12.3	-9.8	-12.0	-14.3
55	-6.0	-8.3	-10.6	-6.7	-9.0	-11.2	-8.3	-10.6	-12.8
50	-5.4	-7.7	-9.9	-5.9	-8.2	-10.5	-7.3	-9.6	-11.9
45	-4.8	-7.1	-9.3	-5.2	-7.4	-9.7	-6.4	-8.6	-10.9
40	-4.2	-6.4	-8.7	-4.4	-6.7	-8.9	-5.4	-7.7	-10.0

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1600				32.2			41.7		
1800	42.9			48.8			57.5	30.2	
2000	60.9			66.1	35.0		77.5	44.2	
2200	79.3	45.9		84.3	51.7			60.6	32.6
2400	98.0	64.0	31.1		69.1	37.8		81.7	46.8
2600		82.4	49.0		87.6	54.6			63.7
2800			67.1			72.2			86.2
3000			85.6			90.7			

1. **Enter Weight Adjustment table with slush/standing water depth and 20K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -40 m/+35 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (20K Derate)

No Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-10	-5	0	0	0	0	0	0	0
85	-12	-7	-2	0	0	0	0	0	0
80	-14	-9	-4	-2	0	0	0	0	0
75	-16	-11	-6	-6	-1	0	0	0	0
70	-18	-13	-8	-10	-5	0	0	0	0
65	-19	-14	-9	-13	-8	-3	0	0	0
60	-21	-16	-11	-16	-11	-6	-4	0	0
55	-22	-17	-12	-19	-14	-9	-9	-4	0
50	-23	-18	-13	-21	-16	-11	-14	-9	-4
45	-24	-19	-14	-22	-17	-12	-17	-12	-7
40	-25	-20	-15	-24	-19	-14	-19	-14	-9

1. **Obtain V1, VR and V2 for the actual weight using the 20K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff - High Altitudes (20K Derate)

Maximum Reverse Thrust

Weight Adjustments (1000 KG)

20K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	10000	12000	14000	10000	12000	14000	10000	12000	14000
90	-20.1	-21.0	-21.9	-23.6	-24.5	-25.4	-34.4	-35.3	-36.2
85	-17.8	-18.7	-19.6	-20.7	-21.6	-22.5	-29.4	-30.3	-31.2
80	-15.7	-16.6	-17.5	-18.1	-19.0	-19.9	-24.8	-25.7	-26.6
75	-13.9	-14.8	-15.7	-15.8	-16.7	-17.6	-20.8	-21.7	-22.6
70	-12.3	-13.2	-14.1	-13.8	-14.7	-15.6	-17.5	-18.4	-19.3
65	-11.0	-12.0	-12.9	-12.2	-13.1	-14.0	-14.8	-15.7	-16.6
60	-10.0	-10.9	-11.8	-10.9	-11.8	-12.7	-12.8	-13.7	-14.6
55	-9.3	-10.2	-11.1	-10.0	-10.9	-11.8	-11.4	-12.3	-13.2
50	-8.8	-9.7	-10.6	-9.3	-10.2	-11.1	-10.5	-11.4	-12.3
45	-8.3	-9.2	-10.1	-8.6	-9.5	-10.4	-9.7	-10.6	-11.5
40	-7.7	-8.7	-9.6	-7.9	-8.9	-9.8	-8.9	-9.8	-10.7

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	10000	12000	14000	10000	12000	14000	10000	12000	14000
2000	32.8			35.3			39.3	30.4	
2200	47.5	37.6		49.8	40.0	30.5	53.4	43.9	34.8
2400	62.9	52.5	42.5	65.0	54.8	44.8	68.7	58.3	48.5
2600	78.9	68.1	57.6	80.9	70.2	59.8	85.9	74.2	63.4
2800	95.6	84.4	73.4	97.5	86.3	75.4		91.9	79.8
3000			89.9			91.8			97.9

1. **Enter Weight Adjustment table with slush/standing water depth and 20K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -35 m/+35 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	10000	12000	14000	10000	12000	14000	10000	12000	14000
85	0	0	0	0	0	0	0	0	0
80	0	0	0	0	0	0	0	0	0
75	-2	0	0	0	0	0	0	0	0
70	-3	-1	0	0	0	0	0	0	0
65	-4	-2	0	0	0	0	0	0	0
60	-5	-3	-1	-2	0	0	0	0	0
55	-7	-5	-3	-4	-2	0	0	0	0
50	-8	-6	-4	-6	-4	-2	0	0	0
45	-9	-7	-5	-7	-5	-3	-3	-1	0
40	-10	-8	-6	-8	-6	-4	-5	-3	-1

1. **Obtain V1, VR and V2 for the actual weight using the 20K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff - High Altitudes (20K Derate)

No Reverse Thrust

Weight Adjustments (1000 KG)

20K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	10000	12000	14000	10000	12000	14000	10000	12000	14000
90	-22.6	-23.5	-24.4	-26.1	-27.0	-27.9	-34.7	-35.6	-36.6
85	-20.1	-21.0	-21.9	-23.0	-23.9	-24.8	-30.1	-31.0	-31.9
80	-17.8	-18.7	-19.6	-20.2	-21.1	-22.0	-25.8	-26.7	-27.6
75	-15.7	-16.6	-17.5	-17.7	-18.6	-19.5	-22.1	-23.0	-23.9
70	-14.0	-14.9	-15.8	-15.5	-16.5	-17.4	-18.9	-19.8	-20.7
65	-12.6	-13.5	-14.4	-13.8	-14.7	-15.6	-16.3	-17.2	-18.1
60	-11.4	-12.3	-13.2	-12.3	-13.2	-14.1	-14.3	-15.2	-16.1
55	-10.6	-11.5	-12.4	-11.2	-12.2	-13.1	-12.8	-13.8	-14.7
50	-9.9	-10.8	-11.7	-10.5	-11.4	-12.3	-11.9	-12.8	-13.7
45	-9.3	-10.2	-11.1	-9.7	-10.6	-11.5	-10.9	-11.8	-12.7
40	-8.7	-9.6	-10.5	-8.9	-9.8	-10.7	-10.0	-10.9	-11.8

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	10000	12000	14000	10000	12000	14000	10000	12000	14000
2200							32.6		
2400	31.1			37.8			46.8	36.2	
2600	49.0	35.9		54.6	42.2	30.2	63.7	51.0	40.0
2800	67.1	53.8	40.7	72.2	59.2	46.7	86.2	69.0	55.4
3000	85.6	72.0	58.6	90.7	77.1	63.9		93.6	74.7
3200		90.6	77.0		95.8	82.0			
3400			95.6						

1. **Enter Weight Adjustment table with slush/standing water depth and 20K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -40 m/+40 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	10000	12000	14000	10000	12000	14000	10000	12000	14000
85	-2	0	0	0	0	0	0	0	0
80	-4	-2	0	0	0	0	0	0	0
75	-6	-4	-2	0	0	0	0	0	0
70	-8	-6	-4	0	0	0	0	0	0
65	-9	-7	-5	-3	-1	0	0	0	0
60	-11	-9	-7	-6	-4	-2	0	0	0
55	-12	-10	-8	-9	-7	-5	0	0	0
50	-13	-11	-9	-11	-9	-7	-4	-2	0
45	-14	-12	-10	-12	-10	-8	-7	-5	-3
40	-15	-13	-11	-14	-12	-10	-9	-7	-5

1. **Obtain V1, VR and V2 for the actual weight using the 20K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (20K Derate)

Maximum Reverse Thrust

Weight Adjustment (1000 KG)

20K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-2.1	-2.1	-2.1	-7.8	-7.8	-7.8	-12.4	-12.4	-12.4
85	-1.8	-1.8	-1.8	-7.0	-7.0	-7.0	-11.2	-11.2	-11.2
80	-1.6	-1.6	-1.6	-6.3	-6.3	-6.3	-10.2	-10.2	-10.2
75	-1.4	-1.4	-1.4	-5.6	-5.6	-5.6	-9.2	-9.2	-9.2
70	-1.3	-1.3	-1.3	-5.1	-5.1	-5.1	-8.4	-8.4	-8.4
65	-1.1	-1.1	-1.1	-4.6	-4.6	-4.6	-7.6	-7.6	-7.6
60	-1.1	-1.1	-1.1	-4.3	-4.3	-4.3	-7.0	-7.0	-7.0
55	-1.1	-1.1	-1.1	-4.0	-4.0	-4.0	-6.4	-6.4	-6.4
50	-1.1	-1.1	-1.1	-3.8	-3.8	-3.8	-6.0	-6.0	-6.0
45	-1.1	-1.1	-1.1	-3.7	-3.7	-3.7	-5.6	-5.6	-5.6
40	-1.3	-1.3	-1.3	-3.7	-3.7	-3.7	-5.4	-5.4	-5.4

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1000	34.4								
1200	56.6	31.0							
1400	78.9	53.3		41.2					
1600		75.5	49.9	58.2	33.7				
1800		97.9	72.2	76.3	50.5		39.3		
2000			94.5	95.7	68.0	42.9	51.0		
2200					86.8	60.0	63.3	39.6	
2400						78.2	76.4	51.3	
2600						97.6	90.6	63.6	39.9
2800								76.8	51.6
3000								91.0	63.9
3200									77.1
3400									91.3

1. **Enter Weight Adjustment table with reported braking action and 20K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -25 m/+25 m for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -25 m/+25 m for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -40 m/+35 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (20K Derate)
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-6	-3	-1	-11	-8	-6	-18	-15	-13
85	-5	-3	0	-11	-9	-6	-19	-17	-14
80	-5	-3	0	-12	-9	-7	-20	-18	-15
75	-6	-3	-1	-13	-10	-8	-22	-19	-17
70	-6	-3	-1	-14	-11	-9	-23	-21	-18
65	-6	-4	-1	-15	-12	-10	-25	-23	-20
60	-7	-5	-2	-16	-13	-11	-27	-24	-22
55	-8	-5	-3	-17	-15	-12	-29	-26	-24
50	-9	-6	-4	-19	-16	-14	-31	-28	-26
45	-10	-8	-5	-20	-18	-15	-33	-30	-28
40	-12	-9	-7	-22	-20	-17	-35	-32	-30

1. **Obtain V1, VR and V2 for the actual weight using the 20K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (20K Derate)

No Reverse Thrust

Weight Adjustments (1000 KG)

20K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-3.0	-3.0	-3.0	-9.8	-9.8	-9.8	-15.2	-15.2	-15.2
85	-2.7	-2.7	-2.7	-8.8	-8.8	-8.8	-13.9	-13.9	-13.9
80	-2.4	-2.4	-2.4	-8.0	-8.0	-8.0	-12.6	-12.6	-12.6
75	-2.2	-2.2	-2.2	-7.2	-7.2	-7.2	-11.5	-11.5	-11.5
70	-2.0	-2.0	-2.0	-6.5	-6.5	-6.5	-10.4	-10.4	-10.4
65	-1.8	-1.8	-1.8	-6.0	-6.0	-6.0	-9.5	-9.5	-9.5
60	-1.7	-1.7	-1.7	-5.5	-5.5	-5.5	-8.7	-8.7	-8.7
55	-1.7	-1.7	-1.7	-5.2	-5.2	-5.2	-8.0	-8.0	-8.0
50	-1.7	-1.7	-1.7	-4.9	-4.9	-4.9	-7.4	-7.4	-7.4
45	-1.7	-1.7	-1.7	-4.8	-4.8	-4.8	-6.9	-6.9	-6.9
40	-1.8	-1.8	-1.8	-4.7	-4.7	-4.7	-6.5	-6.5	-6.5

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1200	48.8								
1400	72.9	45.2							
1600	96.2	69.3	41.5	35.3					
1800		92.7	65.7	56.5					
2000			89.2	78.1	45.3				
2200					66.7	34.2			
2400					88.6	55.4	35.0		
2600						77.0	50.2		
2800						99.1	66.0	31.9	
3000							82.6	47.1	
3200							99.9	62.8	
3400								79.2	44.0
3600								96.4	59.6
3800									75.8
4000									92.9

1. **Enter Weight Adjustment table with reported braking action and 20K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust “Good” field length available by -30 m/+25 m for every 5°C above/below 4°C.
   Adjust “Medium” field length available by -30 m/+25 m for every 5°C above/below 4°C.
   Adjust “Poor” field length available by -50 m/+45 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (20K Derate)
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-7	-4	-2	-12	-10	-7	-24	-21	-19
85	-6	-4	-1	-13	-11	-8	-26	-24	-21
80	-6	-4	-1	-15	-12	-10	-28	-26	-23
75	-7	-4	-2	-16	-13	-11	-30	-28	-25
70	-7	-5	-2	-17	-15	-12	-33	-30	-28
65	-8	-5	-3	-19	-16	-14	-35	-32	-30
60	-9	-6	-4	-20	-18	-15	-37	-35	-32
55	-10	-7	-5	-22	-20	-17	-39	-37	-34
50	-11	-9	-6	-24	-22	-19	-42	-39	-37
45	-13	-10	-8	-26	-24	-21	-44	-41	-39
40	-14	-12	-9	-28	-26	-23	-46	-44	-41

1. **Obtain V1, VR and V2 for the actual weight using the 20K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff - High Altitudes (20K Derate)

Maximum Reverse Thrust

Weight Adjustment (1000 KG)

20K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	10000	12000	14000	10000	12000	14000	10000	12000	14000
90	-2.1	-2.1	-2.1	-7.8	-7.8	-7.8	-12.4	-12.4	-12.4
85	-1.8	-1.8	-1.8	-7.0	-7.0	-7.0	-11.2	-11.2	-11.2
80	-1.6	-1.6	-1.6	-6.3	-6.3	-6.3	-10.2	-10.2	-10.2
75	-1.4	-1.4	-1.4	-5.6	-5.6	-5.6	-9.2	-9.2	-9.2
70	-1.3	-1.3	-1.3	-5.1	-5.1	-5.1	-8.4	-8.4	-8.4
65	-1.1	-1.1	-1.1	-4.6	-4.6	-4.6	-7.6	-7.6	-7.6
60	-1.1	-1.1	-1.1	-4.3	-4.3	-4.3	-7.0	-7.0	-7.0
55	-1.1	-1.1	-1.1	-4.0	-4.0	-4.0	-6.4	-6.4	-6.4
50	-1.1	-1.1	-1.1	-3.8	-3.8	-3.8	-6.0	-6.0	-6.0
45	-1.1	-1.1	-1.1	-3.7	-3.7	-3.7	-5.6	-5.6	-5.6
40	-1.3	-1.3	-1.3	-3.7	-3.7	-3.7	-5.4	-5.4	-5.4

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	10000	12000	14000	10000	12000	14000	10000	12000	14000
1600	50.3	40.1							
1800	72.5	62.4	52.2						
2000	94.8	84.6	74.5	43.0	33.3				
2200			96.8	60.1	50.0	40.3			
2400				78.3	67.6	57.3			
2600				97.7	86.4	75.3	39.8	30.7	
2800						94.6	51.4	42.2	33.1
3000							63.8	53.9	44.6
3200							77.0	66.4	56.5
3400							91.2	79.8	69.1
3600								94.3	82.7
3800									97.3

1. **Enter Weight Adjustment table with reported braking action and 20K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -25 m/+25 m for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -25 m/+25 m for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -40 m/+40 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff - High Altitudes (20K Derate)

Maximum Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	10000	12000	14000	10000	12000	14000	10000	12000	14000
85	0	0	0	-6	-5	-4	-14	-13	-12
80	0	0	0	-7	-6	-5	-15	-14	-13
75	-1	0	0	-8	-7	-6	-17	-16	-15
70	-1	0	0	-9	-8	-7	-18	-17	-16
65	-1	0	0	-10	-9	-8	-20	-19	-18
60	-2	-1	0	-11	-10	-9	-22	-21	-20
55	-3	-2	-1	-12	-11	-10	-24	-23	-22
50	-4	-3	-2	-14	-13	-12	-26	-25	-24
45	-5	-4	-3	-15	-14	-13	-28	-27	-26
40	-7	-6	-5	-17	-16	-15	-30	-29	-28

1. **Obtain V1, VR and V2 for the actual weight using the 20K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff - High Altitudes (20K Derate)

No Reverse Thrust

Weight Adjustment (1000 KG)

20K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	10000	12000	14000	10000	12000	14000	10000	12000	14000
90	-3.0	-3.0	-3.0	-9.8	-9.8	-9.8	-15.2	-15.2	-15.2
85	-2.7	-2.7	-2.7	-8.8	-8.8	-8.8	-13.9	-13.9	-13.9
80	-2.4	-2.4	-2.4	-8.0	-8.0	-8.0	-12.6	-12.6	-12.6
75	-2.2	-2.2	-2.2	-7.2	-7.2	-7.2	-11.5	-11.5	-11.5
70	-2.0	-2.0	-2.0	-6.5	-6.5	-6.5	-10.4	-10.4	-10.4
65	-1.8	-1.8	-1.8	-6.0	-6.0	-6.0	-9.5	-9.5	-9.5
60	-1.7	-1.7	-1.7	-5.5	-5.5	-5.5	-8.7	-8.7	-8.7
55	-1.7	-1.7	-1.7	-5.2	-5.2	-5.2	-8.0	-8.0	-8.0
50	-1.7	-1.7	-1.7	-4.9	-4.9	-4.9	-7.4	-7.4	-7.4
45	-1.7	-1.7	-1.7	-4.8	-4.8	-4.8	-6.9	-6.9	-6.9
40	-1.8	-1.8	-1.8	-4.7	-4.7	-4.7	-6.5	-6.5	-6.5

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	10000	12000	14000	10000	12000	14000	10000	12000	14000
1600	41.8	30.6							
1800	66.1	55.1	44.0						
2000	89.6	78.9	68.1						
2200			91.6	34.2					
2400				55.4	42.4				
2600				77.0	63.8	50.7			
2800				99.1	85.6	72.2			
3000						94.2			
3400							43.7	30.4	
3600							59.3	45.5	32.1
3800							75.5	61.1	47.3
4000							92.6	77.4	63.0
4200								94.6	79.4
4400									96.6

1. **Enter Weight Adjustment table with reported braking action and 20K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust “Good” field length available by -30 m/+30 m for every 5°C above/below 4°C.**
   Adjust “Medium” field length available by -30 m/+30 m for every 5°C above/below 4°C.
   Adjust “Poor” field length available by -50 m/+50 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff - High Altitudes (20K Derate)

No Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	10000	12000	14000	10000	12000	14000	10000	12000	14000
85	-1	0	0	-8	-7	-6	-21	-20	-19
80	-1	0	0	-10	-9	-8	-23	-22	-21
75	-2	-1	0	-11	-10	-9	-25	-24	-23
70	-2	-1	0	-12	-11	-10	-28	-27	-26
65	-3	-2	-1	-14	-13	-12	-30	-29	-28
60	-4	-3	-2	-15	-14	-13	-32	-31	-30
55	-5	-4	-3	-17	-16	-15	-34	-33	-32
50	-6	-5	-4	-19	-18	-17	-37	-36	-35
45	-8	-7	-6	-21	-20	-19	-39	-38	-37
40	-9	-8	-7	-23	-22	-21	-41	-40	-39

1. **Obtain V1, VR and V2 for the actual weight using the 20K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Takeoff %N1 (20K Derate)

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

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
60	84.0	84.4	84.7	86.1	87.3	88.1	89.1	89.3	89.5	88.8	88.2	87.9	87.5
55	84.8	85.3	85.8	87.0	88.1	89.0	90.0	90.1	90.3	89.6	88.8	87.9	86.9
50	85.8	86.3	86.8	87.9	88.9	89.8	90.8	90.9	91.0	90.3	89.6	88.7	87.7
45	86.8	87.2	87.7	88.7	89.7	90.7	91.7	91.7	91.7	91.1	90.4	89.5	88.6
40	87.7	88.2	88.6	89.7	90.6	91.6	92.5	92.4	92.4	91.8	91.2	90.3	89.4
35	88.6	89.0	89.5	90.6	91.5	92.4	93.4	93.3	93.2	92.5	91.9	91.0	90.1
30	88.2	89.3	90.5	91.4	92.5	93.3	94.3	94.1	94.0	93.4	92.7	91.8	90.9
25	87.5	88.6	89.7	90.7	91.8	92.7	93.8	94.2	94.7	94.2	93.5	92.6	91.7
20	86.8	87.9	89.0	90.0	91.1	91.9	93.0	93.4	93.9	94.5	94.3	93.4	92.5
15	86.0	87.2	88.3	89.3	90.3	91.2	92.2	92.6	93.1	93.7	94.2	94.2	93.4
10	85.3	86.4	87.5	88.5	89.6	90.4	91.5	91.9	92.3	92.9	93.4	93.7	94.3
5	84.6	85.7	86.8	87.7	88.8	89.6	90.7	91.1	91.6	92.1	92.6	92.9	93.5
0	83.8	84.9	86.0	87.0	88.0	88.9	89.9	90.3	90.8	91.4	91.8	92.1	92.7
-5	83.1	84.2	85.2	86.2	87.2	88.1	89.1	89.5	90.0	90.5	91.0	91.3	91.9
-10	82.3	83.4	84.5	85.4	86.4	87.3	88.3	88.7	89.2	89.7	90.2	90.5	91.0
-15	81.6	82.6	83.7	84.6	85.6	86.5	87.5	87.9	88.3	88.9	89.3	89.7	90.2
-20	80.8	81.8	82.9	83.8	84.8	85.7	86.7	87.0	87.5	88.1	88.5	88.8	89.4
-25	80.0	81.1	82.1	83.0	84.0	84.8	85.8	86.2	86.7	87.3	87.7	88.0	88.5
-30	79.2	80.3	81.3	82.2	83.2	84.0	85.0	85.4	85.8	86.4	86.8	87.2	87.7
-35	78.4	79.5	80.5	81.4	82.4	83.2	84.1	84.5	85.0	85.6	86.0	86.3	86.8
-40	77.6	78.6	79.6	80.6	81.5	82.3	83.3	83.7	84.1	84.7	85.1	85.4	86.0
-45	76.8	77.8	78.8	79.7	80.7	81.5	82.4	82.8	83.3	83.8	84.2	84.5	85.1
-50	76.0	77.0	78.0	78.9	79.8	80.6	81.6	81.9	82.4	82.9	83.3	83.7	84.2

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.9	0.9	0.9

Takeoff %N1 - High Altitudes (20K Derate)

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

OAT (°C)	PRESSURE ALTITUDE (FT)					
	10000	11000	12000	13000	14000	14500
40	89.4					
35	90.1	90.1	90.2			
30	90.9	90.9	90.9	90.9	91.0	91.0
25	91.7	91.7	91.6	91.6	91.6	91.7
20	92.5	92.5	92.4	92.4	92.4	92.4
15	93.4	93.3	93.2	93.1	93.1	93.1
10	94.3	94.2	94.0	93.9	93.9	93.9
5	93.5	94.1	94.7	95.1	95.0	94.9
0	92.7	93.3	93.9	94.6	95.4	95.8
-5	91.9	92.5	93.1	93.8	94.6	95.0
-10	91.0	91.7	92.3	93.0	93.8	94.2
-15	90.2	90.8	91.5	92.2	93.0	93.4
-20	89.4	90.0	90.6	91.4	92.2	92.6
-25	88.5	89.2	89.8	90.5	91.4	91.8
-30	87.7	88.3	88.9	89.7	90.5	90.9
-35	86.8	87.5	88.1	88.8	89.7	90.1
-40	86.0	86.6	87.2	88.0	88.8	89.2
-45	85.1	85.7	86.3	87.1	87.9	88.4
-50	84.2	84.8	85.5	86.2	87.1	87.5

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)					
	10000	11000	12000	13000	14000	14500
PACKS OFF	0.9	0.9	1.0	1.0	1.0	1.0
ENGINE ANTI-ICE	0.0	-0.7	-1.4	-1.4	-1.4	-1.4

Assumed Temperature Reduced Thrust (20K Derate)

Maximum Assumed Temperature (Table 1 of 3)

Based on 25% Takeoff Thrust Reduction

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
55	73	71	69	67								
50	73	71	69	67	65	63						
45	73	71	69	67	65	63	61	59	57			
40	69	68	69	67	65	63	61	59	57	55		
35	64	63	65	66	65	63	61	59	57	55	53	
30	61	59	60	61	61	61	61	59	57	55	53	51
25	61	59	60	60	60	60	59	58	57	55	53	51
20	61	59	60	60	60	60	59	58	53	51	52	51
15	61	59	60	60	60	60	59	58	53	49	46	46
10 & BELOW	61	59	60	60	60	60	59	58	53	49	45	40

Takeoff %N1 (Table 2 of 3)

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

ASSUMED TEMP (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
75	81.4	81.5	84.0	85.8	87.2	88.8	89.7	90.6	90.4	90.1	89.8	89.4
70	82.5	82.6	84.3	85.5	86.6	88.2	89.1	89.9	89.7	89.5	89.2	88.8
65	83.4	83.7	85.2	86.4	87.2	88.2	88.5	89.3	89.1	88.9	88.6	88.1
60	84.4	84.7	86.1	87.3	88.1	89.1	89.3	89.5	88.8	88.2	87.9	87.5
55	85.3	85.8	87.0	88.1	89.0	90.0	90.1	90.3	89.6	88.8	87.9	86.9
50	86.3	86.8	87.9	88.9	89.8	90.8	90.9	91.0	90.3	89.6	88.7	87.7
45	87.2	87.7	88.7	89.7	90.7	91.7	91.7	91.7	91.1	90.4	89.5	88.6
40	88.2	88.6	89.7	90.6	91.6	92.5	92.4	92.4	91.8	91.2	90.3	89.4
35	89.0	89.5	90.6	91.5	92.4	93.4	93.3	93.2	92.5	91.9	91.0	90.1
30	89.3	90.5	91.4	92.5	93.3	94.3	94.1	94.0	93.4	92.7	91.8	90.9
25	88.6	89.7	90.7	91.8	92.7	93.8	94.2	94.7	94.2	93.5	92.6	91.7
20	87.9	89.0	90.0	91.1	91.9	93.0	93.4	93.9	94.5	94.3	93.4	92.5
15	87.2	88.3	89.3	90.3	91.2	92.2	92.6	93.1	93.7	94.2	94.2	93.4
10	86.4	87.5	88.5	89.6	90.4	91.5	91.9	92.3	92.9	93.4	93.7	94.3
MINIMUM ASSUMED TEMP (°C)	32	30	30	30	29	29	27	25	21	18	14	10

With engine bleed for packs off, increase %N1 by 0.9.

Assumed Temperature Reduced Thrust (20K Derate)
%N1 Adjustment for Temperature Difference (Table 3 of 3)

ASSUMED TEMP MINUS OAT (°C)	OUTSIDE AIR TEMPERATURE (°C)													
	-40	-20	0	5	10	15	20	25	30	35	40	45	50	55
110	11.2													
100	10.3	6.0												
90	10.5	8.2												
80	11.8	7.1	3.2											
70	10.7	7.4	5.3	3.6	1.8									
60	9.2	8.7	4.1	4.0	3.9	2.2	0.5							
50	7.8	7.5	4.3	2.7	2.6	3.7	2.7	0.9	0.5					
40		6.0	5.7	4.4	2.8	2.9	3.3	3.1	1.4	1.1	0.8			
30		4.6	4.4	4.3	4.2	4.1	4.0	3.9	3.5	3.3	3.0	2.8	3.4	
20			3.0	2.9	2.9	2.9	2.8	2.7	2.6	2.6	2.5	2.5	2.4	2.3
10			1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.3	1.3	1.3	1.2	1.2
0			0	0	0	0	0	0	0	0	0	0	0	0

1. **Determine Maximum Assumed Temperature allowed from Table 1.**
2. **Find Maximum %N1 from Table 2 using the desired assumed temperature (no greater than temperature from Table 1).**
3. **Use the difference between assumed temperature and OAT to determine the %N1 adjustment from Table 3.**
4. **Subtract %N1 adjustment from Maximum %N1 in Table 2.**

Assumed Temperature Reduced Thrust - High Altitudes (20K Derate)

Maximum Assumed Temperature (Table 1 of 3)

Based on 25% Takeoff Thrust Reduction

OAT (°C)	PRESSURE ALTITUDE (FT)					
	10000	11000	12000	13000	14000	14500
40	56					
35	56	54	52			
30	56	54	52	50	48	47
25	56	54	52	50	48	47
20	51	52	52	50	48	47
15	46	46	47	47	48	47
10	40	40	41	41	42	42
5	40	39	38	37	37	38
0 & BELOW	40	39	38	36	35	34

Maximum Takeoff %N1 (Table 2 of 3)

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

ASSUMED TEMP (°C)	AIRPORT PRESSURE ALTITUDE (FT)					
	10000	11000	12000	13000	14000	14500
60	87.5					
55	86.9	87.5	88.1	88.7		
50	87.7	87.8	87.8	88.0	88.8	89.1
45	88.6	88.6	88.6	88.6	88.8	88.8
40	89.4	89.4	89.4	89.4	89.5	89.6
35	90.1	90.1	90.2	90.2	90.3	90.3
30	90.9	90.9	90.9	90.9	91.0	91.0
25	91.7	91.7	91.6	91.6	91.6	91.7
20	92.5	92.5	92.4	92.4	92.4	92.4
15	93.4	93.3	93.2	93.1	93.1	93.1
10	94.3	94.2	94.0	93.9	93.9	93.9
5		94.1	94.7	95.1	95.0	94.9
0				94.6	95.4	95.8
MINIMUM ASSUMED TEMP (°C)	10	8	6	4	2	1

%N1 Adjustment for Engine Bleed

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)					
	10000	11000	12000	13000	14000	14500
PACKS OFF	0.9	0.9	1.0	1.0	1.0	1.0
ENGINE ANTI-ICE	0.0	-0.7	-1.4	-1.4	-1.4	-1.4

Assumed Temperature Reduced Thrust - High Altitudes (20K Derate)

%N1 Adjustment for Temperature Difference (Table 3 of 3)

ASSUMED TEMP MINUS OAT (°C)	OUTSIDE AIR TEMPERATURE (°C)										
	-60	-40	-20	0	5	10	15	20	25	30	35
110	15.2										
100	15.2										
90	14.3	11.9									
80	13.1	11.9									
70	11.9	10.9	8.8								
60		9.6	8.8								
50		8.3	7.6	5.7							
40			6.3	5.7	4.4	4.3	4.2	4.2	4.2		
30			4.9	4.5	4.4	4.3	4.2	4.2	4.2	2.8	2.7
20				3.1	3.0	3.0	2.9	2.8	2.8	2.8	2.7
10				1.6	1.6	1.5	1.5	1.5	1.4	1.4	1.4
0					0	0	0	0	0	0	0

1. **Determine Maximum Assumed Temperature allowed from Table 1.**
2. **Find Maximum %N1 from Table 2 using the desired assumed temperature (no greater than temperature from Table 1).**
3. **Use the difference between assumed temperature and OAT to determine the %N1 adjustment from Table 3.**
4. **Subtract %N1 adjustment from Maximum %N1 in Table 2.**

Max Climb %N1

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

TAT (°C)	PRESSURE ALTITUDE (FT)/SPEED (KIAS/MACH)									
	0	5000	10000	15000	20000	25000	30000	35000	37000	41000
	280	280	280	280	280	280	280	.78	.78	.78
60	89.4	89.7	89.7	89.8	89.6	91.4	93.0	94.4	94.5	92.8
55	90.2	90.5	90.5	90.7	90.0	90.8	92.4	93.7	93.8	92.1
50	90.9	91.2	91.3	91.5	91.0	90.8	91.7	93.0	93.1	91.4
45	91.6	91.9	92.1	92.3	91.9	91.7	91.7	92.3	92.4	90.7
40	92.4	92.6	92.9	93.1	92.7	92.5	92.5	91.6	91.7	90.0
35	92.9	93.3	93.6	93.8	93.6	93.3	93.3	92.4	91.7	90.1
30	92.2	94.1	94.3	94.6	94.4	94.1	94.0	93.2	92.6	91.1
25	91.5	94.1	95.0	95.2	95.2	94.8	94.7	94.0	93.4	92.1
20	90.7	93.3	95.8	96.0	95.9	95.6	95.4	94.7	94.2	93.0
15	90.0	92.5	95.2	96.8	96.7	96.3	96.1	95.5	95.0	94.0
10	89.2	91.8	94.4	97.1	97.6	97.0	96.7	96.2	95.8	94.9
5	88.4	91.0	93.6	96.3	98.5	97.9	97.4	97.0	96.6	95.8
0	87.7	90.2	92.8	95.5	97.9	99.0	98.4	97.8	97.5	96.7
-5	86.9	89.4	92.0	94.7	97.2	98.9	99.4	98.6	98.3	97.7
-10	86.1	88.6	91.2	93.9	96.4	98.1	99.7	99.5	99.2	98.7
-15	85.3	87.8	90.3	93.1	95.6	97.4	98.9	100.5	100.1	99.7
-20	84.5	87.0	89.5	92.3	94.8	96.6	98.1	100.2	100.7	100.3
-25	83.7	86.1	88.7	91.4	94.1	95.8	97.3	99.3	99.9	99.5
-30	82.9	85.3	87.8	90.6	93.3	95.0	96.5	98.5	99.0	98.7
-35	82.0	84.5	87.0	89.8	92.4	94.1	95.6	97.6	98.2	97.8
-40	81.2	83.6	86.1	88.9	91.6	93.3	94.8	96.8	97.3	96.9

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)					
	0	10	20	30	35	41
ENGINE ANTI-ICE	-0.6	-0.8	-0.9	-0.9	-0.8	-0.8
ENGINE & WING ANTI-ICE*	-1.8	-2.1	-2.5	-2.7	-3.0	-3.0

***Dual bleed sources**

Go-around %N1

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

AIRPORT OAT		TAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)												
°C	°F		-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
57	134	60	95.0	95.2											
52	125	55	95.9	96.5	96.7	96.6									
47	116	50	96.6	97.1	97.6	97.8	97.8	97.7	97.6						
42	108	45	97.3	97.9	98.3	98.5	98.6	98.7	98.9	98.8	98.5				
37	99	40	98.0	98.6	99.1	99.2	99.3	99.5	99.5	99.7	99.5	99.2	98.9	99.9	
32	90	35	98.1	99.2	99.9	100.0	100.2	100.2	100.4	100.4	100.3	100.0	99.6	100.7	101.8
27	81	30	97.3	98.5	99.8	100.4	100.7	100.7	100.8	100.8	100.8	100.7	100.4	101.3	102.3
22	72	25	96.5	97.7	99.1	99.7	100.3	100.6	101.0	100.9	100.9	100.9	100.9	101.6	102.5
17	63	20	95.8	97.0	98.3	98.9	99.5	99.9	100.2	100.6	100.9	101.1	101.1	101.7	102.5
12	54	15	95.0	96.2	97.5	98.1	98.8	99.1	99.5	99.8	100.2	100.6	100.9	101.8	102.5
7	45	10	94.2	95.4	96.8	97.4	98.0	98.4	98.8	99.1	99.5	99.8	100.2	101.1	102.1
2	36	5	93.4	94.6	96.0	96.6	97.2	97.6	98.0	98.4	98.7	99.1	99.4	100.4	101.3
-3	27	0	92.6	93.8	95.2	95.8	96.4	96.8	97.2	97.6	98.0	98.3	98.7	99.6	100.5
-8	18	-5	91.8	93.0	94.4	95.0	95.7	96.1	96.5	96.9	97.2	97.6	97.9	98.8	99.8
-13	9	-10	91.0	92.2	93.6	94.2	94.9	95.3	95.7	96.1	96.5	96.8	97.2	98.1	99.0
-17	1	-15	90.2	91.4	92.8	93.4	94.1	94.5	94.9	95.3	95.7	96.0	96.4	97.3	98.2
-22	-8	-20	89.3	90.6	91.9	92.6	93.2	93.7	94.1	94.5	94.9	95.2	95.6	96.5	97.4
-27	-17	-25	88.5	89.7	91.1	91.8	92.4	92.8	93.3	93.7	94.1	94.5	94.8	95.7	96.6
-32	-26	-30	87.6	88.9	90.3	90.9	91.6	92.0	92.5	92.9	93.3	93.7	94.0	94.9	95.8
-37	-35	-35	86.8	88.0	89.4	90.1	90.8	91.2	91.7	92.1	92.5	92.8	93.2	94.1	95.0
-42	-44	-40	85.9	87.2	88.6	89.2	89.9	90.3	90.8	91.3	91.7	92.0	92.4	93.2	94.1
-47	-53	-45	85.0	86.3	87.7	88.4	89.0	89.5	90.0	90.5	90.8	91.2	91.5	92.4	93.3
-52	-62	-50	84.1	85.4	86.8	87.5	88.2	88.6	89.1	89.6	90.0	90.4	90.7	91.6	92.4

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (FT)											
	-2000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.8	0.8	0.8	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9
A/C HIGH	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1

Go-around %N1 - High Altitudes

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

AIRPORT OAT		TAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)					
°C	°F		10000	11000	12000	13000	14000	14500
32	90	35	101.8	101.6				
27	81	30	102.3	102.4	102.3	102.1	102.1	
22	72	25	102.5	102.5	102.5	102.4	102.3	102.2
17	63	20	102.5	102.5	102.4	102.4	102.3	102.3
12	54	15	102.5	102.5	102.4	102.4	102.3	102.3
7	45	10	102.1	102.5	102.4	102.4	102.3	102.2
2	36	5	101.3	102.0	102.5	102.4	102.3	102.3
-3	27	0	100.5	101.2	101.9	102.1	102.3	102.3
-8	18	-5	99.8	100.4	101.1	101.3	101.5	101.7
-13	9	-10	99.0	99.6	100.3	100.6	100.8	100.9
-17	1	-15	98.2	98.8	99.5	99.8	100.0	100.1
-22	-8	-20	97.4	98.0	98.7	98.9	99.1	99.2
-27	-17	-25	96.6	97.2	97.9	98.1	98.3	98.4
-32	-26	-30	95.8	96.4	97.0	97.3	97.5	97.6
-37	-35	-35	95.0	95.6	96.2	96.5	96.6	96.7
-42	-44	-40	94.1	94.7	95.4	95.6	95.8	95.9
-47	-53	-45	93.3	93.9	94.5	94.7	94.9	95.0
-52	-62	-50	92.4	93.0	93.6	93.9	94.1	94.2

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)					
	10000	11000	12000	13000	14000	14500
PACKS OFF	0.9	0.9	0.9	1.0	1.0	1.0
ENGINE ANTI-ICE	0.0	-0.8	-1.5	-1.5	-1.5	-1.4

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Climb (280/.76)

Flaps Up, Set Max Climb Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		40	50	60	70	80
40000	**PITCH ATT**	**4.0**	**4.0**	**4.5**		
	V/S (FT/MIN)	1800	1200	600		
30000	**PITCH ATT**	**4.0**	**4.0**	**4.0**	**4.0**	**4.0**
	V/S (FT/MIN)	2600	2000	1500	1200	900
20000	**PITCH ATT**	**7.5**	**6.5**	**6.5**	**6.0**	**6.0**
	V/S (FT/MIN)	4200	3300	2700	2200	1800
10000	**PITCH ATT**	**11.0**	**9.5**	**8.5**	**8.5**	**8.0**
	V/S (FT/MIN)	5700	4500	3700	3000	2600
SEA LEVEL	**PITCH ATT**	**15.0**	**12.5**	**11.5**	**10.5**	**10.0**
	V/S (FT/MIN)	6900	5400	4400	3700	3200

Cruise (.76/280)

Flaps Up, %N1 for Level Flight

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		40	50	60	70	80
40000	**PITCH ATT**	**2.0**	**2.5**	**3.5**		
	%N1	82.4	85.0	89.0		
35000	**PITCH ATT**	**1.0**	**2.0**	**2.5**	**3.0**	**3.5**
	%N1	80.7	82.1	84.1	86.5	90.5
30000	**PITCH ATT**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**
	%N1	80.2	81.0	82.2	83.8	85.7
25000	**PITCH ATT**	**1.0**	**1.5**	**2.0**	**2.5**	**3.5**
	%N1	76.6	77.4	78.5	80.0	81.9
20000	**PITCH ATT**	**1.0**	**1.5**	**2.0**	**3.0**	**3.5**
	%N1	73.0	73.8	74.8	76.1	77.9
15000	**PITCH ATT**	**1.0**	**1.5**	**2.5**	**3.0**	**3.5**
	%N1	69.2	70.0	71.1	72.3	74.0

Descent (.76/280)

Flaps Up, Set Idle Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		40	50	60	70	80
40000	**PITCH ATT**	**-1.5**	**-0.5**	**0.5**	**1.0**	**1.5**
	V/S (FT/MIN)	-2800	-2500	-2400	-2600	-2700
30000	**PITCH ATT**	**-3.0**	**-2.0**	**-1.0**	**0.0**	**0.5**
	V/S (FT/MIN)	-3000	-2500	-2200	-2000	-1900
20000	**PITCH ATT**	**-3.0**	**-2.0**	**-1.0**	**0.0**	**1.0**
	V/S (FT/MIN)	-2700	-2300	-2000	-1800	-1700
10000	**PITCH ATT**	**-3.0**	**-2.0**	**-1.0**	**0.0**	**1.0**
	V/S (FT/MIN	-2400	-2000	-1800	-1600	-1500
SEA LEVEL	**PITCH ATT**	**-3.5**	**-2.0**	**-1.0**	**0.0**	**1.0**
	V/S (FT/MIN)	-2200	-1800	-1600	-1500	-1400

Flight With Unreliable Airspeed/Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Holding (VREF40 + 70)

Flaps Up, %N1 for Level Flight

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		40	50	60	70	80
15000	**PITCH ATT**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
	%N1	55.8	61.5	65.8	69.7	73.1
	KIAS	177	195	214	231	247
10000	**PITCH ATT**	**5.0**	**5.5**	**5.0**	**5.0**	**5.0**
	%N1	52.2	57.2	61.9	65.8	69.0
	KIAS	177	194	213	230	246
5000	**PITCH ATT**	**5.5**	**5.5**	**5.5**	**5.0**	**5.0**
	%N1	48.6	53.6	57.8	61.7	65.4
	KIAS	177	193	212	229	245

Terminal Area (5000 FT)

%N1 for Level Flight

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS UP (GEAR UP)	**PITCH ATT.**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
(VREF40 + 70)	%N1	49.0	53.0	58.0	61.0	65.0
FLAPS 1 (GEAR UP)	**PITCH ATT.**	**5.0**	**5.5**	**6.0**	**6.0**	**6.5**
(VREF40 + 50)	%N1	50.0	56.0	60.0	64.0	67.0
FLAPS 5 (GEAR UP)	**PITCH ATT.**	**5.5**	**6.0**	**6.5**	**6.5**	**7.0**
(VREF40 + 30)	%N1	50.0	56.0	61.0	65.0	68.0
FLAPS 15 (GEAR DOWN)	**PITCH ATT.**	**6.0**	**6.0**	**6.5**	**6.5**	**7.0**
(VREF40 + 20)	%N1	59.0	65.0	70.0	74.0	78.0

Final Approach (1500 FT)

Gear Down, %N1 for 3° Glideslope

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS 15	**PITCH ATT**	**3.5**	**3.5**	**3.5**	**4.0**	**4.0**
(VREF15 + 10)	%N1	41.5	45.4	49.3	53.1	56.2
FLAPS 30	**PITCH ATT**	**1.5**	**2.0**	**2.0**	**2.0**	**2.5**
(VREF30 + 10)	%N1	45.4	50.4	54.6	58.2	61.7
FLAPS 40	**PITCH ATT**	**0.0**	**0.0**	**0.5**	**0.5**	**1.0**
(VREF40 + 10)	%N1	52.4	57.5	62.3	66.0	69.7

Go-Around

Flaps 15, Gear Up, Set Go-Around Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		40	50	60	70	80
10000	**PITCH ATT**	**21.0**	**17.0**	**14.5**	**12.5**	**11.0**
	V/S (FT/MIN)	3900	3000	2500	2000	1600
	KIAS	126	139	151	163	174
5000	**PITCH ATT**	**24.0**	**19.5**	**16.5**	**14.5**	**12.5**
	V/S (FT/MIN)	4300	3400	2800	2300	1900
	KIAS	126	138	150	161	172
SEA LEVEL	**PITCH ATT**	**27.0**	**22.0**	**18.5**	**16.0**	**14.0**
	V/S (FT/MIN)	4600	3700	3000	2500	2100
	KIAS	126	138	149	160	170

Intentionally
Blank

Performance Inflight Chapter PI
All Engine Section 31

Long Range Cruise Maximum Operating Altitude
Max Cruise Thrust
ISA + 10°C and Below

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
85	31000	-8	34200*	34200*	33800	32200	30800
80	32300	-10	35700*	35700*	35100	33500	32100
75	33700	-14	37000*	37000*	36500	34900	33500
70	35200	-17	38300*	38300*	37900	36400	35000
65	36700	-19	39700*	39700*	39400	37900	36500
60	38400	-19	41000	41000	41000	39600	38200
55	40200	-19	41000	41000	41000	41000	40000
50	41000	-19	41000	41000	41000	41000	41000
45	41000	-19	41000	41000	41000	41000	41000
40	41000	-19	41000	41000	41000	41000	41000

ISA + 15°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
85	31000	-2	32900*	32900*	32900*	32200	30800
80	32300	-5	34600*	34600*	34600*	33500	32100
75	33700	-8	36100*	36100*	36100*	34900	33500
70	35200	-11	37500*	37500*	37500*	36400	35000
65	36700	-13	38900*	38900*	38900*	37900	36500
60	38400	-13	40300*	40300*	40300*	39600	38200
55	40200	-13	41000	41000	41000	41000	40000
50	41000	-13	41000	41000	41000	41000	41000
45	41000	-13	41000	41000	41000	41000	41000
40	41000	-13	41000	41000	41000	41000	41000

ISA + 20°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
85	31000	4	30400*	30400*	30400*	30400*	30400*
80	32300	1	32900*	32900*	32900*	32900*	32100
75	33700	-2	34800*	34800*	34800*	34800*	33500
70	35200	-6	36300*	36300*	36300*	36300*	35000
65	36700	-8	37800*	37800*	37800*	37800*	36500
60	38400	-8	39200*	39200*	39200*	39200*	38200
55	40200	-8	40700*	40700*	40700*	40700*	40000
50	41000	-8	41000	41000	41000	41000	41000
45	41000	-8	41000	41000	41000	41000	41000
40	41000	-8	41000	41000	41000	41000	41000

***Denotes altitude thrust limited in level flight, 100 fpm residual rate of climb.**

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)								
		25	27	29	31	33	35	37	39	41
85	%N1	84.8	85.9	87.1	88.5	90.5				
	MACH	.740	.756	.769	.781	.789				
	KIAS	310	305	297	290	280				
	FF/ENG	1521	1505	1488	1480	1503				
80	%N1	83.5	84.7	85.9	87.2	88.7	91.3			
	MACH	.725	.745	.760	.773	.785	.788			
	KIAS	304	300	294	286	279	267			
	FF/ENG	1440	1429	1412	1395	1395	1431			
75	%N1	82.1	83.4	84.6	85.9	87.1	88.9	92.9		
	MACH	.707	.731	.750	.764	.777	.787	.784		
	KIAS	295	294	289	283	275	267	254		
	FF/ENG	1354	1350	1338	1319	1304	1313	1371		
70	%N1	80.5	82.0	83.3	84.5	85.8	87.1	89.6		
	MACH	.685	.712	.736	.754	.767	.780	.789		
	KIAS	286	286	283	279	272	264	256		
	FF/ENG	1262	1266	1260	1246	1226	1216	1244		
65	%N1	78.8	80.3	81.8	83.1	84.3	85.6	87.4	90.7	
	MACH	.663	.690	.717	.740	.757	.770	.783	.789	
	KIAS	276	276	275	273	268	261	254	244	
	FF/ENG	1169	1176	1178	1170	1154	1135	1141	1179	
60	%N1	77.1	78.4	80.0	81.4	82.8	84.0	85.6	88.0	91.9
	MACH	.642	.665	.693	.720	.742	.759	.772	.785	.788
	KIAS	267	265	266	265	262	257	250	243	233
	FF/ENG	1083	1082	1089	1089	1079	1062	1055	1069	1111
55	%N1	75.3	76.6	78.0	79.5	81.0	82.3	84.0	86.0	88.5
	MACH	.621	.642	.666	.694	.721	.744	.760	.773	.786
	KIAS	257	256	255	255	254	251	245	239	232
	FF/ENG	1003	996	996	1000	999	989	980	979	994
50	%N1	73.3	74.6	76.0	77.4	78.9	80.5	82.1	84.2	86.2
	MACH	.598	.619	.641	.664	.693	.721	.744	.760	.773
	KIAS	248	246	244	243	243	243	240	234	228
	FF/ENG	930	916	910	908	911	909	905	903	902
45	%N1	71.1	72.5	73.8	75.2	76.6	78.1	80.1	82.2	84.3
	MACH	.571	.594	.615	.637	.661	.689	.718	.742	.759
	KIAS	236	235	234	232	231	231	231	228	223
	FF/ENG	851	843	832	824	821	822	833	836	834
40	%N1	68.4	70.0	71.4	72.8	74.1	75.6	77.5	79.8	82.0
	MACH	.541	.563	.587	.609	.631	.655	.682	.712	.737
	KIAS	223	223	223	222	220	219	218	218	216
	FF/ENG	785	779	771	759	749	743	746	754	757

Shaded area approximates optimum altitude.

Long Range Cruise Enroute Fuel and Time - Low Altitudes

Ground to Air Miles Conversions

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
294	269	248	230	214	200	190	181	173	166	159
442	404	371	344	321	300	286	272	260	249	239
590	540	496	459	428	400	381	363	347	332	319
739	676	621	575	535	500	476	454	434	415	399
888	812	746	690	642	600	571	544	520	498	479
1038	949	871	806	750	700	667	636	607	582	559
1188	1086	996	921	857	800	762	727	694	665	638
1339	1224	1122	1037	965	900	857	817	781	747	718
1490	1361	1248	1153	1072	1000	952	908	867	830	797
1642	1499	1374	1269	1180	1100	1047	998	954	913	877
1794	1637	1500	1385	1287	1200	1142	1089	1040	996	956
1947	1776	1626	1501	1395	1300	1237	1180	1127	1079	1036
2101	1916	1753	1618	1502	1400	1332	1270	1213	1161	1115
2255	2055	1880	1734	1610	1500	1428	1361	1300	1244	1195
2409	2195	2007	1851	1718	1600	1523	1451	1386	1327	1274
2564	2335	2134	1968	1826	1700	1618	1542	1473	1410	1353
2720	2476	2262	2084	1934	1800	1713	1633	1559	1492	1432
2876	2617	2390	2201	2042	1900	1808	1723	1645	1574	1511
3033	2758	2518	2318	2150	2000	1903	1813	1731	1657	1590

Reference Fuel And Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		20		24		28	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	1.4	0:42	1.3	0:40	1.1	0:38	0.9	0:37	0.8	0:36
300	2.2	1:01	1.9	0:58	1.7	0:54	1.5	0:52	1.4	0:51
400	2.9	1:21	2.6	1:17	2.3	1:11	2.1	1:08	1.9	1:06
500	3.6	1:40	3.3	1:35	2.9	1:28	2.6	1:24	2.4	1:21
600	4.4	2:00	4.0	1:54	3.5	1:45	3.2	1:40	3.0	1:36
700	5.1	2:20	4.7	2:12	4.1	2:02	3.7	1:56	3.5	1:51
800	5.9	2:40	5.4	2:31	4.7	2:19	4.3	2:12	4.0	2:06
900	6.6	3:00	6.1	2:50	5.3	2:36	4.8	2:28	4.5	2:22
1000	7.3	3:21	6.7	3:09	5.9	2:53	5.4	2:45	5.0	2:37
1100	8.0	3:41	7.4	3:28	6.5	3:11	5.9	3:01	5.6	2:52
1200	8.7	4:02	8.1	3:47	7.1	3:28	6.5	3:17	6.1	3:08
1300	9.5	4:23	8.7	4:07	7.7	3:46	7.0	3:34	6.6	3:23
1400	10.2	4:44	9.4	4:26	8.3	4:03	7.6	3:50	7.1	3:39
1500	10.9	5:05	10.0	4:46	8.9	4:21	8.1	4:07	7.6	3:55
1600	11.6	5:26	10.7	5:06	9.5	4:39	8.7	4:23	8.1	4:10
1700	12.3	5:47	11.4	5:26	10.1	4:57	9.2	4:40	8.6	4:26
1800	13.0	6:09	12.0	5:46	10.7	5:15	9.7	4:57	9.1	4:42
1900	13.7	6:30	12.6	6:06	11.2	5:33	10.2	5:14	9.6	4:58
2000	14.3	6:52	13.3	6:26	11.8	5:51	10.8	5:31	10.1	5:14

Long Range Cruise Enroute Fuel and Time - Low Altitudes

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	40	50	60	70	80
1	-0.1	0.0	0.0	0.1	0.1
2	-0.2	-0.1	0.0	0.1	0.3
3	-0.4	-0.2	0.0	0.2	0.5
4	-0.5	-0.3	0.0	0.3	0.6
5	-0.7	-0.3	0.0	0.4	0.8
6	-0.8	-0.4	0.0	0.5	1.0
7	-0.9	-0.5	0.0	0.6	1.2
8	-1.0	-0.5	0.0	0.7	1.4
9	-1.2	-0.6	0.0	0.8	1.6
10	-1.3	-0.7	0.0	0.9	1.7
11	-1.4	-0.8	0.0	1.0	1.9
12	-1.6	-0.8	0.0	1.1	2.1
13	-1.7	-0.9	0.0	1.2	2.3
14	-1.8	-1.0	0.0	1.3	2.5
15	-1.9	-1.0	0.0	1.4	2.7

Based on .78/280/250 descent.

Long Range Cruise Enroute Fuel and Time - High Altitudes

Ground to Air Miles Conversions

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
537	503	472	445	422	400	382	365	350	336	324
803	753	707	667	632	600	573	548	526	505	486
1070	1003	943	890	843	800	765	732	702	674	649
1337	1254	1179	1113	1054	1000	956	915	878	843	812
1605	1505	1415	1335	1264	1200	1147	1099	1054	1012	975
1874	1757	1651	1558	1475	1400	1339	1282	1230	1181	1138
2144	2009	1888	1781	1686	1600	1530	1465	1405	1350	1300
2413	2262	2125	2005	1898	1800	1721	1648	1581	1519	1463
2684	2515	2362	2228	2109	2000	1913	1831	1756	1688	1625
2956	2769	2600	2452	2320	2200	2104	2014	1932	1856	1787
3228	3023	2838	2676	2531	2400	2295	2198	2107	2024	1949
3502	3278	3076	2900	2743	2600	2486	2380	2283	2193	2111
3775	3534	3315	3124	2954	2800	2677	2563	2458	2361	2273
4050	3789	3554	3349	3166	3000	2868	2746	2633	2529	2435
4325	4046	3794	3573	3378	3200	3059	2928	2807	2697	2596
4602	4303	4034	3798	3590	3400	3250	3110	2982	2864	2757
4878	4561	4274	4024	3802	3600	3441	3293	3157	3032	2919
5156	4819	4515	4249	4014	3800	3632	3475	3331	3199	3079
5435	5078	4756	4475	4226	4000	3822	3658	3506	3366	3240
5715	5338	4997	4701	4438	4200	4013	3839	3679	3533	3400
5996	5598	5239	4927	4651	4400	4203	4021	3853	3699	3560
6278	5859	5482	5154	4864	4600	4394	4203	4027	3866	3720
6562	6122	5725	5381	5076	4800	4584	4384	4200	4032	3879
6846	6385	5969	5608	5289	5000	4775	4566	4374	4198	4038

Long Range Cruise Enroute Fuel and Time - High Altitudes

Reference Fuel And Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	29		31		33		35		37	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
400	1.9	1:05	1.8	1:03	1.7	1:02	1.7	1:02	1.6	1:01
600	2.9	1:35	2.8	1:32	2.7	1:30	2.6	1:29	2.6	1:29
800	3.9	2:05	3.8	2:01	3.7	1:59	3.6	1:57	3.5	1:56
1000	5.0	2:35	4.8	2:30	4.7	2:27	4.5	2:25	4.4	2:23
1200	6.0	3:05	5.8	3:00	5.6	2:56	5.4	2:53	5.3	2:51
1400	7.0	3:36	6.8	3:30	6.6	3:24	6.3	3:21	6.2	3:18
1600	8.0	4:07	7.7	4:00	7.5	3:53	7.3	3:49	7.1	3:46
1800	8.9	4:38	8.7	4:30	8.4	4:22	8.2	4:17	8.0	4:13
2000	9.9	5:09	9.6	5:00	9.3	4:52	9.1	4:46	8.8	4:41
2200	10.9	5:41	10.6	5:31	10.2	5:22	9.9	5:15	9.7	5:09
2400	11.8	6:13	11.5	6:02	11.2	5:51	10.8	5:43	10.5	5:37
2600	12.8	6:45	12.4	6:33	12.0	6:21	11.7	6:12	11.4	6:05
2800	13.7	7:18	13.3	7:05	12.9	6:52	12.5	6:42	12.2	6:34
3000	14.6	7:50	14.2	7:36	13.8	7:22	13.4	7:11	13.1	7:02
3200	15.5	8:23	15.1	8:08	14.7	7:53	14.2	7:41	13.9	7:31
3400	16.5	8:56	16.0	8:40	15.5	8:25	15.1	8:11	14.7	8:00
3600	17.4	9:30	16.9	9:13	16.4	8:56	15.9	8:41	15.5	8:29
3800	18.3	10:04	17.7	9:45	17.2	9:28	16.7	9:12	16.3	8:58
4000	19.2	10:37	18.6	10:18	18.1	9:59	17.6	9:42	17.1	9:28
4200	20.1	11:12	19.5	10:52	18.9	10:32	18.4	10:14	17.9	9:57
4400	20.9	11:46	20.3	11:25	19.7	11:04	19.2	10:45	18.7	10:27
4600	21.8	12:22	21.2	11:59	20.6	11:37	20.0	11:16	19.4	10:58
4800	22.7	12:57	22.0	12:33	21.4	12:10	20.8	11:48	20.2	11:28
5000	23.6	13:32	22.9	13:07	22.2	12:43	21.5	12:20	21.0	11:59

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	40	50	60	70	80
2	-0.3	-0.2	0.0	0.2	0.7
4	-0.6	-0.3	0.0	0.5	1.3
6	-0.9	-0.5	0.0	0.7	1.9
8	-1.2	-0.7	0.0	1.0	2.5
10	-1.5	-0.8	0.0	1.2	3.0
12	-1.8	-1.0	0.0	1.4	3.5
14	-2.1	-1.1	0.0	1.6	3.9
16	-2.5	-1.3	0.0	1.8	4.3
18	-2.8	-1.4	0.0	2.0	4.7
20	-3.1	-1.6	0.0	2.1	5.0
22	-3.5	-1.7	0.0	2.3	5.3
24	-3.8	-1.9	0.0	2.4	5.5

Based on .78/280/250 descent.

Long Range Cruise Wind-Altitude Trade

PRESSURE ALTITUDE (1000 FT)	CRUISE WEIGHT (1000 KG)								
	80	75	70	65	60	55	50	45	40
41				43	15	2	1	11	27
39			33	11	1	1	10	24	42
37	51	23	7	0	2	10	23	39	56
35	14	3	0	3	11	23	37	53	69
33	1	0	4	13	24	37	51	66	80
31	2	7	15	26	38	51	64	77	88
29	10	18	28	39	51	64	75	86	95
27	22	31	42	53	64	75	85	93	101
25	35	45	55	65	75	84	92	99	104

The above wind factor table is for calculation of wind required to maintain present range capability at new pressure altitude, i.e., break-even wind.

Method:

1. **Read wind factors for present and new altitudes from table.**
2. **Determine difference (new altitude wind factor minus present altitude wind factor); This difference may be negative or positive.**
3. **Break-even wind at new altitude is present altitude wind plus difference from step 2.**

Descent

.78/280/250

PRESSURE ALTITUDE (FT)	TIME (MIN)	FUEL (KG)	DISTANCE (NM)			
			LANDING WEIGHT (1000 KG)			
			40	50	60	70
41000	27	340	104	122	135	144
39000	26	340	99	116	130	138
37000	25	340	94	111	124	133
35000	25	330	90	106	118	127
33000	24	330	87	102	114	122
31000	23	320	82	96	107	115
29000	22	310	77	90	101	108
27000	21	310	73	85	94	101
25000	20	300	68	79	88	94
23000	19	290	63	73	81	87
21000	18	280	59	68	75	80
19000	17	270	54	62	69	73
17000	16	260	49	57	63	66
15000	14	240	45	51	56	59
10000	11	200	31	35	38	39
5000	7	150	18	20	21	21
1500	4	110	9	9	9	9

Allowances for a straight-in approach are included.

Holding

Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)								
		1500	5000	10000	15000	20000	25000	30000	35000	41000
80	%N1	62.4	65.4	69.0	73.1	77.2	81.5	85.4		
	KIAS	244	245	246	247	249	251	254		
	FF/ENG	1410	1380	1370	1360	1330	1330	1360		
75	%N1	60.7	63.7	67.4	71.5	75.5	79.9	83.8	88.2	
	KIAS	236	237	238	239	241	243	245	249	
	FF/ENG	1330	1300	1290	1280	1250	1240	1270	1300	
70	%N1	58.9	61.7	65.8	69.7	73.8	78.2	82.2	86.4	
	KIAS	228	229	230	231	232	234	237	240	
	FF/ENG	1250	1220	1210	1200	1170	1160	1180	1200	
65	%N1	57.2	59.8	64.1	67.7	72.0	76.3	80.4	84.6	
	KIAS	220	220	222	223	224	225	227	230	
	FF/ENG	1170	1150	1130	1110	1100	1070	1090	1100	
60	%N1	55.3	57.8	61.9	65.8	70.0	74.2	78.5	82.6	
	KIAS	211	212	213	213	215	216	218	220	
	FF/ENG	1090	1070	1050	1030	1020	990	1000	1010	
55	%N1	53.2	55.8	59.6	63.8	67.7	72.1	76.4	80.5	87.8
	KIAS	202	203	203	204	205	206	208	210	214
	FF/ENG	1010	990	970	950	940	910	910	920	980
50	%N1	51.0	53.6	57.2	61.5	65.3	69.8	73.9	78.3	85.3
	KIAS	192	193	194	195	195	197	198	200	203
	FF/ENG	940	910	890	870	860	850	840	850	890
45	%N1	48.7	51.1	54.8	58.6	63.0	67.0	71.3	75.8	82.7
	KIAS	184	184	184	184	185	186	187	189	191
	FF/ENG	860	830	830	810	790	780	760	760	790
40	%N1	46.2	48.6	52.2	55.8	60.2	64.1	68.5	72.9	79.9
	KIAS	177	177	177	177	177	177	177	177	180
	FF/ENG	800	780	750	730	710	700	690	680	700

This table includes 5% additional fuel for holding in a racetrack pattern.

Intentionally
Blank

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF15	ONE REV	NO REV

Dry Runway

MAX MANUAL	880	55/-50	20/25	-30/110	10/-10	20/-20	30	15	35
AUTOBRAKE MAX	1125	60/-60	25/35	-40/140	0/0	25/-25	55	0	0
AUTOBRAKE 3	1570	95/-100	40/60	-70/230	0/0	40/-40	90	0	0
AUTOBRAKE 2	2020	135/-150	60/85	-95/325	15/-30	55/-55	100	25	25
AUTOBRAKE 1	2255	170/-180	75/105	-110/385	50/-65	65/-65	95	185	205

Good Reported Braking Action

MAX MANUAL	1220	70/-75	30/45	-55/190	30/-25	30/-30	45	65	145
AUTOBRAKE MAX	1290	75/-80	35/45	-55/195	25/-20	30/-30	55	70	160
AUTOBRAKE 3	1575	95/-100	40/60	-70/235	5/0	40/-40	90	5	15
AUTOBRAKE 2	2020	135/-150	60/85	-95/325	15/-30	55/-55	100	25	25
AUTOBRAKE 1	2255	170/-180	75/105	-110/385	50/-65	65/-65	95	185	205

Medium Reported Braking Action

MAX MANUAL	1680	115/-115	50/70	-85/320	75/-60	40/-45	60	185	455
AUTOBRAKE MAX	1690	115/-115	50/75	-90/320	70/-55	45/-45	70	180	450
AUTOBRAKE 3	1750	115/-120	50/75	-90/325	60/-35	45/-45	90	150	425
AUTOBRAKE 2	2070	140/-150	60/85	-105/365	45/-45	55/-60	100	65	195
AUTOBRAKE 1	2270	170/-180	75/105	-115/400	70/-70	65/-65	95	200	265

Poor Reported Braking Action

MAX MANUAL	2210	165/-165	70/105	-135/505	185/-120	55/-60	75	405	1120
AUTOBRAKE MAX	2210	165/-165	75/105	-135/505	185/-120	55/-60	75	405	1120
AUTOBRAKE 3	2210	165/-165	75/105	-135/505	185/-115	55/-60	80	405	1120
AUTOBRAKE 2	2340	170/-175	75/110	-140/520	165/-105	60/-65	95	310	1005
AUTOBRAKE 1	2460	185/-195	80/115	-145/540	170/-120	65/-70	95	365	920

Reference distance is based on sea level, standard day, no wind or slope, VREF15 approach speed, two-engine detent No. 2 reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 55 m.
For autobrake and manual speedbrakes, increase reference landing distance by 45 m.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF30	ONE REV	NO REV

Dry Runway

MAX MANUAL	855	50/-45	15/25	-30/110	10/-10	15/-15	30	15	30
AUTOBRAKE MAX	1070	55/-60	25/30	-40/135	0/0	25/-25	50	0	0
AUTOBRAKE 3	1490	85/-95	40/55	-65/225	0/0	40/-40	85	0	0
AUTOBRAKE 2	1900	125/-135	55/80	-90/315	15/-30	55/-55	90	30	30
AUTOBRAKE 1	2110	155/-160	70/95	-110/370	50/-60	60/-60	85	165	195

Good Reported Braking Action

MAX MANUAL	1180	65/-70	30/40	-55/190	30/-25	25/-30	45	60	135
AUTOBRAKE MAX	1250	70/-75	30/45	-55/195	25/-20	30/-30	55	65	145
AUTOBRAKE 3	1490	90/-95	40/55	-65/230	5/0	40/-40	85	5	15
AUTOBRAKE 2	1900	125/-135	55/80	-90/315	15/-30	55/-55	90	30	30
AUTOBRAKE 1	2110	155/-160	70/95	-110/370	50/-60	60/-60	85	165	195

Medium Reported Braking Action

MAX MANUAL	1610	105/-110	45/65	-85/310	70/-55	40/-40	60	165	400
AUTOBRAKE MAX	1620	110/-110	50/70	-85/315	70/-50	40/-40	70	165	400
AUTOBRAKE 3	1670	110/-110	50/70	-90/320	60/-35	45/-45	85	140	385
AUTOBRAKE 2	1955	130/-140	55/80	-100/355	45/-45	55/-55	90	65	180
AUTOBRAKE 1	2125	155/-165	70/95	-110/385	70/-65	60/-60	85	180	255

Poor Reported Braking Action

MAX MANUAL	2090	155/-155	65/100	-130/495	175/-115	55/-60	70	355	955
AUTOBRAKE MAX	2095	155/-155	65/100	-130/495	180/-115	55/-60	70	355	960
AUTOBRAKE 3	2095	155/-155	65/100	-130/495	175/-110	55/-60	80	355	960
AUTOBRAKE 2	2210	160/-160	70/100	-135/510	160/-105	55/-60	90	280	860
AUTOBRAKE 1	2310	170/-175	75/105	-140/525	165/-115	60/-65	85	330	805

Reference distance is based on sea level, standard day, no wind or slope, VREF30 approach speed, two-engine detent No. 2 reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 50 m.
For autobrake and manual speedbrakes, increase reference landing distance by 45 m.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 40

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF40	ONE REV	NO REV

Dry Runway

MAX MANUAL	840	50/-40	15/25	-30/105	10/-10	15/-15	30	15	30
AUTOBRAKE MAX	1045	50/-55	25/35	-40/130	0/0	20/-25	50	0	0
AUTOBRAKE 3	1440	85/-90	40/55	-65/220	0/0	35/-35	85	0	0
AUTOBRAKE 2	1835	120/-130	55/80	-90/305	10/-30	50/-50	90	20	20
AUTOBRAKE 1	2045	150/-155	65/90	-105/365	45/-55	60/-55	85	145	175

Good Reported Braking Action

MAX MANUAL	1165	65/-70	30/45	-55/190	30/-25	25/-25	45	55	130
AUTOBRAKE MAX	1235	70/-75	30/45	-55/195	25/-20	30/-30	55	60	140
AUTOBRAKE 3	1445	85/-90	40/55	-65/225	10/-5	35/-35	85	5	15
AUTOBRAKE 2	1835	120/-130	55/80	-90/305	10/-30	50/-50	90	20	20
AUTOBRAKE 1	2045	150/-155	65/90	-105/365	45/-55	60/-55	85	145	175

Medium Reported Braking Action

MAX MANUAL	1575	105/-105	45/65	-85/310	70/-55	40/-40	60	155	375
AUTOBRAKE MAX	1590	105/-110	45/70	-85/310	70/-50	40/-40	70	155	370
AUTOBRAKE 3	1630	105/-110	50/70	-85/315	60/-40	40/-45	85	140	370
AUTOBRAKE 2	1895	125/-135	55/80	-100/350	45/-45	50/-50	90	60	175
AUTOBRAKE 1	2055	150/-155	65/95	-110/380	70/-65	55/-60	85	160	235

Poor Reported Braking Action

MAX MANUAL	2040	150/-150	65/95	-130/490	175/-110	50/-55	70	330	875
AUTOBRAKE MAX	2045	150/-150	65/100	-130/490	175/-115	50/-55	70	330	875
AUTOBRAKE 3	2050	155/-150	65/100	-130/490	175/-110	50/-55	80	330	875
AUTOBRAKE 2	2150	155/-155	70/100	-130/500	155/-105	55/-60	85	260	795
AUTOBRAKE 1	2240	165/-170	70/105	-135/515	165/-115	60/-65	85	305	745

Reference distance is based on sea level, standard day, no wind or slope, VREF40 approach speed, two-engine detent No. 2 reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 50 m.
For autobrake and manual speedbrakes, increase reference landing distance by 45 m.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Airspeed Unreliable (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	945	65/-55	20/30	-35/115	10/-10	20/-20	N/A	20	45
AUTOBRAKE MAX	1230	60/-65	30/40	-45/145	0/0	30/-30	N/A	0	0
AUTOBRAKE 2	2195	150/-160	70/95	-100/340	30/-45	60/-60	N/A	105	105

Good Reported Braking Action

MAX MANUAL	1300	75/-75	35/45	-55/195	30/-25	30/-30	N/A	75	175
AUTOBRAKE MAX	1385	80/-80	35/50	-60/205	25/-20	35/-35	N/A	85	190
AUTOBRAKE 2	2195	150/-160	70/95	-100/340	30/-45	60/-60	N/A	105	105

Medium Reported Braking Action

MAX MANUAL	1775	120/-120	55/75	-90/325	75/-60	45/-45	N/A	210	525
AUTOBRAKE MAX	1800	120/-120	55/75	-90/325	70/-55	45/-50	N/A	210	525
AUTOBRAKE 3	1915	120/-125	55/80	-95/340	50/-35	50/-50	N/A	135	445

Poor Reported Braking Action

MAX MANUAL	2305	170/-170	75/110	-135/510	180/-120	60/-65	N/A	445	1250
AUTOBRAKE MAX	2305	170/-170	75/110	-135/510	180/-120	60/-65	N/A	440	1250
AUTOBRAKE 3	2320	170/-170	75/110	-135/510	175/-105	60/-65	N/A	440	1250

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Airspeed Unreliable (Flaps 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	915	55/-50	20/25	-35/115	10/-10	20/-20	N/A	20	40
AUTOBRAKE MAX	1175	55/-60	25/35	-45/145	0/0	25/-25	N/A	0	0
AUTOBRAKE 2	2065	135/-145	65/85	-95/325	35/-40	60/-60	N/A	100	100

Good Reported Braking Action

MAX MANUAL	1265	70/-75	35/45	-55/195	30/-25	30/-30	N/A	70	165
AUTOBRAKE MAX	1350	75/-80	35/50	-60/200	25/-25	30/-30	N/A	80	180
AUTOBRAKE 2	2065	135/-145	65/85	-95/325	35/-40	60/-60	N/A	100	100

Medium Reported Braking Action

MAX MANUAL	1705	110/-115	50/70	-85/320	70/-55	45/-45	N/A	190	465
AUTOBRAKE MAX	1735	115/-115	50/70	-90/320	65/-55	45/-45	N/A	190	470
AUTOBRAKE 3	1830	115/-115	55/75	-90/330	50/-35	50/-50	N/A	125	405

Poor Reported Braking Action

MAX MANUAL	2185	160/-155	70/100	-130/500	170/-115	55/-60	N/A	390	1070
AUTOBRAKE MAX	2190	160/-160	70/100	-130/500	175/-115	55/-60	N/A	390	1070
AUTOBRAKE 3	2210	160/-160	70/100	-130/500	165/-100	55/-60	N/A	390	1075

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Airspeed Unreliable (Flaps 40)

VREF40

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	905	55/-45	20/25	-30/110	10/-10	20/-20	N/A	20	40
AUTOBRAKE MAX	1145	55/-60	25/35	-40/140	0/0	25/-25	N/A	0	0
AUTOBRAKE 2	1995	135/-140	60/85	-95/320	30/-40	55/-55	N/A	90	90

Good Reported Braking Action

MAX MANUAL	1250	70/-70	35/45	-55/195	30/-25	30/-30	N/A	70	155
AUTOBRAKE MAX	1335	75/-80	35/50	-60/200	25/-25	30/-30	N/A	75	170
AUTOBRAKE 2	1995	135/-140	60/85	-95/320	35/-40	55/-55	N/A	90	90

Medium Reported Braking Action

MAX MANUAL	1675	110/-110	50/70	-85/315	70/-60	40/-45	N/A	180	435
AUTOBRAKE MAX	1705	115/-115	50/75	-90/320	65/-55	45/-45	N/A	180	440
AUTOBRAKE 3	1785	110/-115	50/75	-90/330	50/-40	45/-50	N/A	125	390

Poor Reported Braking Action

MAX MANUAL	2140	155/-155	70/100	-130/495	170/-110	55/-60	N/A	365	975
AUTOBRAKE MAX	2145	155/-155	70/100	-130/495	170/-110	55/-60	N/A	360	975
AUTOBRAKE 3	2165	160/-155	70/100	-130/495	165/-105	55/-60	N/A	365	985

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

All Flaps Up Landing

VREF40 + 55

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1195	155/-70	30/70	-40/135	15/-10	30/-30	35	35	70
AUTOBRAKE MAX	1725	85/-80	45/60	-55/180	5/-5	45/-45	70	0	5
AUTOBRAKE 2	3090	195/-215	105/145	-120/405	70/-75	95/-95	95	275	320

Good Reported Braking Action

MAX MANUAL	1635	85/-90	45/65	-65/220	35/-30	40/-45	45	105	240
AUTOBRAKE MAX	1860	90/-95	50/70	-70/235	25/-20	50/-50	65	80	215
AUTOBRAKE 2	3090	195/-215	105/145	-120/405	70/-75	95/-95	95	275	320

Medium Reported Braking Action

MAX MANUAL	2305	145/-150	75/105	-100/360	90/-75	65/-65	60	295	735
AUTOBRAKE MAX	2380	145/-150	75/110	-105/365	85/-70	65/-65	70	300	760
AUTOBRAKE 3	2720	140/-160	85/120	-115/395	55/-50	80/-80	105	150	485

Poor Reported Braking Action

MAX MANUAL	3050	215/-215	110/155	-155/570	215/-150	85/-90	75	640	1825
AUTOBRAKE MAX	3050	215/-215	110/155	-155/570	215/-140	85/-90	85	635	1810
AUTOBRAKE 3	3165	205/-210	110/155	-155/580	190/-130	90/-95	105	555	1750

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

ANTISKID INOPERATIVE (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1570	95/-100	40/60	-75/265	45/-40	35/-40	60	125	295
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1760	115/-115	50/70	-90/325	70/-55	40/-45	65	185	460
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2250	165/-160	70/105	-135/505	170/-110	55/-60	75	400	1135
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	3015	240/-235	100/150	-220/935	1360/-260	65/-90	90	985	3725
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

ANTISKID INOPERATIVE (Flaps 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1510	90/-95	40/55	-75/260	45/-40	35/-35	60	110	265
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1685	105/-110	45/65	-85/320	65/-55	40/-40	65	165	405
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2140	150/-150	65/95	-130/495	165/-105	50/-55	75	350	970
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	2845	225/-215	90/140	-215/915	1265/-245	60/-85	85	865	3105
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

ANTISKID INOPERATIVE (Flaps 40)

VREF40

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1480	90/-90	40/55	-75/260	45/-40	35/-35	60	105	250
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1650	105/-105	45/65	-85/315	65/-55	40/-40	65	155	375
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2090	150/-145	65/95	-130/490	165/-105	50/-55	75	325	885
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	2765	215/-210	90/135	-210/905	1220/-240	60/-80	80	805	2815
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Jammed or Restricted Flight Controls (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	880	60/-50	20/25	-30/110	10/-10	15/-20	30	15	40
AUTOBRAKE MAX	1125	60/-60	25/35	-40/140	0/0	25/-25	55	0	0
AUTOBRAKE 2	2000	140/-150	60/85	-95/320	20/-30	55/-55	100	45	45
Good Reported Braking Action									
MAX MANUAL	1210	70/-70	30/45	-55/190	25/-25	30/-30	45	70	155
AUTOBRAKE MAX	1280	75/-80	35/45	-55/195	25/-20	30/-30	50	75	170
AUTOBRAKE 2	2000	140/-150	60/85	-95/320	20/-30	55/-55	100	45	45
Medium Reported Braking Action									
MAX MANUAL	1655	110/-110	50/70	-85/315	70/-55	40/-45	60	190	480
AUTOBRAKE MAX	1665	115/-115	50/70	-85/315	65/-50	40/-45	70	190	475
AUTOBRAKE 3	1735	115/-115	50/70	-90/325	55/-35	45/-45	90	145	440
Poor Reported Braking Action									
MAX MANUAL	2155	165/-160	70/105	-130/500	175/-115	55/-60	75	415	1170
AUTOBRAKE MAX	2155	165/-160	70/105	-130/500	175/-115	55/-60	75	415	1170
AUTOBRAKE 3	2155	165/-160	70/105	-130/500	175/-110	55/-60	75	415	1170

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

LEADING EDGE FLAPS TRANSIT (Flaps 15)

VREF15 + 15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	990	65/-55	20/30	-35/120	10/-10	20/-20	35	25	50
AUTOBRAKE MAX	1290	65/-70	30/40	-45/150	0/0	30/-30	60	0	0
AUTOBRAKE 2	2345	155/-170	75/100	-105/350	30/-45	70/-65	100	95	95

Good Reported Braking Action

MAX MANUAL	1385	80/-80	35/50	-60/205	30/-30	35/-35	50	90	205
AUTOBRAKE MAX	1465	85/-85	40/55	-60/210	30/-25	35/-35	55	95	220
AUTOBRAKE 2	2345	155/-170	75/100	-105/350	30/-45	70/-65	100	95	95

Medium Reported Braking Action

MAX MANUAL	1900	125/-130	60/85	-95/335	80/-65	50/-50	65	240	610
AUTOBRAKE MAX	1915	130/-130	60/85	-95/335	75/-60	50/-50	70	240	610
AUTOBRAKE 3	2025	125/-130	60/85	-95/350	55/-35	55/-55	95	165	540

Poor Reported Braking Action

MAX MANUAL	2470	185/-180	85/120	-140/525	195/-130	65/-70	75	510	1460
AUTOBRAKE MAX	2470	185/-180	85/120	-140/525	195/-130	65/-70	75	510	1460
AUTOBRAKE 3	2475	185/-180	85/125	-140/525	195/-115	65/-70	90	505	1460

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

LOSS OF SYSTEM A (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	965	65/-50	20/30	-35/120	15/-10	20/-20	40	25	40
AUTOBRAKE MAX	1125	55/-60	25/35	-40/140	0/0	25/-25	55	0	0
AUTOBRAKE 2	2050	135/-145	60/80	-95/325	0/-5	60/-60	125	0	0

Good Reported Braking Action

MAX MANUAL	1395	85/-85	40/55	-60/210	40/-35	35/-35	60	110	220
AUTOBRAKE MAX	1395	85/-90	40/55	-60/210	35/-25	35/-35	65	105	215
AUTOBRAKE 2	2050	135/-145	60/80	-95/325	0/-5	60/-60	125	0	0

Medium Reported Braking Action

MAX MANUAL	1920	135/-135	60/85	-95/345	95/-75	50/-50	80	295	705
AUTOBRAKE MAX	1905	135/-135	60/85	-95/345	100/-75	50/-50	80	290	695
AUTOBRAKE 3	1905	135/-135	60/85	-95/345	100/-75	50/-50	80	290	695

Poor Reported Braking Action

MAX MANUAL	2495	195/-190	85/125	-145/540	220/-145	65/-70	95	605	1765
AUTOBRAKE MAX	2490	195/-190	85/125	-145/540	225/-150	65/-70	95	605	1765
AUTOBRAKE 3	2490	195/-190	85/125	-145/540	225/-150	65/-70	95	605	1765

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

LOSS OF SYSTEM A (Flaps 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	935	60/-45	20/30	-35/115	15/-10	20/-20	45	25	35
AUTOBRAKE MAX	1070	55/-60	25/30	-40/135	0/0	25/-25	50	5	10
AUTOBRAKE 2	1930	125/-135	55/75	-95/315	0/0	55/-55	120	0	0

Good Reported Braking Action

MAX MANUAL	1350	80/-80	35/50	-60/210	40/-35	30/-35	65	100	200
AUTOBRAKE MAX	1350	80/-85	35/50	-60/210	30/-30	30/-35	65	100	195
AUTOBRAKE 2	1930	125/-135	55/75	-95/315	0/0	55/-55	120	0	0

Medium Reported Braking Action

MAX MANUAL	1830	125/-125	55/80	-95/340	90/-70	45/-50	80	260	615
AUTOBRAKE MAX	1820	125/-125	55/80	-95/340	95/-75	45/-50	80	260	610
AUTOBRAKE 3	1820	125/-125	55/80	-95/340	95/-75	45/-50	80	260	610

Poor Reported Braking Action

MAX MANUAL	2360	180/-175	80/115	-140/530	210/-135	60/-65	90	530	1475
AUTOBRAKE MAX	2355	180/-175	80/115	-140/530	215/-140	60/-65	90	530	1475
AUTOBRAKE 3	2360	180/-175	80/115	-140/530	215/-140	60/-65	90	530	1475

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

LOSS OF SYSTEM A (Flaps 40)

VREF40

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

BRAKING CONFIGURATION	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	ONE REV	NO REV
MAX MANUAL	935	55/-45	20/30	-35/115	15/-10	20/-20	45	25	35
AUTOBRAKE MAX	1045	55/-55	25/35	-40/135	5/0	25/-25	50	10	20
AUTOBRAKE 2	1860	120/-130	55/75	-90/310	0/0	50/-50	115	0	0

Good Reported Braking Action

BRAKING CONFIGURATION	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	ONE REV	NO REV
MAX MANUAL	1330	80/-80	35/50	-60/210	40/-35	30/-30	65	95	190
AUTOBRAKE MAX	1335	80/-85	35/55	-60/210	35/-30	30/-30	70	95	185
AUTOBRAKE 2	1860	120/-130	55/75	-90/310	0/0	50/-50	115	0	0

Medium Reported Braking Action

BRAKING CONFIGURATION	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	ONE REV	NO REV
MAX MANUAL	1790	125/-120	55/80	-95/335	90/-70	45/-45	80	240	560
AUTOBRAKE MAX	1785	125/-120	55/80	-95/335	95/-75	45/-45	80	240	560
AUTOBRAKE 3	1785	125/-120	55/80	-95/335	95/-75	45/-45	80	240	560

Poor Reported Braking Action

BRAKING CONFIGURATION	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	ONE REV	NO REV
MAX MANUAL	2285	175/-170	75/115	-140/525	205/-135	60/-65	90	480	1305
AUTOBRAKE MAX	2290	175/-170	75/115	-140/525	210/-140	60/-65	90	480	1305
AUTOBRAKE 3	2290	175/-170	75/115	-140/525	210/-140	60/-65	90	480	1305

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

LOSS OF SYSTEM A AND SYSTEM B (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1440	75/-80	35/50	-60/195	35/-30	35/-35	75	-10	60
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1670	95/-100	45/60	-70/240	55/-45	40/-40	85	10	145
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2295	150/-150	70/100	-110/385	120/-95	55/-60	105	150	665
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	2955	215/-210	95/145	-160/590	260/-175	75/-80	120	450	1910
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

LOSS OF SYSTEM B (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1015	50/-55	25/30	-40/135	15/-15	20/-20	40	35	55
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1280	75/-75	35/45	-55/195	30/-25	30/-30	50	80	155
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	1755	120/-120	50/75	-90/325	80/-60	45/-45	65	225	510
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	2285	175/-170	75/110	-135/515	190/-125	55/-65	80	475	1290
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

MANUAL REVERSION (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1440	75/-80	35/50	-60/195	35/-30	35/-35	75	-10	60
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1670	95/-100	45/60	-70/240	55/-45	40/-40	85	10	145
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2295	150/-150	70/100	-110/385	120/-95	55/-60	105	150	665
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	2955	215/-210	95/145	-160/590	260/-175	75/-80	120	450	1910
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

One Engine Inoperative Landing (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	890	60/-50	20/30	-35/110	10/-10	20/-20	35	0	20
AUTOBRAKE MAX	1125	60/-60	30/40	-40/140	0/0	25/-25	55	0	0
AUTOBRAKE 2	2045	135/-145	65/90	-95/325	0/-10	60/-60	120	0	0
Good Reported Braking Action									
MAX MANUAL	1260	75/-75	35/50	-55/200	30/-30	30/-30	50	0	85
AUTOBRAKE MAX	1340	80/-85	40/50	-60/205	30/-25	30/-30	55	0	90
AUTOBRAKE 2	2045	135/-145	65/90	-95/325	0/-10	60/-60	120	0	0
Medium Reported Braking Action									
MAX MANUAL	1800	120/-125	60/80	-95/340	90/-70	45/-50	70	0	270
AUTOBRAKE MAX	1815	125/-125	60/85	-95/345	85/-65	50/-50	80	0	270
AUTOBRAKE 3	1845	125/-130	60/85	-95/345	85/-55	50/-50	85	0	275
Poor Reported Braking Action									
MAX MANUAL	2470	185/-185	90/125	-150/560	245/-155	65/-70	85	0	685
AUTOBRAKE MAX	2470	185/-185	90/125	-150/560	250/-160	70/-70	85	0	685
AUTOBRAKE 3	2475	190/-190	90/125	-150/560	250/-150	70/-70	95	0	685

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

One Engine Inoperative Landing (Flaps 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	860	55/-45	20/25	-30/110	10/-10	15/-15	35	0	15
AUTOBRAKE MAX	1070	55/-60	25/35	-40/135	0/0	25/-25	50	0	0
AUTOBRAKE 2	1920	125/-130	60/85	-95/315	5/-10	55/-55	115	0	0

Good Reported Braking Action

MAX MANUAL	1215	70/-75	35/45	-55/195	30/-25	30/-30	50	0	75
AUTOBRAKE MAX	1295	75/-80	35/50	-60/205	30/-25	30/-30	60	0	85
AUTOBRAKE 2	1920	125/-130	60/85	-95/315	5/-10	55/-55	115	0	0

Medium Reported Braking Action

MAX MANUAL	1710	115/-115	55/75	-90/335	90/-70	45/-45	65	0	235
AUTOBRAKE MAX	1730	115/-120	55/75	-95/335	80/-60	45/-45	75	0	235
AUTOBRAKE 3	1755	115/-120	55/80	-95/335	85/-55	45/-45	85	0	245

Poor Reported Braking Action

MAX MANUAL	2315	170/-170	80/115	-145/545	230/-145	65/-65	80	0	575
AUTOBRAKE MAX	2315	170/-170	80/115	-145/545	235/-150	65/-65	85	0	575
AUTOBRAKE 3	2330	175/-175	80/115	-145/545	230/-140	65/-65	90	0	580

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Stabilizer Trim Inoperative (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	880	60/-50	20/25	-30/110	10/-10	15/-20	30	15	40
AUTOBRAKE MAX	1125	60/-60	25/35	-40/140	0/0	25/-25	55	0	0
AUTOBRAKE 2	2000	140/-150	60/85	-95/320	20/-30	55/-55	100	45	45

Good Reported Braking Action

MAX MANUAL	1210	70/-70	30/45	-55/190	25/-25	30/-30	45	70	155
AUTOBRAKE MAX	1280	75/-80	35/45	-55/195	25/-20	30/-30	50	75	170
AUTOBRAKE 2	2000	140/-150	60/85	-95/320	20/-30	55/-55	100	45	45

Medium Reported Braking Action

MAX MANUAL	1655	110/-110	50/70	-85/315	70/-55	40/-45	60	190	480
AUTOBRAKE MAX	1665	115/-115	50/70	-85/315	65/-50	40/-45	70	190	475
AUTOBRAKE 3	1735	115/-115	50/70	-90/325	55/-35	45/-45	90	145	440

Poor Reported Braking Action

MAX MANUAL	2155	165/-160	70/105	-130/500	175/-115	55/-60	75	415	1170
AUTOBRAKE MAX	2155	165/-160	70/105	-130/500	175/-115	55/-60	75	415	1170
AUTOBRAKE 3	2155	165/-160	70/105	-130/500	175/-110	55/-60	75	415	1170

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Asymmetry (1 ≤ Flap Lever <15)

VREF40 + 30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1025	80/-60	25/35	-35/125	10/-10	20/-20	35	25	55
AUTOBRAKE MAX	1400	65/-70	35/50	-50/160	5/-5	35/-35	65	0	5
AUTOBRAKE 2	2495	160/-175	90/125	-110/360	45/-55	75/-70	95	155	160

Good Reported Braking Action

MAX MANUAL	1410	75/-80	40/60	-60/205	30/-25	35/-35	45	85	195
AUTOBRAKE MAX	1540	80/-85	45/65	-60/215	25/-20	40/-40	60	90	215
AUTOBRAKE 2	2500	160/-175	90/125	-110/360	45/-55	75/-70	95	155	160

Medium Reported Braking Action

MAX MANUAL	1955	125/-125	65/95	-95/335	80/-65	50/-55	60	235	590
AUTOBRAKE MAX	2000	125/-130	70/100	-95/340	75/-60	50/-55	70	240	600
AUTOBRAKE 3	2180	125/-130	70/105	-100/360	50/-35	60/-60	100	135	450

Poor Reported Braking Action

MAX MANUAL	2555	185/-185	95/140	-140/530	195/-130	70/-75	75	505	1425
AUTOBRAKE MAX	2555	185/-180	95/140	-140/530	195/-130	70/-75	75	500	1420
AUTOBRAKE 3	2595	180/-180	95/140	-140/535	180/-110	70/-75	95	485	1410

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Asymmetry (Flap Lever 15 or 25)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	880	60/-50	20/30	-30/110	10/-10	15/-20	30	15	40
AUTOBRAKE MAX	1125	60/-60	30/40	-40/140	0/0	25/-25	55	0	0
AUTOBRAKE 2	2000	140/-150	70/90	-95/320	20/-30	55/-55	100	45	45

Good Reported Braking Action

MAX MANUAL	1210	70/-70	35/50	-55/190	25/-25	30/-30	45	70	155
AUTOBRAKE MAX	1280	75/-80	35/50	-55/195	25/-20	30/-30	50	75	170
AUTOBRAKE 2	2000	140/-150	70/90	-95/320	20/-30	55/-55	100	45	45

Medium Reported Braking Action

MAX MANUAL	1655	110/-110	55/75	-85/315	70/-55	40/-45	60	190	480
AUTOBRAKE MAX	1665	115/-115	55/80	-85/315	65/-50	40/-45	70	190	475
AUTOBRAKE 3	1735	115/-115	55/80	-90/325	55/-35	45/-45	90	145	440

Poor Reported Braking Action

MAX MANUAL	2155	165/-160	80/115	-130/500	175/-115	55/-60	75	415	1170
AUTOBRAKE MAX	2155	165/-160	80/115	-130/500	175/-115	55/-60	75	415	1170
AUTOBRAKE 3	2155	165/-160	80/115	-130/500	175/-110	55/-60	75	415	1170

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Asymmetry (Flap Lever 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	855	50/-45	20/25	-30/110	10/-10	15/-15	30	15	35
AUTOBRAKE MAX	1070	55/-60	25/35	-40/135	0/0	25/-25	50	0	0
AUTOBRAKE 2	1885	125/-135	60/85	-90/310	20/-30	50/-50	90	45	45

Good Reported Braking Action

MAX MANUAL	1175	65/-70	30/45	-55/185	25/-25	25/-25	45	65	145
AUTOBRAKE MAX	1240	70/-75	35/50	-55/195	25/-20	30/-30	55	70	155
AUTOBRAKE 2	1885	125/-135	60/85	-90/310	20/-30	50/-50	90	45	45

Medium Reported Braking Action

MAX MANUAL	1585	105/-105	50/70	-85/310	70/-55	40/-40	60	170	425
AUTOBRAKE MAX	1600	110/-110	50/75	-85/310	65/-50	40/-40	65	170	420
AUTOBRAKE 3	1655	105/-110	50/75	-85/315	55/-35	40/-45	85	135	400

Poor Reported Braking Action

MAX MANUAL	2045	150/-150	70/105	-125/485	165/-110	50/-55	70	365	1000
AUTOBRAKE MAX	2050	150/-150	70/105	-125/485	170/-110	50/-55	70	365	1000
AUTOBRAKE 3	2050	155/-150	75/105	-125/485	170/-100	50/-55	80	365	1005

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Disagree (1 ≤ Indicated Flaps <15)

VREF40 + 30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1025	80/-60	25/35	-35/125	10/-10	20/-20	35	25	55
AUTOBRAKE MAX	1400	65/-70	35/50	-50/160	5/-5	35/-35	65	0	5
AUTOBRAKE 2	2495	160/-175	90/125	-110/360	45/-55	75/-70	95	155	160

Good Reported Braking Action

MAX MANUAL	1410	75/-80	40/60	-60/205	30/-25	35/-35	45	85	195
AUTOBRAKE MAX	1540	80/-85	45/65	-60/215	25/-20	40/-40	60	90	215
AUTOBRAKE 2	2500	160/-175	90/125	-110/360	45/-55	75/-70	95	155	160

Medium Reported Braking Action

MAX MANUAL	1955	125/-125	65/95	-95/335	80/-65	50/-55	60	235	590
AUTOBRAKE MAX	2000	125/-130	70/100	-95/340	75/-60	50/-55	70	240	600
AUTOBRAKE 3	2180	125/-130	70/105	-100/360	50/-35	60/-60	100	135	450

Poor Reported Braking Action

MAX MANUAL	2555	185/-185	95/140	-140/530	195/-130	70/-75	75	505	1425
AUTOBRAKE MAX	2555	185/-180	95/140	-140/530	195/-130	70/-75	75	500	1420
AUTOBRAKE 3	2595	180/-180	95/140	-140/535	180/-110	70/-75	95	485	1410

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Disagree (15 ≤ Indicated Flaps <30)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	880	60/-50	20/30	-30/110	10/-10	15/-20	30	15	40
AUTOBRAKE MAX	1125	60/-60	30/40	-40/140	0/0	25/-25	55	0	0
AUTOBRAKE 2	2000	140/-150	70/90	-95/320	20/-30	55/-55	100	45	45

Good Reported Braking Action

MAX MANUAL	1210	70/-70	35/50	-55/190	25/-25	30/-30	45	70	155
AUTOBRAKE MAX	1280	75/-80	35/50	-55/195	25/-20	30/-30	50	75	170
AUTOBRAKE 2	2000	140/-150	70/90	-95/320	20/-30	55/-55	100	45	45

Medium Reported Braking Action

MAX MANUAL	1655	110/-110	55/75	-85/315	70/-55	40/-45	60	190	480
AUTOBRAKE MAX	1665	115/-115	55/80	-85/315	65/-50	40/-45	70	190	475
AUTOBRAKE 3	1735	115/-115	55/80	-90/325	55/-35	45/-45	90	145	440

Poor Reported Braking Action

MAX MANUAL	2155	165/-160	80/115	-130/500	175/-115	55/-60	75	415	1170
AUTOBRAKE MAX	2155	165/-160	80/115	-130/500	175/-115	55/-60	75	415	1170
AUTOBRAKE 3	2155	165/-160	80/115	-130/500	175/-110	55/-60	75	415	1170

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Disagree (30 ≤ Indicated Flaps <40)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	855	50/-45	20/25	-30/110	10/-10	15/-15	30	15	35
AUTOBRAKE MAX	1070	55/-60	25/35	-40/135	0/0	25/-25	50	0	0
AUTOBRAKE 2	1885	125/-135	60/85	-90/310	20/-30	50/-50	90	45	45

Good Reported Braking Action

MAX MANUAL	1175	65/-70	30/45	-55/185	25/-25	25/-25	45	65	145
AUTOBRAKE MAX	1240	70/-75	35/50	-55/195	25/-20	30/-30	55	70	155
AUTOBRAKE 2	1885	125/-135	60/85	-90/310	20/-30	50/-50	90	45	45

Medium Reported Braking Action

MAX MANUAL	1585	105/-105	50/70	-85/310	70/-55	40/-40	60	170	425
AUTOBRAKE MAX	1600	110/-110	50/75	-85/310	65/-50	40/-40	65	170	420
AUTOBRAKE 3	1655	105/-110	50/75	-85/315	55/-35	40/-45	85	135	400

Poor Reported Braking Action

MAX MANUAL	2045	150/-150	70/105	-125/485	165/-110	50/-55	70	365	1000
AUTOBRAKE MAX	2050	150/-150	70/105	-125/485	170/-110	50/-55	70	365	1000
AUTOBRAKE 3	2050	155/-150	75/105	-125/485	170/-100	50/-55	80	365	1005

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flaps Up Landing

VREF40 + 40

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	60000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 60000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1080	100/-65	30/40	-35/125	10/-10	25/-25	30	25	60
AUTOBRAKE MAX	1525	75/-75	40/55	-50/170	5/-5	40/-40	65	0	5
AUTOBRAKE 2	2695	175/-190	100/135	-110/375	60/-65	80/-80	90	215	250

Good Reported Braking Action

MAX MANUAL	1480	80/-85	45/60	-60/205	30/-30	35/-35	45	90	200
AUTOBRAKE MAX	1655	80/-85	50/70	-65/220	25/-20	40/-40	65	75	195
AUTOBRAKE 2	2695	175/-190	100/135	-110/375	60/-65	80/-80	90	215	250

Medium Reported Braking Action

MAX MANUAL	2055	130/-135	70/100	-95/345	80/-65	55/-55	60	245	615
AUTOBRAKE MAX	2125	130/-135	75/105	-100/350	75/-60	55/-60	65	255	630
AUTOBRAKE 3	2385	130/-145	80/110	-105/375	50/-45	65/-70	100	130	420

Poor Reported Braking Action

MAX MANUAL	2700	190/-190	105/150	-145/540	195/-135	75/-80	75	530	1490
AUTOBRAKE MAX	2705	190/-190	105/150	-145/540	195/-125	75/-80	80	525	1480
AUTOBRAKE 3	2790	185/-190	105/150	-145/550	175/-115	75/-80	100	475	1445

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Recommended Brake Cooling Schedule

Reference Brake Energy Per Brake (Millions of Foot Pounds)

		WIND CORRECTED BRAKES ON SPEED (KIAS)*																	
		80			100			120			140			160			180		
WEIGHT (1000 KG)	OAT (°C)	PRESSURE ALTITUDE (1000 FT)																	
		0	5	10	0	5	10	0	5	10	0	5	10	0	5	10	0	5	10
80	0	15.3	17.2	19.4	22.9	25.8	29.3	31.7	35.8	40.9	41.5	47.1	54.2	52.2	59.6	69.0	62.4	71.4	83.3
	10	15.8	17.7	20.0	23.6	26.6	30.2	32.7	37.0	42.2	42.8	48.7	55.9	53.9	61.5	71.2	64.4	73.7	86.0
	15	16.0	18.0	20.3	24.0	27.1	30.7	33.2	37.6	42.9	43.5	49.4	56.8	54.7	62.4	72.3	65.3	74.8	87.3
	20	16.3	18.3	20.6	24.4	27.5	31.1	33.7	38.1	43.5	44.1	50.1	57.6	55.6	63.4	73.4	66.3	75.9	88.6
	30	16.7	18.8	21.2	25.0	28.2	32.0	34.6	39.2	44.7	45.4	51.5	59.3	57.1	65.1	75.4	68.2	78.0	91.0
	40	16.8	18.9	21.3	25.2	28.5	32.3	35.0	39.6	45.3	46.0	52.3	60.2	58.0	66.3	77.0	69.5	79.7	93.3
	50	16.8	19.0	21.4	25.3	28.6	32.5	35.2	40.0	45.8	46.4	52.9	61.1	58.8	67.4	78.5	70.7	81.3	95.6
70	0	13.9	15.6	17.6	20.6	23.3	26.3	28.4	32.1	36.5	37.1	42.1	48.2	46.6	53.0	61.2	56.4	64.4	74.8
	10	14.4	16.2	18.2	21.3	24.0	27.2	29.3	33.1	37.7	38.3	43.4	49.7	48.1	54.7	63.1	58.2	66.5	77.2
	15	14.6	16.4	18.5	21.6	24.4	27.6	29.8	33.6	38.3	38.9	44.1	50.5	48.8	55.6	64.1	59.1	67.5	78.4
	20	14.8	16.7	18.8	22.0	24.8	28.0	30.2	34.2	38.9	39.5	44.7	51.3	49.5	56.4	65.1	60.0	68.5	79.6
	30	15.2	17.1	19.3	22.6	25.5	28.8	31.1	35.1	40.0	40.6	46.0	52.7	50.9	58.0	66.9	61.6	70.4	81.8
	40	15.3	17.2	19.4	22.7	25.6	29.1	31.3	35.5	40.4	41.0	46.6	53.5	51.7	58.9	68.1	62.7	71.8	83.6
	50	15.3	17.2	19.4	22.8	25.8	29.2	31.5	35.7	40.8	41.4	47.1	54.2	52.3	59.7	69.3	63.7	73.1	85.4
60	0	12.6	14.1	15.9	18.4	20.7	23.4	25.1	28.3	32.2	32.5	36.9	42.1	40.7	46.3	53.1	49.6	56.5	65.3
	10	13.0	14.6	16.4	19.0	21.4	24.2	25.9	29.2	33.2	33.6	38.0	43.4	42.0	47.7	54.9	51.2	58.3	67.4
	15	13.2	14.8	16.6	19.3	21.7	24.6	26.3	29.7	33.7	34.1	38.6	44.1	42.7	48.5	55.7	51.9	59.2	68.4
	20	13.4	15.0	16.9	19.6	22.1	24.9	26.7	30.1	34.2	34.6	39.2	44.8	43.3	49.2	56.5	52.7	60.1	69.5
	30	13.7	15.4	17.4	20.1	22.7	25.6	27.4	31.0	35.2	35.6	40.3	46.0	44.5	50.6	58.1	54.2	61.7	71.4
	40	13.8	15.5	17.5	20.3	22.8	25.8	27.7	31.3	35.6	36.0	40.8	46.6	45.1	51.3	59.0	55.0	62.8	72.8
	50	13.8	15.5	17.5	20.3	22.9	25.9	27.8	31.5	35.8	36.2	41.1	47.1	45.6	51.9	59.9	55.7	63.8	74.2
50	0	11.2	12.6	14.1	16.2	18.2	20.5	21.8	24.6	27.9	28.0	31.7	36.1	34.8	39.5	45.1	42.1	47.9	55.1
	10	11.6	13.0	14.6	16.7	18.8	21.2	22.5	25.4	28.8	28.9	32.7	37.2	35.9	40.7	46.6	43.5	49.4	56.8
	15	11.7	13.2	14.8	16.9	19.1	21.5	22.8	25.8	29.2	29.4	33.2	37.8	36.5	41.4	47.3	44.2	50.2	57.7
	20	11.9	13.4	15.1	17.2	19.4	21.9	23.2	26.2	29.6	29.8	33.7	38.4	37.0	42.0	48.0	44.8	50.9	58.6
	30	12.3	13.8	15.5	17.7	19.9	22.5	23.8	26.9	30.5	30.7	34.7	39.4	38.1	43.2	49.4	46.1	52.4	60.2
	40	12.3	13.8	15.6	17.8	20.0	22.6	24.0	27.1	30.7	30.9	35.0	39.9	38.5	43.7	50.0	46.7	53.1	61.2
	50	12.3	13.8	15.6	17.8	20.1	22.7	24.1	27.2	30.9	31.1	35.2	40.2	38.8	44.1	50.6	47.2	53.8	62.1
40	0	9.9	11.1	12.5	14.0	15.7	17.7	18.5	20.8	23.5	23.5	26.5	30.1	28.9	32.7	37.3	34.8	39.4	45.1
	10	10.2	11.5	12.9	14.4	16.2	18.2	19.1	21.5	24.3	24.3	27.4	31.1	29.9	33.8	38.5	35.9	40.7	46.5
	15	10.4	11.7	13.1	14.6	16.5	18.5	19.4	21.8	24.7	24.6	27.8	31.5	30.3	34.3	39.1	36.4	41.3	47.2
	20	10.6	11.9	13.3	14.9	16.7	18.8	19.7	22.2	25.1	25.0	28.2	32.0	30.8	34.8	39.7	37.0	41.9	47.9
	30	10.9	12.2	13.7	15.3	17.2	19.3	20.2	22.8	25.8	25.7	29.0	32.9	31.7	35.8	40.8	38.0	43.1	49.3
	40	10.9	12.2	13.7	15.3	17.3	19.5	20.4	22.9	26.0	25.9	29.3	33.2	31.9	36.2	41.2	38.4	43.6	50.0
	50	10.9	12.2	13.8	15.4	17.3	19.5	20.4	23.0	26.1	26.0	29.4	33.4	32.1	36.4	41.6	38.7	44.0	50.5

***To correct for wind, enter table with the brakes on speed minus one half the headwind or plus 1.5 times the tailwind. If ground speed is used for brakes on speed, ignore wind and enter table with sea level, 15°C.**

Adjusted Brake Energy Per Brake (Millions of Foot Pounds)
No Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)								
EVENT		10	20	30	40	50	60	70	80	90
RTO MAX MAN		10	20	30	40	50	60	70	80	90
LANDING	MAX MAN	7.5	15.8	24.6	33.8	43.5	53.5	63.6	73.9	84.2
	MAX AUTO	7.3	15.0	23.2	31.9	41.2	51.0	61.3	72.2	83.7
	AUTOBRAKE 3	7.0	14.2	21.8	29.7	38.1	47.1	56.7	67.1	78.3
	AUTOBRAKE 2	6.6	13.3	20.2	27.3	34.7	42.6	51.0	59.9	69.6
	AUTOBRAKE 1	6.3	12.4	18.6	24.9	31.6	38.6	46.2	54.4	63.5

ADVISORY INFORMATION

Recommended Brake Cooling Schedule

Adjusted Brake Energy Per Brake (Millions of Foot Pounds)

Two Engine Detent Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)								
EVENT		10	20	30	40	50	60	70	80	90
RTO MAX MAN		10	20	30	40	50	60	70	80	90
LANDING	MAX MAN	6.9	14.5	22.7	31.4	40.4	49.7	59.3	68.9	78.5
	MAX AUTO	6.0	12.6	19.8	27.6	36.0	45.1	54.8	65.3	76.5
	AUTOBRAKE 3	4.5	9.5	15.1	21.3	28.1	35.6	43.7	52.5	62.0
	AUTOBRAKE 2	2.6	5.9	9.7	14.1	19.1	24.7	31.0	37.9	45.4
	AUTOBRAKE 1	1.8	3.8	6.3	9.1	12.5	16.4	21.0	26.3	32.5

Cooling Time (Minutes) - Category F Steel Brakes

(Note: A placard showing carbon brakes configuration will be put at the Center Forward Panel upon modification.)

	EVENT ADJUSTED BRAKE ENERGY (MILLIONS OF FOOT POUNDS)								
	16 & BELOW	17	20	23	25	28	32	33 TO 48	49 & ABOVE
	BRAKE TEMPERATURE MONITOR SYSTEM INDICATION ON CDS								
	UP TO 2.4	2.6	3.1	3.5	3.9	4.4	4.9	5.0 TO 7.5	7.5 & ABOVE
INFLIGHT GEAR DOWN	NO SPECIAL PROCEDURE REQUIRED	1	2	3	4	5	6	CAUTION	FUSE PLUG MELT ZONE
GROUND		10	20	30	40	50	60		

Cooling Time (Minutes) - Category M Carbon Brakes

	EVENT ADJUSTED BRAKE ENERGY (MILLIONS OF FOOT POUNDS)								
	16 & BELOW	17	19	20.9	23.5	26.9	29.4	30 TO 41	41 & ABOVE
	BRAKE TEMPERATURE MONITOR SYSTEM INDICATION ON CDS								
	UP TO 2.5	2.6	3	3.3	3.8	4.5	4.9	5.0 TO 7.1	7.1 & ABOVE
INFLIGHT GEAR DOWN	NO SPECIAL PROCEDURE REQUIRED	1	4	5	6	7	7.6	CAUTION	FUSE PLUG MELT ZONE
GROUND		6.7	16.0	24.1	34.2	45.9	53.3		

Observe maximum quick turnaround limit.
Table shows energy per brake added by a single stop with all brakes operating. Energy is assumed to be equally distributed among the operating brakes. Total energy is the sum of residual energy plus energy added.
Add 1.0 million foot pounds per brake for each taxi mile.

When in caution zone, wheel fuse plugs may melt. Delay takeoff and inspect after one hour. If overheat occurs after takeoff, extend gear soon for at least 7 minutes.

When in fuse plug melt zone, clear runway immediately. Unless required, do not set parking brake. Do not approach gear or attempt to taxi for one hour. Tire, wheel and brake replacement may be required. If overheat occurs after takeoff, extend gear soon for at least 12 minutes.

Brake temperature monitor system (BTMS) indication on CDS systems page may be used 10 to 15 minutes after airplane has come to a complete stop or inflight with gear retracted to determine recommended cooling schedule.

ADVISORY INFORMATION

Recommended Brake Cooling Schedule - High Altitudes

Reference Brake Energy Per Brake (Millions of Foot Pounds)

		WIND CORRECTED BRAKES ON SPEED (KIAS)*															
		60				100				140				180			
WEIGHT (1000 KG)	OAT (°C)	PRESSURE ALTITUDE (1000 FT)															
		10	12	14	14.5	10	12	14	14.5	10	12	14	14.5	10	12	14	14.5
80	0	11.4	11.9	12.5	12.7	29.3	30.9	32.7	33.2	54.2	57.7	61.6	62.7	83.3	89.5		
	10	11.7	12.3	12.9	13.1	30.2	31.9	33.8	34.3	55.9	59.5	63.6	64.8	86.0	92.3		
	15	11.9	12.5	13.1	13.3	30.7	32.4	34.3	34.8	56.8	60.4	64.6	65.8	87.3	93.7		
	20	12.1	12.7	13.3	13.5	31.1	32.9	34.8	35.3	57.6	61.3	65.5	66.7	88.6	95.0		
	30	12.4	13.0	13.7	13.9	32.0	33.8	35.8	36.3	59.3	63.0	67.4	68.6	91.0	97.7		
	40	12.5	13.1	13.8	14.0	32.3	34.1	36.1	36.7	60.2	64.2	68.6	69.9	93.3	100.3		
	50	12.5	13.1	13.8	14.0	32.5	34.4	36.4	37.0	61.1	65.2	69.8	71.1	95.6	103.0		
70	0	10.5	11.0	11.5	11.7	26.3	27.8	29.4	29.8	48.2	51.2	54.6	55.6	74.8	80.1	86.3	88.0
	10	10.8	11.3	11.9	12.1	27.2	28.7	30.3	30.8	49.7	52.8	56.3	57.3	77.2	82.7	89.0	90.8
	15	11.0	11.5	12.1	12.3	27.6	29.1	30.8	31.3	50.5	53.6	57.2	58.2	78.4	83.9	90.4	92.2
	20	11.2	11.7	12.3	12.5	28.0	29.6	31.3	31.8	51.3	54.4	58.1	59.1	79.6	85.2	91.7	93.5
	30	11.5	12.0	12.6	12.8	28.8	30.4	32.1	32.6	52.7	56.0	59.7	60.7	81.8	87.5	94.2	96.1
	40	11.5	12.1	12.7	12.9	29.1	30.7	32.4	32.9	53.5	56.9	60.7	61.8	83.6	89.7	96.7	98.7
	50	11.5	12.1	12.7	12.9	29.2	30.8	32.6	33.1	54.2	57.6	61.6	62.7	85.4	91.8	99.1	101.2
60	0	9.6	10.1	10.6	10.7	23.4	24.7	26.1	26.5	42.1	44.6	47.5	48.3	65.3	69.8	74.8	76.3
	10	9.9	10.4	10.9	11.1	24.2	25.5	26.9	27.3	43.4	46.1	49.0	49.8	67.4	72.0	77.2	78.7
	15	10.1	10.6	11.1	11.3	24.6	25.9	27.3	27.7	44.1	46.8	49.7	50.6	68.4	73.1	78.4	79.9
	20	10.2	10.7	11.3	11.4	24.9	26.3	27.7	28.1	44.8	47.5	50.5	51.4	69.5	74.2	79.6	81.1
	30	10.5	11.0	11.6	11.8	25.6	27.0	28.5	28.9	46.0	48.8	51.9	52.8	71.4	76.2	81.8	83.4
	40	10.5	11.1	11.6	11.8	25.8	27.2	28.7	29.2	46.6	49.5	52.7	53.6	72.8	77.8	83.6	85.3
	50	10.5	11.1	11.6	11.8	25.9	27.3	28.9	29.3	47.1	50.0	53.3	54.2	74.2	79.4	85.4	87.1
50	0	8.8	9.2	9.7	9.8	20.5	21.6	22.8	23.1	36.1	38.1	40.5	41.2	55.1	58.6	62.7	63.8
	10	9.1	9.5	10.0	10.1	21.2	22.3	23.5	23.9	37.2	39.4	41.8	42.5	56.8	60.5	64.7	65.9
	15	9.2	9.6	10.1	10.3	21.5	22.7	23.9	24.3	37.8	40.0	42.4	43.1	57.7	61.4	65.7	66.9
	20	9.3	9.8	10.3	10.4	21.9	23.0	24.3	24.6	38.4	40.6	43.1	43.8	58.6	62.3	66.6	67.8
	30	9.6	10.1	10.6	10.7	22.5	23.6	24.9	25.3	39.4	41.7	44.3	45.0	60.2	64.1	68.5	69.7
	40	9.6	10.1	10.6	10.8	22.6	23.8	25.1	25.5	39.9	42.2	44.8	45.6	61.2	65.2	69.8	71.1
	50	9.6	10.1	10.6	10.8	22.7	23.9	25.2	25.6	40.2	42.6	45.3	46.1	62.1	66.3	71.0	72.4
40	0	8.1	8.4	8.9	9.0	17.7	18.6	19.6	19.9	30.1	31.8	33.6	34.2	45.1	47.8	50.9	51.8
	10	8.3	8.7	9.2	9.3	18.2	19.2	20.2	20.5	31.1	32.8	34.7	35.3	46.5	49.3	52.6	53.5
	15	8.5	8.9	9.3	9.4	18.5	19.5	20.5	20.8	31.5	33.3	35.3	35.8	47.2	50.1	53.4	54.3
	20	8.6	9.0	9.4	9.6	18.8	19.8	20.8	21.1	32.0	33.8	35.8	36.4	47.9	50.9	54.2	55.1
	30	8.8	9.2	9.7	9.8	19.3	20.3	21.4	21.7	32.9	34.8	36.8	37.4	49.3	52.3	55.7	56.6
	40	8.9	9.3	9.7	9.9	19.5	20.5	21.6	21.9	33.2	35.1	37.2	37.8	50.0	53.0	56.5	57.5
	50	8.8	9.3	9.7	9.9	19.5	20.5	21.6	21.9	33.4	35.4	37.5	38.1	50.5	53.7	57.3	58.3

***To correct for wind, enter table with the brakes on speed minus one half the headwind or plus 1.5 times the tailwind. If ground speed is used for brakes on speed, ignore wind and enter table with sea level, 15°C.**

ADVISORY INFORMATION

Recommended Brake Cooling Schedule - High Altitudes
Adjusted Brake Energy Per Brake (Millions of Foot Pounds)
No Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)								
EVENT		10	20	30	40	50	60	70	80	90
RTO MAX MAN		10	20	30	40	50	60	70	80	90
LANDING	MAX MAN	7.8	16.3	25.3	34.7	44.7	55.0	65.7	76.6	87.9
	MAX AUTO	7.5	15.4	23.6	32.4	41.8	51.8	62.5	74.1	86.5
	AUTOBRAKE 3	7.3	14.7	22.3	30.2	38.6	47.6	57.4	68.1	80.0
	AUTOBRAKE 2	7.0	13.8	20.5	27.4	34.8	42.7	51.5	61.3	72.4
	AUTOBRAKE 1	6.7	13.1	19.2	25.3	31.8	38.8	46.6	55.4	65.5

Two Engine Detent Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)								
EVENT		10	20	30	40	50	60	70	80	90
RTO MAX MAN		10	20	30	40	50	60	70	80	90
LANDING	MAX MAN	7.0	14.6	22.8	31.4	40.5	49.9	59.7	69.8	80.0
	MAX AUTO	5.8	12.3	19.5	27.2	35.6	44.5	53.9	63.7	74.1
	AUTOBRAKE 3	4.3	9.2	14.7	20.7	27.2	34.4	42.0	50.2	59.0
	AUTOBRAKE 2	2.5	5.6	9.1	13.1	17.8	23.0	28.8	35.2	42.3
	AUTOBRAKE 1	1.8	3.8	6.1	8.8	11.9	15.5	19.6	24.4	29.8

Cooling Time (Minutes) - Category F Steel Brakes
(Note: A placard showing carbon brakes configuration will be put at the Center Forward Panel upon modification.)

	EVENT ADJUSTED BRAKE ENERGY (MILLIONS OF FOOT POUNDS)								
	16 & BELOW	17	20	23	25	28	32	33 TO 48	49 & ABOVE
	BRAKE TEMPERATURE MONITOR SYSTEM INDICATION ON CDS								
	UP TO 2.4	2.6	3.1	3.5	3.9	4.4	4.9	5.0 TO 7.5	7.5 & ABOVE
INFLIGHT GEAR DOWN	NO SPECIAL PROCEDURE REQUIRED	1	2	3	4	5	6	CAUTION	FUSE PLUG MELT ZONE
GROUND		10	20	30	40	50	60		

Cooling Time (Minutes) - Category M Carbon Brakes

	EVENT ADJUSTED BRAKE ENERGY (MILLIONS OF FOOT POUNDS)								
	16 & BELOW	17	19	20.9	23.5	26.9	29.4	30 TO 41	41 & ABOVE
	BRAKE TEMPERATURE MONITOR SYSTEM INDICATION ON CDS								
	UP TO 2.5	2.6	3	3.3	3.8	4.5	4.9	5.0 TO 7.1	7.1 & ABOVE
INFLIGHT GEAR DOWN	NO SPECIAL PROCEDURE REQUIRED	1	4	5	6	7	7.6	CAUTION	FUSE PLUG MELT ZONE
GROUND		6.7	16.0	24.1	34.2	45.9	53.3		

Observe maximum quick turnaround limit.
Table shows energy per brake added by a single stop with all brakes operating. Energy is assumed to be equally distributed among the operating brakes. Total energy is the sum of residual energy plus energy added.
Add 1.0 million foot pounds per brake for each taxi mile.

When in caution zone, wheel fuse plugs may melt. Delay takeoff and inspect after one hour. If overheat occurs after takeoff, extend gear soon for at least 7 minutes.

When in fuse plug melt zone, clear runway immediately. Unless required, do not set parking brake. Do not approach gear or attempt to taxi for one hour. Tire, wheel and brake replacement may be required. If overheat occurs after takeoff, extend gear soon for at least 12 minutes.

Brake temperature monitor system (BTMS) indication on CDS systems page may be used 10 to 15 minutes after airplane has come to a complete stop or inflight with gear retracted to determine recommended cooling schedule.

ENGINE INOP

Initial Max Continuous %N1

Based on .79M, A/C high and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (FT)								
	25	27	29	31	33	35	37	39	41
20	96.8	96.6	96.3	96.1	95.9	95.4	95.0	94.7	93.9
15	97.4	97.2	96.9	96.8	96.6	96.2	95.7	95.5	94.8
10	98.0	97.8	97.5	97.4	97.4	96.9	96.5	96.3	95.7
5	98.3	98.6	98.3	98.1	98.1	97.7	97.3	97.1	96.6
0	97.5	98.7	99.2	99.0	98.9	98.5	98.2	98.0	97.5
-5	96.7	98.0	99.1	99.8	99.7	99.3	98.9	98.7	98.4
-10	96.0	97.2	98.4	99.6	100.5	100.2	99.8	99.6	99.4
-15	95.2	96.4	97.6	98.8	100.1	101.0	100.8	100.6	100.3
-20	94.4	95.6	96.8	98.0	99.3	100.5	101.0	100.8	100.6
-25	93.6	94.9	96.0	97.2	98.5	99.7	100.2	100.0	99.8
-30	92.8	94.1	95.2	96.4	97.7	98.8	99.4	99.2	99.0
-35	92.0	93.2	94.4	95.6	96.8	98.0	98.5	98.3	98.1
-40	91.2	92.4	93.5	94.7	96.0	97.1	97.6	97.4	97.2

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)								
	25	27	29	31	33	35	37	39	41
ENGINE ANTI-ICE	-1.2	-1.1	-1.0	-0.9	-0.8	-0.8	-0.8	-0.8	-0.8
ENGINE & WING ANTI-ICE	-4.2	-4.4	-4.5	-4.7	-5.0	-4.8	-4.8	-4.8	-4.8

ENGINE INOP

Max Continuous %N1

37000 FT to 29000 FT Pressure Altitudes

37000 FT PRESS ALT		TAT (°C)											
KIAS	M	-55	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0
160	.51	96.5	97.4	98.3	99.2	100.1	99.6	98.8	97.6	96.3	94.7	93.2	91.8
200	.63	96.0	96.9	97.8	98.7	99.6	100.4	100.1	99.3	98.4	97.5	96.3	95.2
240	.74	95.0	96.0	96.8	97.7	98.6	99.4	100.3	100.7	100.0	99.2	98.4	97.5
280	.86	94.3	95.2	96.1	97.0	97.8	98.7	99.5	100.4	101.2	100.9	100.0	99.1
35000 FT PRESS ALT		TAT (°C)											
KIAS	M	-55	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0
160	.49	96.3	97.2	98.1	99.0	99.9	99.8	99.0	98.0	96.8	95.4	94.0	92.7
200	.60	96.1	97.0	97.9	98.8	99.7	100.6	100.5	99.6	98.6	97.6	96.5	95.4
240	.71	95.0	95.9	96.8	97.7	98.6	99.4	100.3	100.8	100.2	99.5	98.6	97.7
280	.82	93.8	94.6	95.5	96.4	97.2	98.1	98.9	99.8	100.6	100.3	99.5	98.8
33000 FT PRESS ALT		TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
160	.47	97.1	98.0	98.9	99.8	100.6	100.0	99.1	97.9	96.7	95.3	93.9	92.6
200	.58	97.0	97.9	98.8	99.7	100.6	101.4	100.6	99.6	98.6	97.5	96.3	95.1
240	.68	95.9	96.8	97.7	98.5	99.4	100.2	101.1	100.9	100.2	99.4	98.4	97.4
280	.79	94.3	95.1	96.0	96.8	97.7	98.5	99.3	100.2	100.5	99.7	98.9	98.1
320	.89	93.6	94.5	95.4	96.2	97.1	97.9	98.7	99.5	100.3	101.1	100.7	99.8
31000 FT PRESS ALT		TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
160	.45	97.0	97.9	98.8	99.7	100.5	101.1	100.2	99.2	98.0	96.6	95.2	93.9
200	.55	97.0	97.9	98.8	99.7	100.5	101.4	101.6	100.7	99.7	98.6	97.4	96.2
240	.66	95.6	96.5	97.4	98.3	99.1	100.0	100.8	101.3	100.5	99.8	98.8	97.8
280	.76	93.8	94.7	95.5	96.4	97.2	98.0	98.8	99.7	100.5	99.8	98.9	98.0
320	.85	92.4	93.2	94.1	94.9	95.7	96.5	97.4	98.2	98.9	99.7	99.9	99.1
29000 FT PRESS ALT		TAT (°C)											
KIAS	M	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
160	.43	97.8	98.7	99.6	100.4	101.3	101.2	100.2	99.1	97.9	96.4	95.1	93.8
200	.53	97.5	98.4	99.3	100.2	101.0	101.9	101.3	100.4	99.3	98.2	96.9	95.8
240	.63	96.3	97.1	98.0	98.9	99.7	100.5	101.4	101.1	100.2	99.2	98.3	97.2
280	.73	94.2	95.0	95.9	96.7	97.5	98.3	99.2	99.9	100.1	99.2	98.2	97.5
320	.82	92.1	92.9	93.7	94.5	95.3	96.1	96.9	97.7	98.5	99.2	98.5	97.6
360	.91	92.1	92.9	93.7	94.5	95.3	96.1	96.9	97.7	98.5	99.2	100.0	100.1

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)				
	29	31	33	35	37
ENGINE ANTI-ICE ON	-0.9	-0.9	-0.8	-0.8	-0.8
ENGINE & WING ANTI-ICE ON	-4.1	-4.3	-4.5	-4.7	-4.7

ENGINE INOP

Max Continuous %N1
27000 FT to 20000 FT Pressure Altitudes

27000 FT PRESS ALT		TAT (°C)											
KIAS	M	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
160	.41	97.7	98.6	99.5	100.3	101.2	102.0	101.2	100.2	99.0	97.8	96.4	95.1
200	.51	96.9	97.8	98.7	99.5	100.4	101.2	101.8	100.8	99.9	98.8	97.6	96.4
240	.60	95.6	96.5	97.4	98.2	99.1	99.9	100.7	101.3	100.4	99.4	98.5	97.5
280	.70	93.6	94.4	95.3	96.1	96.9	97.7	98.5	99.3	100.1	99.4	98.4	97.6
320	.79	91.6	92.4	93.2	94.0	94.8	95.6	96.4	97.2	98.0	98.7	98.6	97.8
360	.88	91.0	91.8	92.6	93.4	94.2	95.0	95.8	96.6	97.3	98.1	98.8	99.4
25000 FT PRESS ALT		TAT (°C)											
KIASS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
160	.39	98.5	99.4	100.2	101.1	101.9	102.4	101.4	100.3	99.1	97.7	96.5	95.2
200	.49	97.5	98.3	99.2	100.0	100.9	101.7	101.5	100.6	99.5	98.4	97.3	96.2
240	.58	95.7	96.5	97.4	98.2	99.0	99.8	100.7	100.5	99.5	98.6	97.6	96.7
280	.67	93.9	94.7	95.5	96.3	97.1	97.9	98.7	99.5	99.5	98.6	97.6	96.9
320	.76	91.7	92.6	93.4	94.2	95.0	95.8	96.5	97.3	98.0	98.6	97.8	97.2
360	.85	90.4	91.2	92.1	92.9	93.7	94.5	95.3	96.1	96.9	97.6	98.4	98.2
24000 FT PRESS ALT		TAT (°C)											
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
160	.38	98.5	99.3	100.2	101.1	101.9	102.7	101.9	100.8	99.6	98.4	97.1	95.8
200	.48	97.5	98.4	99.2	100.1	100.9	101.8	102.2	101.1	100.1	99.0	97.8	96.7
240	.57	95.9	96.8	97.6	98.5	99.3	100.1	100.9	101.2	100.2	99.2	98.2	97.3
280	.66	94.2	95.1	95.9	96.7	97.5	98.3	99.1	99.9	100.4	99.4	98.3	97.5
320	.75	92.1	93.0	93.8	94.6	95.4	96.2	96.9	97.7	98.5	99.2	98.6	97.8
360	.83	90.6	91.4	92.2	93.1	93.9	94.7	95.5	96.2	97.0	97.8	98.5	98.6
22000 FT PRESS ALT		TAT (°C)											
KIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
160	.37	99.1	100.0	100.9	101.7	102.5	102.8	101.8	100.7	99.5	98.2	97.0	95.8
200	.46	98.4	99.3	100.1	101.0	101.8	102.6	102.3	101.2	100.0	98.9	97.8	96.8
240	.55	97.2	98.1	98.9	99.7	100.5	101.3	102.1	101.6	100.5	99.4	98.5	97.5
280	.63	95.7	96.5	97.4	98.2	99.0	99.8	100.6	101.3	101.0	99.8	98.9	98.1
320	.72	93.9	94.7	95.5	96.3	97.1	97.9	98.6	99.4	100.1	100.2	99.3	98.6
360	.80	92.2	93.0	93.8	94.6	95.4	96.1	96.9	97.7	98.4	99.2	99.7	99.1
20000 FT PRESS ALT		TAT (°C)											
KIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
160	.35	98.7	99.5	100.4	101.2	102.0	102.8	102.5	101.5	100.4	99.2	98.0	96.8
200	.44	98.3	99.2	100.0	100.9	101.7	102.5	103.3	102.3	101.1	100.0	98.9	97.8
240	.53	97.5	98.4	99.2	100.0	100.8	101.7	102.5	103.1	101.8	100.5	99.5	98.6
280	.61	96.2	97.0	97.8	98.7	99.5	100.3	101.1	101.8	102.5	101.3	100.1	99.3
320	.69	94.7	95.5	96.3	97.1	97.9	98.7	99.5	100.2	101.0	101.7	100.9	99.9
360	.77	93.0	93.8	94.6	95.4	96.2	97.0	97.7	98.5	99.2	100.0	100.7	100.4

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)				
	20	22	24	25	27
ENGINE ANTI-ICE ON	-0.9	-0.9	-1.0	-1.0	-1.0
ENGINE & WING ANTI-ICE ON	-3.6	-3.8	-3.8	-3.9	-4.0

ENGINE INOP

Max Continuous %N1

18000 FT to 12000 FT Pressure Altitudes

18000 FT PRESS ALT		TAT (°C)											
KIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
160	.34	97.0	97.8	98.7	99.5	100.3	101.1	101.1	100.3	99.2	98.1	97.0	95.9
200	.42	96.3	97.2	98.0	98.8	99.6	100.4	100.9	100.9	100.4	99.3	98.3	97.3
240	.51	96.3	97.1	97.9	98.7	99.5	100.3	101.1	101.4	101.1	99.9	99.0	98.1
280	.59	96.3	97.1	97.9	98.7	99.5	100.3	101.0	101.8	101.6	100.5	99.6	98.8
320	.67	94.8	95.6	96.4	97.2	97.9	98.7	99.5	100.2	101.0	100.9	100.0	99.2
360	.75	93.0	93.8	94.6	95.3	96.1	96.9	97.6	98.4	99.1	99.9	100.2	99.6

16000 FT PRESS ALT		TAT (°C)											
KIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
160	.33	96.7	97.5	98.3	99.1	99.9	100.7	101.1	99.9	98.7	97.7	96.7	95.8
200	.41	96.6	97.4	98.2	99.0	99.8	100.6	101.4	101.4	100.3	99.2	98.4	97.5
240	.49	96.0	96.8	97.6	98.4	99.2	100.0	100.7	101.5	101.4	100.1	99.2	98.4
280	.57	95.4	96.2	97.0	97.8	98.6	99.3	100.1	100.9	101.6	100.7	99.6	98.8
320	.64	93.8	94.6	95.4	96.2	96.9	97.7	98.5	99.2	100.0	100.7	99.9	99.1
360	.72	91.8	92.6	93.5	94.3	95.1	95.9	96.6	97.4	98.2	99.0	99.7	99.3

14000 FT PRESS ALT		TAT (°C)											
KIAS	M	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
160	.31	95.6	96.4	97.2	97.9	98.7	99.5	99.3	98.2	97.3	96.4	95.5	94.6
200	.39	94.5	95.3	96.1	96.8	97.6	98.4	99.1	99.0	98.9	98.2	97.5	96.7
240	.47	95.0	95.8	96.6	97.4	98.1	98.9	99.6	100.1	99.4	98.7	98.0	97.3
280	.54	94.8	95.6	96.4	97.2	98.0	98.7	99.5	100.2	100.4	99.4	98.5	97.8
320	.62	93.3	94.2	94.9	95.7	96.5	97.3	98.0	98.8	99.5	99.7	98.9	98.1
360	.69	91.5	92.3	93.2	94.0	94.8	95.6	96.4	97.1	97.9	98.7	99.0	98.4

12000 FT PRESS ALT		TAT (°C)											
KIAS	M	-20	-15	-10	-5	0	5	10	15	20	25	30	35
160	.30	95.6	96.3	97.1	97.9	98.6	99.4	98.6	97.4	96.4	95.6	94.7	93.8
200	.38	94.5	95.3	96.1	96.9	97.6	98.4	99.0	98.8	98.6	97.9	97.1	96.3
240	.45	94.3	95.1	95.9	96.7	97.5	98.2	99.0	99.0	98.4	97.8	97.1	96.4
280	.52	94.8	95.6	96.4	97.1	97.9	98.6	99.4	100.1	99.6	98.7	98.0	97.3
320	.60	93.3	94.1	94.9	95.7	96.5	97.2	98.0	98.8	99.5	99.0	98.2	97.5
360	.67	91.6	92.4	93.2	94.0	94.8	95.6	96.4	97.2	97.9	98.7	98.3	97.8

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)			
	12	14	16	18
ENGINE ANTI-ICE ON	-0.9	-0.9	-0.9	-0.9
ENGINE & WING ANTI-ICE ON	-3.2	-3.4	-3.4	-3.5

ENGINE INOP

Max Continuous %N1

10000 FT to 1000 FT Pressure Altitudes

10000 FT PRESS ALT		TAT (°C)											
KIAS	M	-20	-15	-10	-5	0	5	10	15	20	25	30	35
160	.29	94.5	95.3	96.1	96.9	97.6	98.4	99.1	97.9	96.8	96.0	95.1	94.3
200	.36	93.6	94.4	95.2	96.0	96.8	97.5	98.3	98.5	98.1	97.6	96.8	96.0
240	.43	92.9	93.7	94.5	95.3	96.1	96.9	97.6	98.4	98.0	97.4	96.8	96.1
280	.51	93.7	94.5	95.3	96.1	96.9	97.7	98.4	99.2	99.7	98.9	98.0	97.3
320	.58	92.3	93.1	93.9	94.8	95.5	96.3	97.1	97.9	98.7	99.0	98.3	97.6
360	.65	90.7	91.5	92.3	93.1	93.9	94.7	95.5	96.3	97.1	97.8	98.2	97.7
5000 FT PRESS ALT		TAT (°C)											
KIAS	M	-10	-5	0	5	10	15	20	25	30	35	40	45
160	.26	92.1	92.9	93.7	94.5	95.3	96.1	96.7	96.6	96.4	95.7	94.9	94.1
200	.33	91.6	92.4	93.2	94.0	94.8	95.6	96.3	96.6	96.6	96.1	95.4	94.7
240	.40	90.8	91.6	92.4	93.2	94.0	94.8	95.5	96.2	96.1	96.0	95.4	94.7
280	.46	90.3	91.1	91.9	92.7	93.5	94.3	95.0	95.8	96.2	96.1	95.8	95.2
320	.53	89.6	90.4	91.2	92.0	92.8	93.6	94.4	95.1	95.9	96.2	96.5	96.1
360	.59	88.5	89.3	90.1	90.9	91.7	92.5	93.2	94.0	94.8	95.5	95.9	96.2
3000 FT PRESS ALT		TAT (°C)											
KIAS	M	-5	0	5	10	15	20	25	30	35	40	45	50
160	.26	91.1	91.9	92.7	93.5	94.3	95.1	95.6	95.9	95.8	95.1	94.3	93.5
200	.32	90.7	91.5	92.3	93.1	93.8	94.6	95.4	95.7	96.1	95.4	94.7	93.9
240	.38	90.0	90.8	91.6	92.4	93.2	93.9	94.7	95.3	95.7	95.7	95.0	94.3
280	.45	89.4	90.2	91.0	91.8	92.5	93.3	94.1	94.8	95.1	95.4	94.9	94.2
320	.51	88.7	89.5	90.3	91.1	91.9	92.6	93.4	94.1	94.9	95.4	96.0	95.3
360	.57	87.8	88.6	89.3	90.1	90.9	91.6	92.4	93.1	93.9	94.6	95.2	95.5
1000 FT PRESS ALT		TAT (°C)											
KIAS	M	-5	0	5	10	15	20	25	30	35	40	45	50
160	.25	89.1	89.9	90.7	91.5	92.3	93.0	93.8	94.5	95.1	94.9	94.2	93.5
200	.31	88.8	89.6	90.4	91.2	91.9	92.7	93.5	94.2	94.8	95.2	94.5	93.8
240	.37	88.3	89.0	89.8	90.6	91.4	92.1	92.9	93.6	94.3	95.0	94.7	94.0
280	.43	87.7	88.5	89.3	90.0	90.8	91.6	92.3	93.1	93.8	94.3	94.7	94.0
320	.49	87.1	87.9	88.6	89.4	90.2	90.9	91.7	92.4	93.1	93.9	94.6	94.8
360	.55	86.2	87.0	87.8	88.6	89.3	90.1	90.8	91.5	92.3	93.0	93.7	94.5

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)			
	1	3	5	10
ENGINE ANTI-ICE ON	-0.6	-0.8	-0.8	-0.8
ENGINE & WING ANTI-ICE ON	-2.9	-3.0	-3.1	-3.2

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

WEIGHT (1000 KG)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFTDOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
85	82	271	18700	17400	15900
80	77	264	20300	19100	17700
75	72	256	21700	20700	19500
70	67	247	23200	22300	21200
65	62	238	24900	23900	22900
60	57	229	27000	25900	24800
55	53	220	29200	28300	27100
50	48	210	31300	30600	29500
45	43	200	33400	32700	31800
40	38	190	35800	35100	34200

Includes APU fuel burn.

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown/LRC Cruise Range Capability

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
138	128	120	112	106	100	95	90	86	82	78
276	256	240	225	212	200	190	180	172	164	157
414	385	359	337	317	300	284	270	257	246	235
552	513	479	449	423	400	379	360	343	328	314
690	641	599	562	529	500	474	450	429	410	392
828	770	719	674	635	600	569	540	515	492	470
966	898	839	787	741	700	663	630	601	573	549
1105	1027	959	899	847	800	758	720	686	655	627
1243	1155	1079	1012	953	900	853	811	772	737	705
1382	1284	1199	1124	1058	1000	948	901	858	819	784
1520	1412	1319	1237	1164	1100	1042	990	944	901	862
1659	1541	1439	1349	1270	1200	1137	1080	1029	983	940
1797	1670	1559	1462	1376	1300	1232	1170	1115	1064	1018
1936	1798	1679	1574	1482	1400	1327	1260	1201	1146	1096
2075	1927	1799	1687	1588	1500	1421	1350	1286	1228	1175
2214	2056	1919	1800	1694	1600	1516	1440	1372	1309	1253
2353	2185	2040	1912	1800	1700	1611	1530	1457	1391	1331
2492	2314	2160	2025	1906	1800	1705	1620	1543	1473	1409

Driftdown/Cruise Fuel and Time

AIR DIST (NM)	FUEL REQUIRED (1000 KG)										TIME (HR:MIN)
	WEIGHT AT START OF DRIFTDOWN (1000 KG)										
	40	45	50	55	60	65	70	75	80	85	
100	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0:16
200	0.8	0.8	0.9	0.9	1.0	1.0	1.1	1.2	1.2	1.3	0:33
300	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	0:49
400	1.6	1.8	1.9	2.0	2.2	2.3	2.5	2.6	2.8	2.9	1:06
500	2.0	2.2	2.4	2.5	2.7	2.9	3.1	3.3	3.5	3.7	1:22
600	2.4	2.6	2.8	3.1	3.3	3.5	3.8	4.0	4.2	4.5	1:38
700	2.8	3.1	3.3	3.6	3.9	4.1	4.4	4.7	4.9	5.2	1:55
800	3.2	3.5	3.8	4.1	4.4	4.7	5.0	5.3	5.6	6.0	2:11
900	3.6	3.9	4.2	4.6	4.9	5.3	5.6	6.0	6.3	6.7	2:28
1000	3.9	4.3	4.7	5.1	5.5	5.9	6.2	6.6	7.0	7.4	2:45
1100	4.3	4.7	5.1	5.6	6.0	6.4	6.8	7.3	7.7	8.2	3:01
1200	4.7	5.1	5.6	6.0	6.5	7.0	7.5	7.9	8.4	8.9	3:18
1300	5.0	5.5	6.0	6.5	7.0	7.6	8.1	8.6	9.1	9.6	3:34
1400	5.4	5.9	6.5	7.0	7.6	8.1	8.6	9.2	9.7	10.3	3:51
1500	5.8	6.3	6.9	7.5	8.1	8.7	9.2	9.8	10.4	11.0	4:08
1600	6.1	6.7	7.3	8.0	8.6	9.2	9.8	10.5	11.1	11.7	4:24
1700	6.5	7.1	7.8	8.4	9.1	9.8	10.4	11.1	11.7	12.4	4:41
1800	6.8	7.5	8.2	8.9	9.6	10.3	11.0	11.7	12.4	13.1	4:58

Includes APU fuel burn.
Driftdown at optimum driftdown speed and cruise at Long Range Cruise speed.

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Altitude Capability

100 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
80	18100	16400	14000
75	20100	18500	16600
70	21600	20500	18800
65	23100	22100	20700
60	24800	23800	22500
55	27300	25900	24400
50	29800	28800	27200
45	32100	31300	30100
40	34500	33700	32700

With engine anti-ice on, decrease altitude capability by 1300 ft.
With engine and wing anti-ice on, decrease altitude capability by 5500 ft.

ENGINE INOP

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)								
		10	15	17	19	21	25	27	29	31
85	%N1	90.9	94.6	96.8						
	MACH	.557	.596	.612						
	KIAS	309	302	298						
	FF/ENG	2970	2937	2952						
80	%N1	89.3	93.0	94.8	97.4					
	MACH	.542	.585	.600	.617					
	KIAS	301	296	292	289					
	FF/ENG	2794	2768	2755	2784					
75	%N1	87.7	91.5	93.0	95.1	97.9				
	MACH	.527	.573	.588	.604	.622				
	KIAS	292	290	286	283	280				
	FF/ENG	2618	2608	2581	2576	2624				
70	%N1	85.9	89.8	91.4	92.9	95.2				
	MACH	.510	.557	.576	.590	.607				
	KIAS	282	281	280	276	273				
	FF/ENG	2442	2435	2423	2395	2402				
65	%N1	83.9	87.9	89.5	91.1	92.8				
	MACH	.492	.540	.559	.577	.592				
	KIAS	272	272	272	270	266				
	FF/ENG	2265	2261	2251	2237	2215				
60	%N1	81.9	85.9	87.5	89.1	90.7	95.1			
	MACH	.473	.520	.540	.560	.578	.610			
	KIAS	262	262	262	261	260	253			
	FF/ENG	2088	2086	2077	2067	2055	2066			
55	%N1	79.6	83.6	85.3	86.9	88.6	92.2	94.9	98.4	
	MACH	.455	.499	.519	.539	.559	.593	.610	.631	
	KIAS	251	251	252	251	251	245	242	241	
	FF/ENG	1917	1910	1903	1894	1886	1868	1897	1972	
50	%N1	77.2	81.2	82.8	84.5	86.2	89.5	91.5	94.3	97.9
	MACH	.435	.477	.496	.516	.536	.576	.592	.609	.630
	KIAS	241	240	240	240	240	238	234	232	230
	FF/ENG	1754	1733	1728	1721	1714	1703	1700	1725	1795
45	%N1	74.8	78.5	80.1	81.8	83.5	86.9	88.5	90.5	93.5
	MACH	.416	.454	.471	.490	.511	.552	.572	.589	.606
	KIAS	230	228	228	228	228	228	226	223	220
	FF/ENG	1596	1564	1554	1546	1542	1533	1535	1533	1551
40	%N1	72.1	75.6	77.2	78.8	80.5	83.9	85.6	87.2	89.2
	MACH	.395	.431	.447	.464	.482	.524	.545	.566	.584
	KIAS	218	216	216	215	215	215	215	214	212
	FF/ENG	1442	1402	1388	1376	1367	1364	1366	1368	1366

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Diversion Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
297	272	249	230	214	200	190	180	172	164	157
599	546	500	461	429	400	379	361	344	328	315
902	822	751	693	644	600	569	541	516	492	472
1206	1099	1004	926	859	800	759	722	687	656	629
1513	1377	1257	1158	1074	1000	949	902	859	820	786
1821	1656	1511	1391	1290	1200	1138	1081	1030	983	942
2132	1937	1766	1625	1506	1400	1328	1262	1202	1147	1098
2444	2219	2022	1859	1722	1600	1517	1441	1372	1310	1254
2759	2502	2278	2093	1938	1800	1707	1621	1543	1473	1410

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		18		22		26	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	1.3	0:43	1.2	0:41	1.0	0:39	0.9	0:38	0.9	0:37
400	2.8	1:23	2.5	1:19	2.3	1:15	2.1	1:12	2.0	1:09
600	4.2	2:04	3.8	1:57	3.5	1:51	3.3	1:46	3.1	1:42
800	5.5	2:45	5.1	2:36	4.7	2:27	4.4	2:20	4.2	2:15
1000	6.9	3:27	6.4	3:15	6.0	3:04	5.5	2:55	5.3	2:48
1200	8.3	4:09	7.7	3:54	7.1	3:41	6.7	3:29	6.4	3:22
1400	9.6	4:52	9.0	4:35	8.3	4:18	7.8	4:05	7.4	3:55
1600	10.9	5:35	10.2	5:15	9.5	4:56	8.8	4:40	8.5	4:29
1800	12.3	6:19	11.4	5:56	10.6	5:34	9.9	5:16	9.5	5:03

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	40	50	60	70	80
1	-0.1	-0.1	0.0	0.1	0.3
2	-0.3	-0.1	0.0	0.3	0.6
3	-0.4	-0.2	0.0	0.5	1.0
4	-0.6	-0.3	0.0	0.6	1.4
5	-0.7	-0.4	0.0	0.8	1.7
6	-0.9	-0.4	0.0	1.0	2.1
7	-1.0	-0.5	0.0	1.1	2.4
8	-1.2	-0.6	0.0	1.2	2.7
9	-1.4	-0.7	0.0	1.4	3.0
10	-1.5	-0.8	0.0	1.5	3.3
11	-1.7	-0.8	0.0	1.6	3.6
12	-1.8	-0.9	0.0	1.8	3.9
13	-2.0	-1.0	0.0	1.9	4.2

Includes APU fuel burn

ENGINE INOP

MAX CONTINUOUS THRUST

Holding

Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)							
		1500	5000	10000	15000	20000	25000	30000	35000
80	%N1	79.3	82.2	86.4	90.9	98.0			
	KIAS	244	245	246	247	249			
	FF/ENG	2560	2550	2560	2600	2730			
75	%N1	77.6	80.3	84.6	89.0	94.8			
	KIAS	236	237	238	239	241			
	FF/ENG	2400	2390	2390	2420	2480			
70	%N1	75.7	78.4	82.7	87.0	92.0			
	KIAS	228	229	230	231	232			
	FF/ENG	2240	2230	2220	2240	2270			
65	%N1	73.6	76.5	80.6	84.9	89.5	97.4		
	KIAS	220	220	222	223	224	225		
	FF/ENG	2080	2070	2060	2060	2080	2220		
60	%N1	71.3	74.3	78.3	82.7	87.2	93.4		
	KIAS	211	212	213	213	215	216		
	FF/ENG	1920	1910	1900	1900	1900	1960		
55	%N1	69.0	71.9	76.0	80.3	84.7	89.8		
	KIAS	202	203	203	204	205	206		
	FF/ENG	1770	1750	1740	1730	1720	1750		
50	%N1	66.5	69.2	73.5	77.6	82.1	86.8	94.6	
	KIAS	192	193	194	195	195	197	198	
	FF/ENG	1620	1600	1580	1570	1560	1570	1670	
45	%N1	63.8	66.5	70.6	74.8	79.3	83.8	89.4	
	KIAS	184	184	184	184	185	186	187	
	FF/ENG	1480	1450	1430	1410	1390	1400	1440	
40	%N1	60.6	63.5	67.5	71.8	76.0	80.6	85.3	93.9
	KIAS	177	177	177	177	177	177	177	177
	FF/ENG	1330	1310	1280	1260	1240	1230	1260	1350

This table includes 5% additional fuel for holding in a racetrack pattern.

ENGINE INOP

ADVISORY INFORMATION

Gear Down Landing Rate of Climb Available

Flaps 15

TO BE SUPPLIED

Flaps 30

TO BE SUPPLIED

Gear Down Landing Rate of Climb Available - High Altitude

Flaps 15

TO BE SUPPLIED

ENGINE INOP

ADVISORY INFORMATION

Gear Down Landing Rate of Climb Available - High Altitude

Flaps 30

TO BE SUPPLIED

Intentionally
Blank

GEAR DOWN

Long Range Cruise Altitude Capability

Max Cruise Thrust, 100 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
85	15600	12500	9400
80	18500	15600	12700
75	21200	18500	15700
70	23700	21500	18600
65	26200	24500	21900
60	28700	27200	25400
55	30900	29700	28200
50	33000	32000	30800
45	35200	34200	33100
40	37600	36600	35500

GEAR DOWN

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)									
		10	21	23	25	27	29	31	33	35	37
85	%N1	85.9									
	MACH	.482									
	KIAS	267									
	FF/ENG	2417									
80	%N1	84.2									
	MACH	.468									
	KIAS	259									
	FF/ENG	2266									
75	%N1	82.5	91.7								
	MACH	.454	.554								
	KIAS	251	248								
	FF/ENG	2116	2095								
70	%N1	80.5	89.8	91.7	94.3						
	MACH	.440	.541	.557	.575						
	KIAS	243	242	240	238						
	FF/ENG	1969	1955	1943	1965						
65	%N1	78.5	87.8	89.5	91.5	94.4					
	MACH	.425	.524	.543	.560	.578					
	KIAS	235	234	233	231	229					
	FF/ENG	1826	1807	1800	1797	1826					
60	%N1	76.4	85.6	87.4	89.1	91.2	94.4				
	MACH	.409	.504	.525	.544	.562	.580				
	KIAS	226	225	225	224	222	220				
	FF/ENG	1686	1656	1655	1652	1656	1686				
55	%N1	74.2	83.3	85.0	86.8	88.5	90.8	94.0			
	MACH	.393	.484	.504	.525	.545	.562	.581			
	KIAS	217	216	216	216	215	213	211			
	FF/ENG	1548	1509	1506	1509	1511	1515	1545			
50	%N1	71.7	80.7	82.4	84.2	86.0	87.7	90.0	93.3		
	MACH	.376	.463	.482	.502	.523	.544	.561	.580		
	KIAS	207	206	206	206	206	205	203	201		
	FF/ENG	1412	1364	1361	1362	1368	1371	1373	1401		
45	%N1	68.9	77.9	79.6	81.4	83.1	84.9	86.7	89.0	92.3	
	MACH	.358	.441	.458	.477	.498	.520	.541	.559	.578	
	KIAS	197	196	196	196	196	196	195	193	191	
	FF/ENG	1281	1223	1217	1218	1224	1229	1231	1231	1255	
40	%N1	66.0	74.8	76.5	78.2	80.0	81.7	83.6	85.4	87.5	91.3
	MACH	.340	.417	.434	.452	.471	.491	.513	.535	.554	.573
	KIAS	187	185	185	185	185	185	185	185	183	181
	FF/ENG	1156	1089	1077	1076	1082	1086	1088	1090	1090	1113

GEAR DOWN

Long Range Cruise Enroute Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
324	290	260	236	217	200	188	178	168	160	153
654	583	523	474	435	400	377	357	338	321	307
989	880	787	713	653	600	566	535	507	483	461
1329	1181	1054	953	871	800	754	713	676	643	614
1674	1484	1322	1194	1090	1000	943	891	844	803	766
2024	1791	1593	1436	1310	1200	1131	1069	1013	962	918
2380	2102	1865	1680	1530	1400	1320	1247	1181	1122	1070
2742	2417	2140	1924	1751	1600	1508	1424	1348	1280	1221
3111	2736	2418	2171	1972	1800	1695	1600	1514	1438	1371

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		20		24		28	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	2.4	0:49	2.2	0:47	1.9	0:44	1.7	0:42	1.6	0:41
400	4.9	1:36	4.5	1:31	4.0	1:25	3.7	1:20	3.5	1:17
600	7.3	2:25	6.8	2:17	6.1	2:06	5.7	1:59	5.3	1:54
800	9.7	3:14	9.1	3:03	8.1	2:48	7.6	2:38	7.2	2:31
1000	12.1	4:04	11.2	3:50	10.1	3:31	9.4	3:18	8.9	3:08
1200	14.3	4:56	13.4	4:39	12.0	4:14	11.3	3:59	10.7	3:46
1400	16.6	5:49	15.5	5:28	13.9	4:58	13.1	4:40	12.4	4:24
1600	18.8	6:43	17.5	6:18	15.8	5:44	14.8	5:22	14.0	5:03
1800	20.9	7:38	19.6	7:10	17.6	6:30	16.5	6:05	15.7	5:43

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	40	50	60	70	80
2	-0.3	-0.2	0.0	0.3	0.7
4	-0.7	-0.3	0.0	0.6	1.4
6	-1.0	-0.5	0.0	0.9	2.0
8	-1.4	-0.7	0.0	1.2	2.6
10	-1.7	-0.9	0.0	1.4	3.2
12	-2.1	-1.0	0.0	1.6	3.7
14	-2.4	-1.2	0.0	1.8	4.2
16	-2.8	-1.4	0.0	2.0	4.6
18	-3.2	-1.6	0.0	2.2	5.0
20	-3.5	-1.7	0.0	2.4	5.3
22	-3.9	-1.9	0.0	2.5	5.6

GEAR DOWN

Descent

VREF40 + 70 KIAS

PRESSURE ALTITUDE (FT)	TIME (MIN)	FUEL (KG)	DISTANCE (NM)
41000	21	270	90
39000	21	270	86
37000	20	260	81
35000	19	260	77
33000	19	250	73
31000	18	250	68
29000	17	240	64
27000	16	240	60
25000	15	230	56
23000	15	220	52
21000	14	220	48
19000	13	210	44
17000	12	200	40
15000	11	190	36
10000	9	160	26
5000	6	130	16
1500	4	100	9

Allowances for a straight-in approach are included.

GEAR DOWN

Holding

Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)							
		1500	5000	10000	15000	20000	25000	30000	35000
80	%N1	73.9	76.7	80.8	85.1	89.7			
	KIAS	224	224	224	224	224			
	FF/ENG	2090	2080	2070	2080	2090			
75	%N1	72.2	75.2	79.1	83.5	88.0	94.4		
	KIAS	219	219	219	219	219	219		
	FF/ENG	1980	1960	1950	1950	1950	2020		
70	%N1	70.4	73.4	77.4	81.7	86.2	91.5		
	KIAS	214	214	214	214	214	214		
	FF/ENG	1860	1840	1830	1820	1820	1850		
65	%N1	68.6	71.5	75.6	79.9	84.3	89.0		
	KIAS	209	209	209	209	209	209		
	FF/ENG	1750	1720	1710	1700	1690	1710		
60	%N1	66.7	69.5	73.7	77.8	82.2	86.8	93.9	
	KIAS	203	203	203	203	203	203	203	
	FF/ENG	1630	1610	1590	1580	1560	1570	1650	
55	%N1	64.7	67.4	71.6	75.6	80.0	84.6	90.1	
	KIAS	197	197	197	197	197	197	197	
	FF/ENG	1520	1490	1470	1460	1440	1440	1480	
50	%N1	62.3	65.2	69.2	73.4	77.7	82.2	86.9	
	KIAS	190	190	190	190	190	190	190	
	FF/ENG	1400	1380	1360	1340	1320	1310	1340	
45	%N1	59.9	62.8	66.8	71.1	75.2	79.7	84.3	91.1
	KIAS	184	184	184	184	184	184	184	184
	FF/ENG	1290	1270	1250	1230	1200	1190	1210	1250
40	%N1	57.5	60.2	64.3	68.4	72.7	77.0	81.5	86.5
	KIAS	177	177	177	177	177	177	177	177
	FF/ENG	1180	1160	1140	1120	1090	1070	1090	1100

This table includes 5% additional fuel for holding in a racetrack pattern.

Intentionally
Blank

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

WEIGHT (1000 KG)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFTDOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
75	70	218	4400	3200	2400
70	66	213	7700	6600	5300
65	62	208	10300	9500	8200
60	57	202	12600	12000	11200
55	52	196	15500	14500	13900
50	47	190	17800	17400	16500
45	43	184	20900	20100	19200
40	38	177	23300	22500	21700

Includes APU fuel burn.

Long Range Cruise Altitude Capability

100 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
65	4700	3300	2400
60	9300	8100	6600
55	12300	11500	10700
50	16100	14500	13900
45	18500	18100	17300
40	22400	21600	20700

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)									
		5	7	9	11	13	15	17	19	21	23
65	%N1	92.5	94.3								
	MACH	.376	.389								
	KIAS	228	227								
	FF/ENG	3467	3476								
60	%N1	90.1	91.8	93.6							
	MACH	.364	.375	.388							
	KIAS	220	219	218							
	FF/ENG	3180	3181	3188							
55	%N1	87.6	89.2	90.9	92.7	95.2					
	MACH	.351	.362	.374	.387	.400					
	KIAS	212	211	210	209	209					
	FF/ENG	2909	2898	2897	2904	2940					
50	%N1	85.1	86.6	88.1	89.8	91.6	94.1	98.0			
	MACH	.338	.348	.359	.371	.384	.398	.412			
	KIAS	204	203	202	201	200	199	198			
	FF/ENG	2652	2632	2618	2616	2624	2647	2725			
45	%N1	82.4	83.8	85.3	86.8	88.5	90.3	92.6	96.4		
	MACH	.325	.334	.344	.355	.367	.380	.393	.408		
	KIAS	196	195	193	192	191	190	189	189		
	FF/ENG	2407	2379	2358	2344	2341	2343	2350	2406		
40	%N1	79.5	80.8	82.2	83.7	85.2	86.9	88.7	90.7	93.9	98.2
	MACH	.311	.320	.329	.339	.349	.361	.374	.387	.402	.417
	KIAS	188	186	184	183	182	181	180	179	179	178
	FF/ENG	2178	2141	2111	2090	2075	2066	2060	2057	2091	2183

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Diversion Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
172	151	134	120	109	100	93	88	83	78	75
352	308	270	242	219	200	187	175	165	156	148
533	465	408	364	330	300	280	262	246	232	220
716	623	545	486	440	400	373	349	328	309	293
900	783	684	609	551	500	466	436	409	385	365
1086	943	823	733	661	600	559	523	490	462	438
1273	1105	964	856	772	700	652	610	572	538	510
1462	1267	1103	980	883	800	745	696	652	614	581
1652	1430	1244	1103	994	900	838	782	733	690	653
1844	1595	1385	1228	1105	1000	931	868	813	765	724

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)					
	6		10		14	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
100	1.2	0:27	1.1	0:26	1.0	0:26
200	2.6	0:53	2.4	0:50	2.3	0:48
300	3.9	1:18	3.6	1:15	3.5	1:11
400	5.2	1:44	4.9	1:39	4.8	1:35
500	6.5	2:10	6.1	2:04	5.9	1:58
600	7.8	2:37	7.3	2:29	7.1	2:22
700	9.0	3:03	8.5	2:55	8.3	2:46
800	10.3	3:30	9.7	3:20	9.4	3:10
900	11.5	3:58	10.8	3:46	10.5	3:35
1000	12.7	4:25	12.0	4:12	11.6	3:59

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	40	50	60	70	80
1	-0.2	-0.1	0.0	0.1	0.3
2	-0.3	-0.2	0.0	0.3	0.6
3	-0.5	-0.3	0.0	0.5	1.0
4	-0.7	-0.4	0.0	0.7	1.3
5	-0.9	-0.4	0.0	0.9	1.7
6	-1.0	-0.5	0.0	1.1	2.0
7	-1.2	-0.6	0.0	1.2	2.4
8	-1.4	-0.7	0.0	1.4	2.8
9	-1.5	-0.8	0.0	1.6	3.1
10	-1.7	-0.9	0.0	1.8	3.5
11	-1.9	-0.9	0.0	2.0	3.8
12	-2.0	-1.0	0.0	2.1	4.2
13	-2.2	-1.1	0.0	2.3	4.6
14	-2.4	-1.2	0.0	2.5	5.0

Includes APU fuel burn.

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Holding

Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)			
		1500	5000	10000	15000
70	%N1	89.1	92.3		
	KIAS	214	214		
	FF/ENG	3560	3600		
65	%N1	87.1	90.1	95.4	
	KIAS	209	209	209	
	FF/ENG	3310	3330	3410	
60	%N1	84.8	87.8	92.5	
	KIAS	203	203	203	
	FF/ENG	3060	3070	3110	
55	%N1	82.5	85.5	90.0	96.7
	KIAS	197	197	197	197
	FF/ENG	2820	2820	2840	2960
50	%N1	79.9	82.9	87.3	92.4
	KIAS	190	190	190	190
	FF/ENG	2580	2570	2580	2630
45	%N1	77.4	80.2	84.6	89.3
	KIAS	184	184	184	184
	FF/ENG	2370	2350	2340	2370
40	%N1	74.7	77.4	81.8	86.2
	KIAS	177	177	177	177
	FF/ENG	2150	2130	2110	2120

This table includes 5% additional fuel for holding in a racetrack pattern.

Introduction

This chapter contains information to supplement performance data from the Flight Management Computer (FMC). In addition, sufficient inflight data is provided to complete a flight with the FMC inoperative. In the event of conflict between data presented in this chapter and that contained in the approved Airplane Flight Manual, the Flight Manual shall always take precedence.

General

Takeoff Speeds

The speeds presented in the Takeoff Speeds table as well as FMC computed takeoff speeds can be used for all performance conditions except where adjustments must be made to V1 for clearway, stopway, anti-skid inoperative, thrust reversers inoperative, improved climb, contaminated runway situations or brake energy limits. 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 will not help this condition as the minimum control speeds are determined at the actual temperature and therefore are not reduced.

Operations at 26B2 Bump takeoff thrust may be limited at weights below 56699 kg in order to maintain airplane controllability during takeoff. Alternatively, lower minimum takeoff weights may be obtained, for the actual pressure altitude and outside air temperature, by using the Minimum Takeoff Weight table provided in the Performance Dispatch Takeoff Section. For takeoff at weights below the minimum takeoff weight, use of a lower thrust rating (24K full rate thrust or a certified derate) is required. Note that the assumed temperature method of reducing thrust may not be used as a means to comply with this restriction.

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

V1(MCG)

Regulations prohibit scheduling takeoff with a V1 less than minimum V1 for control on the ground, V1(MCG). It is therefore necessary to compare the adjusted V1 to V1(MCG). The V1(MCG) presented in this manual is conservative for all weight and bleed configurations.

To find V1(MCG) enter the V1(MCG) table with the airport pressure altitude and actual OAT. If the adjusted V1 is less than V1(MCG), set V1 equal to V1(MCG). If the adjusted VR is less than V1(MCG), set VR equal to V1(MCG), and determine a new V2 by adding the difference between the normal VR and V1(MCG) to the normal V2. No takeoff weight adjustment is necessary provided that the actual field length exceeds the minimum field length shown in the Field and Climb Limit Weight table in chapter Performance Dispatch.

Clearway and Stopway V1 Adjustments

Maximum allowable clearway limits are provided for guidance when more precise data is not available. Use of clearway is not allowed on wet runways.

Takeoff speed adjustments are to be applied to V1 speed when using takeoff weights based on the use of clearway and stopway.

Adjust V1 speed by the amount shown in the table. The adjusted V1 speed must not exceed VR. If the adjusted V1 speed is greater than VR, reduce V1 to equal VR.

Stab Trim

To find takeoff stabilizer trim setting, enter Stab Trim Setting table with anticipated brake release weight and center of gravity (C.G. % MAC) and read required stabilizer trim units.

VREF

This table contains flaps 40, 30 and 15 reference speeds for a given weight.

With autothrottles disengaged an approach speed wind correction (max 20 knots) of 1/2 steady headwind component + gust increment above steady wind is recommended. Do not apply a wind correction for tailwinds. The maximum command speed should not exceed landing flap placard speed minus 5 knots.

Flap Maneuver Speeds

This table provides flap maneuver speeds for various flap settings. During flap retraction, selection of the next flap position is initiated when reaching the maneuver speed for the existing flap position. During flap retraction, at least adequate maneuver capability or 30° of bank (15° of bank and 15° overshoot) to stick shaker is provided at the flap retraction speed. Full maneuver capability or at least 40° of bank (25° of bank and 15° overshoot) is provided when the airplane has accelerated to the recommended maneuver speed for the selected flap position.

During flap extension, selection of the flaps to the next flap position should be made when approaching, and before decelerating below, the maneuver speed for the existing flap position. The flap extension speed schedule varies with airplane weight and provides full maneuver capability or at least 40° of bank (25° of bank and 15° overshoot) to stick shaker at all weights.

Slush/Standing Water Takeoff

Experience has shown that aircraft performance may deteriorate significantly on runways covered with snow, slush, standing water or ice. Therefore, reductions in field/obstacle limited takeoff weight and revised takeoff speeds are necessary. The tables are intended for guidance in accordance with advisory material and assume an engine failure at the critical point during the takeoff.

The entire runway is assumed to be completely covered by a contaminant of uniform thickness and density. Therefore this information is conservative when operating under typical cold weather conditions where patches of slush exist and some degree of sanding is common. Takeoffs in slush depths greater than 13 mm (0.5 inches) are not recommended because of possible airplane damage as a result of slush impingement on the airplane structure. The use of assumed temperature for reduced thrust is not allowed on contaminated runways. Interpolation for slush/standing water depths between the values shown is permitted.

Takeoff weight determination:

1. Enter the Weight Adjustment table with the dry field/obstacle limit weight to obtain the weight reduction for the slush/standing water depth and airport pressure altitude.
2. Adjust field length available for temperature by amount shown beneath V1(MCG) limit weight table.
3. Enter the V1(MCG) Limit Weight table with the adjusted field length and pressure altitude to obtain the slush/standing water limit weight with respect to minimum field length required for V1(MCG) speed.
4. The maximum allowable takeoff weight in slush/standing water is the lesser of the limit weights found in steps 1 and 3.

Takeoff speed determination:

1. Determine takeoff speeds V1, VR and V2 for actual brake release weight using the Dry Runway Takeoff Speeds table for the appropriate flap setting and thrust rating.
2. If V1(MCG) limited, set V1=V1(MCG). If not limited by V1(MCG) considerations, enter the V1 Adjustment table with actual brake release weight to determine the V1 reduction to apply to V1 speed. If the adjusted V1 is less than V1(MCG), set V1=V1(MCG).

Slippery Runway Takeoff

Airplane braking action is reported as good, medium or poor, depending on existing runway conditions. If braking action is reported as good, conditions should not be expected to be as good as on clean, dry runways. The value “good” is comparative and is intended to mean that airplanes should not experience braking or directional control difficulties when stopping. The performance level used to calculate the “good” data is consistent with wet runway testing done on early Boeing jets. The performance level used to calculate the “poor” data reflects a runway covered with wet ice. Performance is based on a 15 ft screen height at the end of the runway. The tables provided are used in the same manner as the Slush/Standing Water tables.

Anti-Skid Inoperative

When operating with anti-skid inoperative, the field limit weight and V1 must be reduced to account for the effect on accelerate-stop performance. Anti-skid inoperative is only allowed on a dry runway. A simplified method which conservatively accounts for the effects of anti-skid inoperative is to reduce the normal dry field/obstacle limited weight by 8300 kg and the V1 associated with the reduced weight by the amount shown in the table below.

ANTI-SKID INOPERATIVE V1 ADJUSTMENTS	
FIELD LENGTH (M)	V1 ADJUSTMENT (KIAS)
2000	-17
2500	-15
3000	-13
3500	-11
4000	-10

If the resulting V1 is less than V1(MCG), takeoff is permitted with V1 set equal to V1(MCG) provided the dry accelerate-stop distance adjusted for wind and slope exceeds approximately 2200 m.

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

Thrust Reverser Inoperative

When dispatching on a wet runway with both thrust reversers operative, an operative anti-skid system, and all brakes operating, regulations allow deceleration credit for one thrust reverser in the engine failure case and two thrust reversers in the all engine stop case.

When dispatching on a wet runway with one thrust reverser inoperative, the field/obstacle limited weight and V1 speed must be reduced to account for the effect on accelerate-stop performance. A simplified method, which conservatively accounts for this, is to reduce the normal wet runway/field/obstacle limited weight by 1000 kg and the V1 associated with the reduced weight by 2 knots.

If the resulting V1 is less than minimum V1, takeoff is permitted with V1 set equal to V1(MCG) provided the accelerate-stop distance available adjusted for wind and slope exceeds approximately 1600 m.

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

Takeoff %N1

To find Max Takeoff %N1 based on normal engine bleed for air conditioning packs on, enter Takeoff %N1 Table with airport pressure altitude and airport OAT and read %N1. Apply %N1 adjustments as provided when applicable.

Assumed Temperature Reduced Thrust

Regulations permit the use of up to 25% takeoff thrust reduction for operation with assumed temperature reduced thrust. Use of assumed temperature reduced thrust is not allowed with anti-skid inoperative or on runways contaminated with standing water, ice, slush, or snow. Use of assumed temperature reduced thrust is also not permitted when operating at the 26B2 Bump thrust rating. Use of assumed temperature reduced thrust is not recommended if potential windshear conditions exist.

To find the maximum allowable assumed temperature enter the Maximum Assumed Temperature table with airport pressure altitude and OAT. Compare this temperature to that at which the airplane is performance limited as determined from available takeoff performance data. Next, enter the Maximum Takeoff %N1 table with airport pressure altitude and the lower of the two temperatures previously determined, to obtain a maximum takeoff %N1. Do not use an assumed temperature less than the minimum assumed temperature shown. Enter the %N1 Adjustment table with OAT and the difference between the assumed and actual OAT to obtain a %N1 adjustment. Subtract the %N1 adjustment from the maximum takeoff %N1 found previously to determine the assumed temperature reduced thrust %N1.

Apply %N1 adjustments as provided when applicable.

Max Climb %N1

This table shows Max Climb %N1 for a 280/.78 climb speed schedule, normal engine bleed for packs on or off and anti-ice off. Enter the table with airport pressure altitude and TAT and read %N1. %N1 adjustments are shown for anti-ice operation.

Go-around %N1

To find Max Go-around %N1 based on normal engine bleed for packs on (AUTO) and anti-ice on or off, enter the Go-around %N1 table with airport pressure altitude and reported OAT or TAT and read %N1. For packs OFF or HIGH operation, apply the %N1 adjustment shown below the table.

Flight with Unreliable Airspeed / Turbulent Air Penetration

Pitch attitude and average %N1 information is provided for use in all phases of flight in the event of unreliable airspeed/Mach indications resulting from blocking or freezing of the pitot system. Loss of radome or turbulent air may also cause unreliable airspeed/Mach indications. The cruise table in this section may also be used for turbulent air penetration.

Pitch attitude is shown in bold type for emphasis since altitude and/or vertical speed indications may also be unreliable.

All Engines

Long Range Cruise Maximum Operating Altitude

These tables provide the maximum operating altitude in the same manner as the FMC. Maximum altitudes are shown for a given cruise weight and maneuver capability. This table considers both thrust and buffet limits, providing the more limiting of the two. Any data that is thrust limited is denoted by an asterisk and represents only a thrust limited condition in level flight with 100 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 15° may cause the airplane to lose speed and/or altitude. The altitudes shown in the table are limited to the maximum certified altitude of 41000 ft.

Long Range Cruise Control

These tables provide target %N1, Long Range Cruise Mach number, IAS and standard day fuel flow per engine for the airplane weight and pressure altitude. As indicated by the shaded area, at optimum altitude .79M approximates the Long Range Cruise Mach schedule.

Long Range Cruise Enroute Fuel and Time

Long Range Cruise Enroute Fuel and Time tables are provided to determine remaining time and fuel required to destination. The data is based on Long Range Cruise and .78/280/250 descent. Tables are presented for low altitudes and high altitudes.

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

APU Operation During Flight

For APU operation during flight, increase fuel flow according to the table in the Engine Inoperative text section.

Long Range Cruise Wind-Altitude Trade

Wind is a factor which may justify operations considerably below optimum altitude. For example, a favorable wind component may have an effect on ground speed which more than compensates for the loss in air range.

Using this table, it is possible to determine the break-even wind (advantage necessary or disadvantage that can be tolerated) to maintain the same range at another altitude and long range cruise speed. The tables make no allowance for climb or descent time, fuel or distance, and are based on comparing ground fuel mileage.

Descent

Time, fuel, and distance for descent are shown for a .78/280/250 descent speed schedule. Enter the table with top of descent pressure altitude and read distance, time and fuel. Data is based on flight idle thrust descent in zero wind. Allowances are included for a straight-in approach with gear down and landing flaps at the outer marker.

Holding

Target %N1, indicated airspeed and fuel flow per engine information is tabulated for holding with flaps up based on the FMC optimum holding speed schedule. This is the higher of the maximum endurance speed and the maneuvering speed. Small variations in airspeed will not appreciably affect the overall endurance time. Enter the table with weight and pressure altitude to read %N1, IAS and fuel flow per engine.

Advisory Information

Normal Configuration Landing Distance

The normal configuration distance tables are provided as advisory information to help determine the actual landing distance performance of the airplane for different runway surface conditions and brake configurations.

Flaps 15, 30, and 40 landing distances and adjustments are provided for dry runways as well as runways with good, medium, and poor reported braking action, which are commonly referred to as slippery runway conditions.

If the surface is affected by water, snow or ice, and the braking action is reported as "good", conditions should not be expected to be as good as on clean, dry runways. The value "good" is comparative and is intended to mean that airplanes should not experience braking or directional control difficulties when landing. The performance level used to calculate the "good" data is consistent with wet runway testing done on early Boeing jets. The performance level used to calculate "poor" data reflects runways covered with wet ice.

Dry runway landing performance is shown for max manual braking configuration and autobrake settings max, 3, 2, and 1. The autobrake performance may be used to assist in the selection of the most desirable autobrake setting for a given field length. Selection of an autobrake setting results in a constant rate of deceleration. Maximum effort manual braking should achieve shorter landing distance than the max autobrake setting. The reference landing distance is a reference distance from 50 ft above the threshold to stop based on a reference landing weight and normal approach speed for the selected landing flap at sea level, zero wind, zero slope, and two engine detent reverse thrust. Subsequent columns provide adjustments for off-reference landing weight, altitude, wind, slope, temperature, speed, and reverse thrust. Each adjustment is independently added to the reference landing distance.

Non-normal Configuration Landing Distance

Advisory information is provided to support non-normal configurations that affect the landing performance of the airplane. Landing distances and adjustments are provided for dry runways and runways with good, medium, and poor reported braking action.

Enter the table with the applicable non-normal configuration and read the normal approach speed. The reference landing distance is a reference distance from 50 ft above the threshold to stop based on a reference landing weight and speed at sea level, zero wind, and zero slope. Subsequent columns provide adjustments for off-reference landing weight, altitude, wind, slope, and speed conditions. Each adjustment is independently added to the reference landing distance. Landing distance includes the effect of reverse thrust.

Recommended Brake Cooling Schedule

Advisory information is provided to assist in avoiding the problems associated with hot brakes. For normal operation, most landings are at weights below the AFM quick turnaround limit weight.

Use of the recommended cooling schedule will help avoid brake overheat and fuse plug problems that could result from repeated landings at short time intervals or a rejected takeoff.

Enter the Recommended Brake Cooling Schedule table with the airplane weight and brakes on speed, adjusted for wind at the appropriate temperature and altitude condition. Instructions for applying wind adjustments are included below the table. Linear interpolation may be used to obtain intermediate values. The resulting number is the reference brake energy per brake in millions of foot-pounds, and represents the amount of energy absorbed by each brake during a rejected takeoff. Notes providing adjustments for wind are included below the table.

To determine the energy per brake absorbed during landing, enter the appropriate Adjusted Brake Energy Per Brake table (No Reverse Thrust or 2 Engine Reverse) with the reference brake energy per brake and the type of braking used during landing (Max Manual, Max Auto, or Autobrake). The resulting number is the adjusted brake energy per brake and represents the energy absorbed in each brake during the landing.

The recommended cooling time is found in the appropriate (steel or carbon brakes) final table by entering with the adjusted brake energy per brake. Times are provided for ground cooling and inflight gear down cooling.

Brake Temperature Monitor System (BTMS) indications are also shown. If brake cooling is determined from the BTMS, use the hottest brake indication 10 to 15 minutes after the airplane has come to a complete stop, or inflight with gear retracted to determine recommended cooling schedule.

Engine Inoperative

Initial Max Continuous %N1

The Initial Max Continuous %N1 setting for use following an engine failure is shown. The table is based on the typical all engine cruise speed of .79M to provide a target %N1 setting at the start of driftdown. Once driftdown is established, the Max Continuous %N1 table should be used to determine %N1 for the given conditions.

Max Continuous %N1

Power setting is based on one engine operating with one A/C pack operating and all anti-ice bleeds off. Enter the table with pressure altitude, TAT, and IAS or Mach to read %N1.

It is desirable to maintain engine thrust level within the limits of the Max Cruise thrust rating. However, where thrust level in excess of Max Cruise rating is required, such as for meeting terrain clearance, ATC altitude assignments, or to attain maximum range capability, it is permissible to use the thrust needed up to the Max Continuous thrust rating. The Max Continuous thrust rating is intended primarily for emergency use at the discretion of the pilot and is the maximum thrust that may be used continuously.

Driftdown Speed/Level Off Altitude

The table shows optimum driftdown speed as a function of cruise weight at start of driftdown. Also shown are the approximate weight and pressure altitude at which the airplane will level off considering 100 ft/min residual rate of climb.

The level off altitude is dependent on air temperature (ISA deviation).

Driftdown/LRC Range Capability

This table shows the range capability from the start of driftdown. Driftdown is continued to level off altitude. As weight decreases due to fuel burn, the airplane is accelerated to Long Range Cruise speed. Cruise is continued at level off altitude and Long Range Cruise speed.

To determine fuel required, enter the Ground to Air Miles Conversion table with the desired ground distance and adjust for anticipated winds to obtain air distance to destination. Then enter the Driftdown/Cruise Fuel and Time table with air distance and weight at start of driftdown to determine fuel and time required. If altitudes other than the level off altitude is used, fuel and time required may be obtained by using the Engine Inoperative Long Range Cruise Enroute Fuel and Time table.

Long Range Cruise Altitude Capability

The table shows the maximum altitude that can be maintained at a given weight and air temperature (ISA deviation), based on Long Range Cruise speed, Max Continuous thrust, and 100 ft/min residual rate of climb.

Long Range Cruise Control

The table provides target %N1, engine inoperative Long Range Cruise Mach number, IAS and fuel flow for the airplane weight and pressure altitude. The fuel flow values in this table reflect single engine fuel burn.

APU Operation During Flight

For APU operation during flight, increase fuel flow according to the following table. These increments include the APU fuel flow and the effect of increased drag from the APU door.

PRESSURE ALTITUDE (1000 FT)	APU FUEL FLOW (KG/HR)
39	45
35	45
31	50
25	60
20	65
15	75
10	85
5	95

Long Range Cruise Diversion Fuel and Time

Tables are provided for crews to determine the fuel and time required to proceed to an alternate airfield with one engine inoperative. The data is based on single engine Long Range Cruise speed and .78/280/250 descent. Enter with Air Distance as determined from the Ground to Air Miles Conversion table and read Fuel and Time required at the cruise pressure altitude. Adjust the fuel obtained for deviation from the reference weight at checkpoint as required by entering the off reference fuel adjustments table with the fuel required for the reference weight and the actual weight at checkpoint. Read fuel required and time for the actual weight.

Holding

Single engine holding data is provided in the same format as the all engine holding data and is based on the same assumptions.

Gear Down Landing Rate of Climb Available

Rate of climb data is provided as guidance information in the event an engine inoperative landing (manual or autoland) is planned. The tables show gear down rate of climb available for Flaps 15 and Flaps 30. Enter the table with TAT and pressure altitude to read rate of climb available. Apply adjustments shown to correct for weight.

Alternate Mode EEC

Introduction

No takeoff speed adjustments or other performance adjustments are required of Electronic Engine Control (EEC) in the alternate mode (ALTN EEC switch illuminated) for the 7B18, -7B20, -7B22, -7B24 and -7B24A engine thrust ratings.

Operation with derate and/or assumed temperature reduced thrust is not permitted with the EEC in alternate mode.

Operation with the 26/B2 Bump thrust rating is not permitted with the EEC in the alternate mode.

Gear Down

This section contains performance for airplane operation with the landing gear extended. The data is based on engine bleeds for normal air conditioning.

Note: The Flight Management Computer System (FMCS) does not contain special provisions for operation with landing gear extended. As a result, the FMCS may generate inappropriate enroute speed schedules, display non-conservative predictions of fuel burn, estimated time of arrival (ETA), maximum altitude, and compute overly shallow descent path. An accurate estimated time of arrival (ETA) is available if current speed or Mach is entered into the VNAV cruise page.

Tables for gear down performance in this section are identical in format and used in the same manner as tables for the gear up configuration previously described.

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Performance Inflight Chapter PI

Table of Contents Section 40

737-800W CFM56-7B24 KG M FAA CATC/N

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Performance Inflight Chapter PI

Pkg Model Identification Section 40

General

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

Serial and tabulation number are supplied by Boeing.

Registry Number	Serial Number	Tabulation Number
B-5511	37576	YF921
B-5512	37577	YF922
B-5528	37578	YF923
B-5529	37150	YF924
B-5532	37151	YF925
B-5533	37152	YF926
B-5535	37579	YF927
B-5566	37153	YF928
B-5159	35044	YK961

Registry Number	Serial Number	Tabulation Number
B-5160	35045	YK962
B-5161	35046	YK963
B-5162	35047	YK964
B-5301	35048	YK965
B-5302	35049	YK966
B-5303	35050	YK968
B-5305	35051	YK969
B-5306	35052	YK970
B-5307	35053	YK971
B-5459	35057	YK973
B-5458	35055	YK974
B-5476	35056	YK975
B-5488	37148	YK976
B-5489	37149	YK977
B-5487	35058	YK978
B-5498	37574	YK979
B-5499	37575	YK980
B-5630	38386	YS151
B-5631	38387	YS152
B-5632	38388	YS153
B-5633	38389	YS154
B-5635	38390	YS155
B-5653	38391	YS156
B-5655	38392	YS157
B-5656	38393	YS158
B-5657	38394	YS159
B-5659	38396	YS160

Registry Number	Serial Number	Tabulation Number
B-5658	38395	YS166
B-5706	38398	YS168
B-5708	38403	YS169
B-5707	38399	YS170
B-5751	38400	YS171
B-5752	38404	YS172
B-5750	38380	YS173
B-5788	38382	YS174
B-5789	38401	YS175
B-5790	38402	YS176
B-1911	39907	YS179
B-1912	39908	YS180
B-1913	39900	YS181
B-1915	39901	YS182
B-1970	39903	YS183
B-1969	39902	YS184
B-1971	39904	YS185
B-1706	39905	YS186
B-1708	39911	YS187
B-1707	39906	YS188
B-1709	39912	YS189
B-1749	39909	YS190
B-1966	39910	YT501
B-6485	39913	YT502
B-6483	39918	YT503
B-6482	41391	YT504
B-6487	39919	YT505

Registry Number	Serial Number	Tabulation Number
B-6486	41395	YT506
B-1964	39914	YT507
B-6489	39915	YT508
B-6490	41392	YT509
B-6488	41396	YT510
B-6818	39916	YT511
B-6819	39917	YT512
B-6849	40959	YT513
B-6842	40957	YT514
B-7176	41393	YT515
B-7177	41394	YT516
B-7179	40960	YT517
B-7178	40958	YT518
B-7197	42925	YV741
B-7557	42926	YV742
B-7558	42927	YV743
B-7559	42928	YV744
B-7847	42930	YV745
B-7846	42929	YV746
B-7848	42931	YV747
B-7849	42932	YV748
B-1557	42933	YV749
B-1550	42934	YV750
B-1558	42935	YV751
B-1579	42936	YV752

Registry Number	Serial Number	Tabulation Number
B-1580	42937	YV753
YV754	42938	YV754
YV755	42939	YV755

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Performance Inflight Chapter PI

General Section 40

Takeoff Speeds - Dry Runway

V1, VR, V2 for Max Takeoff Thrust

WEIGHT (1000 KG)	FLAPS 1			FLAPS 5			FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
90	172	172	174												
85	166	167	170	159	160	163									
80	160	162	166	154	155	159									
75	155	156	161	149	150	155	148	148	153	145	145	150	142	142	148
70	149	150	157	143	144	151	142	143	149	139	140	146	137	137	144
65	143	144	152	137	138	147	136	137	145	133	134	142	131	131	139
60	137	138	147	131	132	142	130	131	140	127	128	137	125	125	135
55	130	131	142	124	125	136	123	124	135	121	121	132	118	119	130
50	122	123	136	118	118	131	116	117	129	114	115	127	112	112	125
45	115	116	130	110	111	125	109	110	124	107	107	121	105	105	119
40	107	108	124	103	103	119	102	102	118	99	100	116	97	98	114

Check V1(MCG).

V1, VR, V2 Adjustments*

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

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
90	-4	-2	0	0	0	-2	-1	-1	0	0	0	0	0
80	-3	-2	0	1	1	-2	-1	-1	0	0	0	1	1
70	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
60	-1	-1	0	1	1	-1	-1	0	0	0	1	1	1
50	-1	0	0	0	0	-2	-1	0	0	0	0	0	0
40	0	0	0	0	0	-2	-1	0	0	0	0	0	0

***V1 not to exceed VR.**

V1(MCG)

Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	90	88					
60	140	90	88	87	85			
50	122	92	90	87	85	83	81	79
40	104	97	95	91	88	84	81	79
30	86	100	99	95	92	88	85	81
20	68	100	99	97	95	92	88	85
-60	-76	101	101	98	96	94	91	89

Takeoff Speeds - Wet Runway

V1, VR, V2 for Max Takeoff Thrust

WEIGHT (1000 KG)	FLAPS 1			FLAPS 5			FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
90	167	172	174												
85	161	167	170	154	160	163									
80	155	162	166	148	155	159									
75	149	156	161	142	150	155	142	148	153	139	145	150	137	142	148
70	142	150	157	136	144	151	136	143	149	133	140	146	131	137	144
65	136	144	152	130	138	147	129	137	145	127	134	142	125	131	139
60	129	138	147	123	132	142	123	131	140	120	128	137	118	125	135
55	122	131	142	116	125	136	116	124	135	113	121	132	111	119	130
50	114	123	136	109	118	131	109	117	129	106	115	127	104	112	125
45	107	116	130	102	111	125	101	110	124	99	107	121	97	105	119
40	98	108	124	94	103	119	93	102	118	92	100	115	90	98	114

Check V1(MCG).

V1, VR, V2 Adjustment*

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

Slope and Wind V1 Adjustment*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
90	-6	-3	0	3	6	-3	-2	-1	0	1	1	2	2
80	-5	-3	0	3	5	-3	-2	-1	0	1	1	2	2
70	-4	-2	0	2	4	-3	-2	-1	0	1	1	2	2
60	-3	-2	0	2	3	-4	-2	-1	0	1	1	2	3
50	-2	-1	0	1	3	-4	-3	-1	0	1	2	3	3
40	-1	0	0	1	2	-5	-3	-1	0	1	2	3	4

***V1 not to exceed VR.**

V1(MCG)

Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	90	88					
60	140	90	88	87	85			
50	122	92	90	87	85	83	81	79
40	104	97	95	91	88	84	81	79
30	86	100	99	95	92	88	85	81
20	68	100	99	97	95	92	88	85
-60	-76	101	101	98	96	94	91	89

Maximum Allowable Clearway

FIELD LENGTH (M)	DRY RUNWAY MAX ALLOWABLE CLEARWAY FOR V1 REDUCTION (M)
1200	150
1600	180
2000	210
2400	240
2800	270
3200	290

Clearway and Stopway V1 Adjustments

CLEARWAY MINUS STOPWAY (M)	NORMAL V1 (KIAS)							
	DRY RUNWAY				WET RUNWAY			
	100	120	140	160	100	120	140	160
300	-5	-4	-3	-4				
200	-5	-4	-3	-3				
100	-3	-2	-2	-2				
0	0	0	0	0	0	0	0	0
-100	1	1	1	1	3	2	1	1
-200	1	1	1	1	6	4	2	1
-300	1	1	1	1	7	6	3	1

Use of clearway not allowed on wet runways.
V1 not to exceed VR.

Stab Trim Setting

Max Takeoff Thrust

Flaps 1 and 5

WEIGHT (1000 KG)	C.G. (%MAC)									
	6	8	10	14	18	22	26	33	34	36
80	8 1/2	8 1/2	8 1/2	7 3/4	7	6 1/4	5 3/4	4 1/2	4 1/4	4
70	8 1/2	8 1/4	8	7 1/4	6 1/2	6	5 1/4	4	4	3 1/2
60	7 3/4	7 1/2	7	6 1/2	6	5 1/4	4 3/4	3 1/2	3 1/2	3 1/4
50	7	6 1/2	6 1/4	5 3/4	5 1/4	4 1/2	4	3	2 3/4	2 3/4
45	6 1/2	6 1/4	6	5 1/4	4 3/4	4 1/4	3 3/4	2 3/4	2 3/4	2 3/4
35	6 1/2	6 1/4	6	5 1/4	43/4	4 1/4	3 3/4	2 3/4	2 3/4	2 3/4

Flaps 10, 15 and 25

WEIGHT (1000 KG)	C.G. (%MAC)									
	6	8	9	10	16	26	29	32	34	36
80	8 1/2	8 1/2	8 1/2	8 1/2	7	4 3/4	4 1/4	3 1/2	3 1/4	2 3/4
70	8 1/2	8 1/4	8	7 3/4	6 1/4	4 1/4	3 1/2	3	2 3/4	2 3/4
60	7 3/4	7 1/4	7	6 3/4	5 1/2	3 1/2	3	2 3/4	2 3/4	2 3/4
50	6 1/4	6	5 3/4	5 3/4	4 3/4	3	2 3/4	2 3/4	2 3/4	2 3/4
45	5 3/4	5 1/2	5 1/4	5	4 1/4	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4
35	5 3/4	5 1/2	5 1/4	5	4 1/4	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4

VREF

WEIGHT (1000 KG)	FLAPS		
	40	30	15
85	160	168	177
80	155	163	172
75	151	158	167
70	146	153	161
65	141	148	156
60	135	142	149
55	128	136	143
50	122	129	136
45	115	122	128
40	108	115	121

Flap Maneuver Speeds

FLAP POSITION	MANEUVER SPEED
UP	VREF40 + 70
1	VREF40 + 50
5	VREF40 + 30
10	VREF40 + 30
15	VREF40 + 20
25	VREF40 + 10
30	VREF30
40	VREF40

ADVISORY INFORMATION

Slush/Standing Water Takeoff

Maximum Reverse Thrust

Weight Adjustments (1000 KG)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	-13.2	-15.4	-17.7	-16.5	-18.7	-21.0	-25.2	-27.5	-29.8
90	-12.1	-14.4	-16.6	-15.0	-17.2	-19.5	-22.3	-24.6	-26.9
85	-11.0	-13.3	-15.6	-13.5	-15.7	-18.0	-19.5	-21.8	-24.0
80	-10.0	-12.3	-14.5	-12.0	-14.3	-16.5	-16.8	-19.1	-21.3
75	-9.0	-11.3	-13.5	-10.6	-12.9	-15.2	-14.4	-16.6	-18.9
70	-8.0	-10.3	-12.6	-9.3	-11.6	-13.9	-12.2	-14.4	-16.7
65	-7.1	-9.4	-11.6	-8.1	-10.4	-12.7	-10.2	-12.5	-14.8
60	-6.2	-8.5	-10.7	-7.0	-9.2	-11.5	-8.6	-10.8	-13.1
55	-5.3	-7.6	-9.9	-5.9	-8.2	-10.5	-7.1	-9.4	-11.7
50	-4.5	-6.8	-9.1	-4.9	-7.2	-9.5	-5.9	-8.2	-10.5
45	-3.7	-6.0	-8.2	-3.9	-6.2	-8.5	-4.7	-7.0	-9.3
40	-2.9	-5.1	-7.4	-3.0	-5.2	-7.5	-3.5	-5.8	-8.1

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1200				32.5			39.1		
1400	50.5	33.8		53.8	37.5		58.9	43.8	
1600	72.4	55.7		75.1	58.8	32.9	78.6	63.6	39.5
1800	94.4	77.6	50.9	96.4	80.2	54.2	98.4	83.3	59.3
2000		99.6	72.9		101.5	75.5		103.1	79.0
2200			94.8			96.8			98.8

1. **Enter Weight Adjustment table with slush/standing water depth and dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -30 m/+30 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-13	-8	-3	-7	-2	0	0	0	0
85	-14	-9	-4	-8	-3	0	0	0	0
80	-15	-10	-5	-9	-4	0	0	0	0
75	-16	-11	-6	-11	-6	-1	0	0	0
70	-18	-13	-8	-12	-7	-2	0	0	0
65	-19	-14	-9	-14	-9	-4	-4	0	0
60	-20	-15	-10	-16	-11	-6	-7	-2	0
55	-21	-16	-11	-18	-13	-8	-11	-6	-1
50	-22	-17	-12	-20	-15	-10	-15	-10	-5
45	-23	-18	-13	-21	-16	-11	-17	-12	-7
40	-23	-18	-13	-21	-16	-11	-18	-13	-8

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff

No Reverse Thrust

Weight Adjustments (1000 KG)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESSE ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-15.0	-17.5	-20.1	-18.1	-20.6	-23.1	-24.6	-27.1	-29.6
85	-14.0	-16.5	-19.0	-16.5	-19.1	-21.6	-22.0	-24.5	-27.0
80	-12.9	-15.4	-18.0	-15.0	-17.5	-20.0	-19.4	-22.0	-24.5
75	-11.8	-14.4	-16.9	-13.5	-16.0	-18.6	-17.1	-19.6	-22.1
70	-10.8	-13.3	-15.9	-12.1	-14.6	-17.2	-14.9	-17.5	-20.0
65	-9.8	-12.3	-14.8	-10.8	-13.3	-15.8	-13.0	-15.5	-18.0
60	-8.7	-11.3	-13.8	-9.5	-12.0	-14.6	-11.2	-13.7	-16.2
55	-7.7	-10.2	-12.8	-8.3	-10.8	-13.3	-9.6	-12.1	-14.6
50	-6.7	-9.2	-11.7	-7.1	-9.7	-12.2	-8.2	-10.7	-13.2
45	-5.7	-8.2	-10.7	-6.1	-8.6	-11.1	-7.0	-9.5	-12.0
40	-4.7	-7.2	-9.7	-5.0	-7.6	-10.1	-6.0	-8.5	-11.0

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1600							32.3		
1700							46.2		
1800				33.4			60.1		
1900	30.7			52.9			74.1	39.9	
2000	54.1			70.9			88.2	53.8	
2100	75.7			87.8	44.3			67.8	33.7
2200	95.8	43.7			63.0			81.8	47.6
2300		66.2			80.3	35.4		95.9	61.5
2400		86.8	33.1		96.9	54.7			75.5
2500			56.4			72.6			89.6
2600			77.7			89.4			
2700			97.8						

1. **Enter Weight Adjustment table with slush/standing water depth and dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -40 m/+40 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-20	-10	0	-9	0	0	0	0	0
85	-22	-12	-2	-12	-2	0	0	0	0
80	-24	-14	-4	-14	-4	0	0	0	0
75	-26	-16	-6	-17	-7	0	0	0	0
70	-28	-18	-8	-20	-10	0	0	0	0
65	-30	-20	-10	-23	-13	-3	-6	0	0
60	-32	-22	-12	-26	-16	-6	-12	-2	0
55	-34	-24	-14	-29	-19	-9	-18	-8	0
50	-36	-26	-16	-32	-22	-12	-24	-14	-4
45	-38	-28	-18	-35	-25	-15	-29	-19	-9
40	-40	-30	-20	-38	-28	-18	-34	-24	-14

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff

Maximum Reverse Thrust

Weight Adjustment (1000 KG)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	-0.4	-0.4	-0.4	-5.8	-5.8	-5.8	-11.0	-11.0	-11.0
90	-0.6	-0.6	-0.6	-5.8	-5.8	-5.8	-10.6	-10.6	-10.6
85	-0.9	-0.9	-0.9	-5.7	-5.7	-5.7	-10.2	-10.2	-10.2
80	-1.1	-1.1	-1.1	-5.7	-5.7	-5.7	-9.8	-9.8	-9.8
75	-1.3	-1.3	-1.3	-5.6	-5.6	-5.6	-9.3	-9.3	-9.3
70	-1.5	-1.5	-1.5	-5.4	-5.4	-5.4	-8.9	-8.9	-8.9
65	-1.5	-1.5	-1.5	-5.2	-5.2	-5.2	-8.3	-8.3	-8.3
60	-1.5	-1.5	-1.5	-5.0	-5.0	-5.0	-7.8	-7.8	-7.8
55	-1.5	-1.5	-1.5	-4.7	-4.7	-4.7	-7.2	-7.2	-7.2
50	-1.4	-1.4	-1.4	-4.3	-4.3	-4.3	-6.5	-6.5	-6.5
45	-1.3	-1.3	-1.3	-4.0	-4.0	-4.0	-5.9	-5.9	-5.9
40	-1.3	-1.3	-1.3	-3.6	-3.6	-3.6	-5.3	-5.3	-5.3

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1000	47.2								
1200	80.2	62.9	45.0	30.7					
1400		95.1	78.2	54.0	34.5				
1600				79.3	57.9	38.2	33.5		
1800					83.7	61.9	47.5	30.4	
2000						88.2	62.9	44.4	
2200							80.6	59.4	41.3
2400							101.0	76.4	55.9
2600								96.4	72.5
2800									91.8

1. **Enter Weight Adjustment table with reported braking action and dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust “Good” field length available by -20 m/+20 m for every 5°C above/below 4°C.**
   Adjust “Medium” field length available by -20 m/+20 m for every 5°C above/below 4°C.
   Adjust “Poor” field length available by -35 m/+35 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff

Maximum Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-4	-2	0	-13	-10	-8	-23	-21	-18
85	-5	-3	0	-14	-11	-9	-24	-22	-19
80	-6	-3	-1	-15	-12	-10	-26	-23	-21
75	-7	-4	-2	-16	-13	-11	-27	-25	-22
70	-8	-5	-3	-17	-15	-12	-29	-27	-24
65	-9	-6	-4	-19	-17	-14	-32	-29	-27
60	-9	-7	-4	-21	-18	-16	-34	-31	-29
55	-10	-8	-5	-22	-20	-17	-36	-33	-31
50	-11	-9	-6	-23	-21	-18	-37	-35	-32
45	-12	-9	-7	-24	-22	-19	-39	-36	-34
40	-12	-10	-7	-25	-22	-20	-39	-37	-34

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff

No Reverse Thrust

Weight Adjustments (1000 KG)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	-1.0	-1.0	-1.0	-7.9	-7.9	-7.9	-14.4	-14.4	-14.4
90	-1.5	-1.5	-1.5	-8.1	-8.1	-8.1	-14.1	-14.1	-14.1
85	-2.0	-2.0	-2.0	-8.2	-8.2	-8.2	-13.8	-13.8	-13.8
80	-2.4	-2.4	-2.4	-8.4	-8.4	-8.4	-13.4	-13.4	-13.4
75	-2.8	-2.8	-2.8	-8.4	-8.4	-8.4	-12.9	-12.9	-12.9
70	-3.0	-3.0	-3.0	-8.2	-8.2	-8.2	-12.3	-12.3	-12.3
65	-3.1	-3.1	-3.1	-7.9	-7.9	-7.9	-11.5	-11.5	-11.5
60	-3.1	-3.1	-3.1	-7.5	-7.5	-7.5	-10.5	-10.5	-10.5
55	-3.0	-3.0	-3.0	-6.9	-6.9	-6.9	-9.4	-9.4	-9.4
50	-2.8	-2.8	-2.8	-6.3	-6.3	-6.3	-8.2	-8.2	-8.2
45	-2.4	-2.4	-2.4	-5.4	-5.4	-5.4	-6.8	-6.8	-6.8
40	-2.0	-2.0	-2.0	-4.5	-4.5	-4.5	-5.4	-5.4	-5.4

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1200	57.1								
1300	79.2	35.6							
1400	97.5	64.5							
1500		84.8	45.6						
1600		102.9	71.1						
1700			90.2						
1800				49.7					
1900				75.5					
2000				95.7	44.7				
2100					72.2				
2200					92.7	39.3			
2300						68.7			
2400						89.7			
2900							51.7		
3000							73.3		
3100							93.4		
3200								43.7	
3300								66.0	
3400								86.4	
3500									35.6
3600									58.4
3700									79.5
3800									99.4

1. Enter Weight Adjustment table with reported braking action and 24K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.

2. Adjust "Good" field length available by -30 m/+30 m for every 5°C above/below 4°C.
Adjust "Medium" field length available by -30 m/+30 m for every 5°C above/below 4°C.
Adjust "Poor" field length available by -45 m/+45 m for every 5°C above/below 4°C.

3. Find V1(MCG) limit weight for adjusted field length and pressure altitude.

4. Max allowable slippery runway limited weight is lesser of weights from 1 and 3.

ADVISORY INFORMATION

Slippery Runway Takeoff
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	-5	0	0	-14	-9	-4	-31	-26	-21
90	-6	-1	0	-16	-11	-6	-34	-29	-24
85	-7	-2	0	-18	-13	-8	-37	-32	-27
80	-8	-3	0	-20	-15	-10	-40	-35	-30
75	-9	-4	0	-23	-18	-13	-43	-38	-33
70	-11	-6	-1	-25	-20	-15	-47	-42	-37
65	-12	-7	-2	-28	-23	-18	-50	-45	-40
60	-14	-9	-4	-31	-26	-21	-54	-49	-44
55	-15	-10	-5	-33	-28	-23	-59	-54	-49
50	-17	-12	-7	-37	-32	-27	-63	-58	-53
45	-19	-14	-9	-40	-35	-30	-67	-62	-57
40	-21	-16	-11	-43	-38	-33	-72	-67	-62

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Takeoff %N1

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

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
60	90.3	90.8	91.2	91.2	91.1	91.1	91.0	91.1	91.2	91.0	91.2	91.3	91.4
55	91.0	91.6	92.0	92.0	92.0	91.9	91.9	91.9	92.0	91.9	91.7	91.3	90.8
50	91.8	92.4	92.8	92.8	92.8	92.7	92.7	92.7	92.7	92.6	92.6	92.2	91.8
45	92.6	93.2	93.6	93.6	93.6	93.6	93.5	93.5	93.5	93.4	93.3	93.1	92.8
40	93.4	94.0	94.4	94.4	94.4	94.3	94.3	94.2	94.2	94.1	94.1	94.0	93.8
35	94.2	94.8	95.2	95.2	95.2	95.1	95.1	95.0	95.0	94.9	94.8	94.8	94.7
30	93.8	95.0	96.1	96.0	96.0	96.0	95.9	95.8	95.8	95.7	95.7	95.6	95.6
25	93.1	94.3	95.4	95.9	96.4	96.7	96.7	96.6	96.6	96.5	96.4	96.4	96.3
20	92.3	93.5	94.6	95.1	95.7	96.3	96.9	97.6	97.5	97.5	97.4	97.3	97.2
15	91.6	92.7	93.8	94.3	94.9	95.5	96.1	96.8	97.5	98.2	98.6	98.6	98.5
10	90.8	92.0	93.0	93.6	94.1	94.7	95.3	96.0	96.7	97.5	98.2	99.1	100.0
5	90.0	91.2	92.2	92.8	93.3	93.9	94.5	95.2	95.9	96.7	97.4	98.4	99.3
0	89.2	90.4	91.4	92.0	92.5	93.1	93.7	94.4	95.1	95.9	96.7	97.6	98.5
-5	88.4	89.6	90.6	91.2	91.7	92.3	92.9	93.6	94.3	95.1	95.9	96.8	97.7
-10	87.6	88.8	89.8	90.4	90.9	91.5	92.1	92.8	93.5	94.3	95.1	96.1	97.0
-15	86.8	88.0	89.0	89.5	90.0	90.6	91.3	92.0	92.7	93.5	94.3	95.3	96.2
-20	86.0	87.1	88.2	88.7	89.2	89.8	90.5	91.2	91.9	92.6	93.5	94.5	95.4
-25	85.2	86.3	87.3	87.9	88.4	89.0	89.6	90.3	91.0	91.8	92.6	93.7	94.6
-30	84.4	85.5	86.5	87.0	87.5	88.1	88.8	89.5	90.2	91.0	91.8	92.9	93.8
-35	83.5	84.6	85.6	86.2	86.6	87.3	87.9	88.6	89.3	90.1	91.0	92.1	93.0
-40	82.7	83.8	84.8	85.3	85.8	86.4	87.0	87.8	88.5	89.3	90.1	91.2	92.2
-45	81.8	82.9	83.9	84.4	84.9	85.5	86.2	86.9	87.6	88.4	89.3	90.4	91.4
-50	81.0	82.0	83.0	83.5	84.0	84.6	85.3	86.0	86.7	87.5	88.4	89.5	90.5

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.9	1.0

Assumed Temperature Reduced Thrust

Maximum Assumed Temperature (Table 1 of 3)

Based on 25% Takeoff Thrust Reduction

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
55	73	71	69	67								
50	73	71	69	67	65	63						
45	73	71	69	67	65	63	61	59	57			
40	73	71	69	67	65	63	61	59	57	55		
35	67	67	67	67	65	63	61	59	57	55	53	
30	64	61	62	61	61	61	61	59	57	55	53	51
25	64	61	59	57	56	56	57	57	57	55	53	51
20	64	61	59	57	56	54	53	53	53	53	52	51
15	64	61	59	57	56	54	53	52	50	49	48	47
10 & BELOW	64	61	59	57	56	54	53	52	50	48	45	43

Takeoff %N1 (Table 2 of 3)

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

ASSUMED TEMP (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
75	88.3	88.6	89.1	89.6	90.2	90.8	91.5	92.2	92.7	93.1	93.3	93.4
70	89.1	89.5	89.4	89.3	89.6	90.1	90.8	91.6	92.0	92.5	92.6	92.7
65	90.0	90.4	90.3	90.2	90.2	90.1	90.2	90.9	91.4	91.8	91.9	92.1
60	90.8	91.2	91.2	91.1	91.1	91.0	91.1	91.2	91.0	91.2	91.3	91.4
55	91.6	92.0	92.0	92.0	91.9	91.9	91.9	92.0	91.9	91.7	91.3	90.8
50	92.4	92.8	92.8	92.8	92.7	92.7	92.7	92.7	92.6	92.6	92.2	91.8
45	93.2	93.6	93.6	93.6	93.6	93.5	93.5	93.5	93.4	93.3	93.1	92.8
40	94.0	94.4	94.4	94.4	94.3	94.3	94.2	94.2	94.1	94.1	94.0	93.8
35	94.8	95.2	95.2	95.2	95.1	95.1	95.0	95.0	94.9	94.8	94.8	94.7
30	95.0	96.1	96.0	96.0	96.0	95.9	95.8	95.8	95.7	95.7	95.6	95.6
25	94.3	95.4	95.9	96.4	96.7	96.7	96.6	96.6	96.5	96.4	96.4	96.3
20	93.5	94.6	95.1	95.7	96.3	96.9	97.6	97.5	97.5	97.4	97.3	97.2
15	92.7	93.8	94.3	94.9	95.5	96.1	96.8	97.5	98.2	98.6	98.6	98.5
10	92.0	93.0	93.6	94.1	94.7	95.3	96.0	96.7	97.5	98.2	99.1	100.0
MINIMUM ASSUMED TEMP (°C)	32	30	28	26	24	22	20	18	16	15	12	10

With engine bleed for packs off, increase %N1 by 1.0

Assumed Temperature Reduced Thrust
%N1 Adjustment for Temperature Difference (Table 3 of 3)

ASSUMED TEMP MINUS OAT (°C)	OUTSIDE AIR TEMPERATURE (°C)													
	-40	-20	0	5	10	15	20	25	30	35	40	45	50	55
110	12.1													
100	11.3	8.5												
90	11.7	8.9												
80	12.5	8.0	5.5											
70	11.3	8.4	5.9	5.6	4.0									
60	9.7	9.2	4.8	4.7	4.4	4.2	2.6							
50	7.8	7.9	5.3	3.5	3.3	3.6	3.0	2.7	1.2					
40		6.4	6.0	5.5	3.7	3.2	3.7	3.0	2.8	3.0	3.7			
30		4.6	4.6	4.6	4.5	4.3	4.2	4.0	4.1	4.0	3.9	3.8	3.7	
20			3.1	3.1	3.1	3.0	2.9	2.9	2.8	2.7	2.7	2.6	2.6	2.5
10			1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.3	1.3
0			0	0	0	0	0	0	0	0	0	0	0	0

1. **Determine Maximum Assumed Temperature allowed from Table 1.**
2. **Find Maximum %N1 from Table 2 using the desired assumed temperature (no greater than temperature from Table 1).**
3. **Use the difference between assumed temperature and OAT to determine the %N1 adjustment from Table 3.**
4. **Subtract %N1 adjustment from Maximum %N1 in Table 2.**

Takeoff Speeds - Dry Runway (22K Derate)

V1, VR, V2

WEIGHT (1000 KG)	FLAPS 1			FLAPS 5			FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
80	162	163	165	156	156	159									
76	158	158	162	152	152	156									
72	153	154	158	147	147	152	146	146	150	142	142	147			
68	148	149	155	142	143	149	141	141	147	138	138	144			
64	143	144	151	138	138	145	136	137	143	134	134	140	131	131	138
60	138	139	147	132	133	141	131	132	139	128	129	136	126	126	134
56	132	133	142	127	128	137	126	126	135	123	124	132	121	121	130
52	127	127	138	122	122	132	121	121	131	118	118	128	116	116	126
48	121	121	133	116	116	128	115	115	126	112	113	124	110	110	122
44	115	115	128	110	111	123	109	109	122	107	107	119	105	105	117
40	108	108	123	104	104	118	103	103	117	100	101	115	98	99	113

Check V1(MCG).

V1, VR, V2 Adjustments*

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

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
80	-3	-2	0	1	1	-1	-1	0	0	0	1	1	1
76	-3	-1	0	1	1	-1	-1	0	0	0	1	1	1
72	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
68	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
64	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
60	-1	-1	0	1	1	-1	-1	0	0	0	1	1	1
56	-1	0	0	1	1	-1	-1	0	0	0	1	1	1
52	-1	0	0	1	1	-1	-1	0	0	0	1	1	1
48	-1	0	0	0	1	-1	-1	0	0	0	1	1	1
44	0	0	0	0	1	-1	-1	0	0	0	1	1	1
40	0	0	0	0	1	-1	-1	0	0	0	1	1	1

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	87	85					
60	140	87	85	84	83			
50	122	89	87	84	83	81	79	77
40	104	94	91	88	85	82	79	77
30	86	96	96	93	89	86	82	79
20	68	97	96	94	93	90	86	82
-60	-76	98	98	96	94	91	89	87

Takeoff Speeds - Wet Runway (22K Derate)

V1, VR, V2

WEIGHT (1000 KG)	FLAPS 1			FLAPS 5			FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
80	157	163	165	150	156	159									
76	152	158	162	146	152	156									
72	147	154	158	141	147	152	141	146	150	138	142	147			
68	142	149	155	136	143	149	136	141	147	133	138	144			
64	136	144	151	131	138	145	130	137	143	127	134	140	126	131	138
60	131	139	147	125	133	141	125	132	139	122	129	136	120	126	134
56	125	133	142	120	128	137	119	126	135	116	124	132	115	121	130
52	119	127	138	114	122	132	113	121	131	111	118	128	109	116	126
48	113	121	133	108	116	128	108	115	126	105	113	124	103	110	122
44	107	115	128	102	111	123	102	109	122	99	107	119	98	105	117
40	100	108	123	96	104	118	95	103	117	93	101	115	92	99	113

Check V1(MCG).

V1, VR, V2 Adjustments*

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

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
80	-5	-3	0	3	5	-3	-2	-1	0	1	1	2	2
76	-5	-2	0	3	5	-3	-2	-1	0	1	1	2	2
72	-4	-2	0	2	5	-3	-2	-1	0	1	1	2	2
68	-4	-2	0	2	4	-3	-2	-1	0	1	1	2	3
64	-3	-2	0	2	4	-3	-2	-1	0	1	1	2	3
60	-3	-2	0	2	4	-3	-2	-1	0	1	1	2	3
56	-3	-1	0	2	3	-4	-2	-1	0	1	2	2	3
52	-3	-1	0	1	3	-4	-3	-1	0	1	2	2	3
48	-2	-1	0	1	2	-4	-3	-1	0	1	2	2	3
44	-2	-1	0	1	2	-4	-3	-1	0	1	2	3	3
40	-2	-1	0	1	2	-5	-3	-2	0	1	2	3	4

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	87	85					
60	140	87	85	84	83			
50	122	89	87	84	83	81	79	77
40	104	94	91	88	85	82	79	77
30	86	96	96	93	89	86	82	79
20	68	97	96	94	93	90	86	82
-60	-76	98	98	96	94	91	89	87

Maximum Allowable Clearway (22K Derate)

FIELD LENGTH (M)	DRY RUNWAY MAX ALLOWABLE CLEARWAY FOR V1 REDUCTION (M)
1200	150
1600	180
2000	210
2400	240
2800	270
3200	290

Clearway and Stopway V1 Adjustments (22K Derate)

CLEARWAY MINUS STOPWAY (M)	NORMAL V1 (KIAS)							
	DRY RUNWAY				WET RUNWAY			
	100	120	140	160	100	120	140	160
300	-4	-3	-3	-3				
200	-3	-3	-3	-2				
100	-2	-2	-2	-1				
0	0	0	0	0	0	0	0	0
-100	0	0	0	0	1	1	1	0
-200	0	0	0	0	4	3	2	0
-300	0	0	0	0	4	3	2	1

Use of clearway not allowed on wet runways.
V1 not to exceed VR.

Stab Trim Setting (22K Derate)

Flaps 1 and 5

WEIGHT	C.G. (%MAC)									
(1000 KG)	6	9	11	14	18	21	24	28	32	36
80	8 1/2	8 1/2	8 1/2	8	7 1/4	6 3/4	6 1/4	5 3/4	5	4 1/2
70	8 1/2	8 1/4	8	7 1/2	6 3/4	6 1/4	5 3/4	5 1/4	4 1/2	3 3/4
60	8 1/4	7 3/4	7 1/2	7	6 1/4	5 3/4	5 1/4	4 3/4	4	3 1/4
50	7 1/4	6 3/4	6 1/2	6	5 1/2	5	4 3/4	4	3 1/2	3
45	6 1/2	6 1/4	6	5 3/4	5	4 3/4	4 1/4	3 3/4	3 1/4	2 3/4
35	6 1/2	6 1/4	6	5 3/4	5	4 3/4	4 1/4	3 3/4	3 1/4	2 3/4

Flaps 10, 15 and 25

WEIGHT	C.G. (%MAC)									
(1000 KG)	6	8	9	10	16	26	27	31	34	36
80	8 1/2	8 1/2	8 1/2	8 1/2	7	5	4 3/4	4	3 1/4	3
70	8 1/2	8 1/4	8	8	6 1/2	4 1/2	4 1/4	3 1/2	3	2 3/4
60	7 3/4	7 1/4	7	7	5 3/4	4	3 3/4	3	2 3/4	2 3/4
50	6 1/2	6 1/4	6	5 3/4	4 3/4	3	3	2 3/4	2 3/4	2 3/4
45	6	5 3/4	5 1/2	5 1/2	4 1/4	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4
35	6	5 3/4	5 1/2	5 1/2	4 1/4	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4

ADVISORY INFORMATION

Slush/Standing Water Takeoff (22K Derate)

Maximum Reverse Thrust

Weight Adjustments (1000 KG)

22K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	-12.7	-15.2	-17.7	-16.3	-18.8	-21.3	-23.1	-25.5	-28.0
90	-11.7	-14.2	-16.7	-14.9	-17.4	-19.9	-20.9	-23.4	-25.9
85	-10.8	-13.3	-15.8	-13.5	-16.0	-18.5	-18.7	-21.2	-23.7
80	-9.8	-12.3	-14.8	-12.1	-14.6	-17.1	-16.6	-19.1	-21.6
75	-8.9	-11.4	-13.9	-10.8	-13.2	-15.7	-14.5	-17.0	-19.5
70	-8.0	-10.5	-13.0	-9.5	-12.0	-14.5	-12.6	-15.1	-17.6
65	-7.1	-9.6	-12.1	-8.3	-10.8	-13.3	-10.8	-13.3	-15.8
60	-6.3	-8.8	-11.3	-7.2	-9.7	-12.2	-9.1	-11.6	-14.1
55	-5.5	-8.0	-10.5	-6.1	-8.6	-11.1	-7.6	-10.1	-12.6
50	-4.7	-7.2	-9.7	-5.2	-7.7	-10.2	-6.2	-8.7	-11.2
45	-3.9	-6.4	-8.9	-4.3	-6.8	-9.3	-4.9	-7.4	-9.9
40	-3.2	-5.7	-8.2	-3.5	-5.9	-8.4	-3.7	-6.2	-8.7

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1200	36.3			39.3			44.3		
1400	57.8	38.1		60.6	41.0		65.5	46.0	
1600	81.2	59.7	39.8	83.4	62.5	42.7	92.4	67.4	47.7
1800	104.8	83.2	61.7		85.4	64.4		94.9	69.5
2000			85.2			87.3			97.4

1. **Enter Weight Adjustment table with slush/standing water depth and 22K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -20 m/+20 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (22K Derate)

Maximum Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-13	-8	-3	-8	-3	0	0	0	0
85	-13	-8	-3	-8	-3	0	0	0	0
80	-14	-9	-4	-7	-2	0	0	0	0
75	-14	-9	-4	-8	-3	0	0	0	0
70	-15	-10	-5	-10	-5	0	0	0	0
65	-17	-12	-7	-12	-7	-2	-1	0	0
60	-19	-14	-9	-14	-9	-4	-5	0	0
55	-20	-15	-10	-17	-12	-7	-9	-4	0
50	-21	-16	-11	-18	-13	-8	-12	-7	-2
45	-21	-16	-11	-19	-14	-9	-15	-10	-5
40	-21	-16	-11	-19	-14	-9	-16	-11	-6

1. **Obtain V1, VR and V2 for the actual weight using the 22K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (22K Derate)

No Reverse Thrust

Weight Adjustments (1000 KG)

22K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	-15.6	-17.8	-20.1	-19.5	-21.8	-24.0	-26.3	-28.6	-30.9
90	-14.4	-16.7	-18.9	-17.8	-20.1	-22.3	-23.9	-26.1	-28.4
85	-13.2	-15.5	-17.7	-16.1	-18.3	-20.6	-21.4	-23.6	-25.9
80	-12.0	-14.3	-16.5	-14.4	-16.6	-18.9	-18.9	-21.2	-23.4
75	-10.8	-13.1	-15.4	-12.8	-15.0	-17.3	-16.6	-18.8	-21.1
70	-9.7	-12.0	-14.3	-11.3	-13.5	-15.8	-14.4	-16.7	-18.9
65	-8.7	-11.0	-13.2	-9.9	-12.1	-14.4	-12.4	-14.7	-16.9
60	-7.7	-10.0	-12.2	-8.6	-10.9	-13.1	-10.6	-12.8	-15.1
55	-6.8	-9.0	-11.3	-7.4	-9.7	-12.0	-8.9	-11.2	-13.4
50	-5.9	-8.2	-10.4	-6.4	-8.7	-10.9	-7.4	-9.7	-12.0
45	-5.0	-7.3	-9.6	-5.5	-7.7	-10.0	-6.1	-8.4	-10.6
40	-4.2	-6.5	-8.8	-4.6	-6.8	-9.1	-4.9	-7.1	-9.4

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1400				31.5			44.2		
1600	50.9			58.2			69.4	42.6	
1800	80.4	49.0		85.5	56.3		95.9	67.5	41.0
2000		78.5	47.0		83.7	54.5		94.2	65.7
2200			76.7			81.9			92.4
2400			103.2						

1. **Enter Weight Adjustment table with slush/standing water depth and 22K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -35 m/+30 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for available field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (22K Derate)
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	-18	-13	-8	-11	-6	-1	0	0	0
90	-18	-13	-8	-11	-6	-1	0	0	0
85	-18	-13	-8	-11	-6	-1	0	0	0
80	-19	-14	-9	-10	-5	0	0	0	0
75	-19	-14	-9	-11	-6	-1	0	0	0
70	-21	-16	-11	-13	-8	-3	0	0	0
65	-23	-18	-13	-16	-11	-6	-1	0	0
60	-25	-20	-15	-19	-14	-9	-7	-2	0
55	-26	-21	-16	-22	-17	-12	-12	-7	-2
50	-27	-22	-17	-24	-19	-14	-16	-11	-6
45	-28	-23	-18	-26	-21	-16	-20	-15	-10
40	-27	-22	-17	-25	-20	-15	-22	-17	-12

1. **Obtain V1, VR and V2 for the actual weight using the 22K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (22K Derate)

Maximum Reverse Thrust

Weight Adjustment (1000 KG)

22K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	0.0	0.0	0.0	-5.4	-5.4	-5.4	-11.0	-11.0	-11.0
90	-0.3	-0.3	-0.3	-5.4	-5.4	-5.4	-10.5	-10.5	-10.5
85	-0.6	-0.6	-0.6	-5.4	-5.4	-5.4	-10.0	-10.0	-10.0
80	-0.8	-0.8	-0.8	-5.4	-5.4	-5.4	-9.5	-9.5	-9.5
75	-1.0	-1.0	-1.0	-5.2	-5.2	-5.2	-9.0	-9.0	-9.0
70	-1.1	-1.1	-1.1	-5.1	-5.1	-5.1	-8.5	-8.5	-8.5
65	-1.2	-1.2	-1.2	-4.8	-4.8	-4.8	-8.0	-8.0	-8.0
60	-1.3	-1.3	-1.3	-4.6	-4.6	-4.6	-7.5	-7.5	-7.5
55	-1.3	-1.3	-1.3	-4.4	-4.4	-4.4	-7.0	-7.0	-7.0
50	-1.3	-1.3	-1.3	-4.2	-4.2	-4.2	-6.5	-6.5	-6.5
45	-1.4	-1.4	-1.4	-4.0	-4.0	-4.0	-6.1	-6.1	-6.1
40	-1.4	-1.4	-1.4	-3.9	-3.9	-3.9	-5.6	-5.6	-5.6

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1000	53.3	32.6							
1200	85.3	66.1	45.9	36.5					
1400		97.2	78.5	60.3	40.2				
1600				86.1	64.4	43.9	37.8		
1800					90.3	68.5	52.4	33.7	
2000						94.6	68.9	47.9	
2200							87.6	63.8	43.6
2400								81.9	58.9
2600								101.3	76.3
2800									95.6

1. **Enter Weight Adjustment table with reported braking action and 22K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust “Good” field length available by -20 m/+20 m for every 5°C above/below 4°C.**
   Adjust “Medium” field length available by -20 m/+20 m for every 5°C above/below 4°C.
   Adjust “Poor” field length available by -30 m/+30 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (22K Derate)
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-4	-2	0	-12	-9	-7	-21	-18	-16
85	-5	-2	0	-12	-10	-7	-22	-20	-17
80	-5	-3	0	-13	-11	-8	-23	-21	-18
75	-6	-4	-1	-14	-12	-9	-25	-22	-20
70	-7	-4	-2	-16	-13	-11	-27	-24	-22
65	-8	-5	-3	-17	-15	-12	-29	-26	-24
60	-9	-6	-4	-19	-17	-14	-31	-29	-26
55	-10	-7	-5	-21	-18	-16	-33	-31	-28
50	-10	-8	-5	-22	-19	-17	-35	-33	-30
45	-11	-8	-6	-23	-20	-18	-37	-34	-32
40	-11	-8	-6	-23	-21	-18	-37	-35	-32

1. **Obtain V1, VR and V2 for the actual weight using the 22K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (22K Derate)

No Reverse Thrust

Weight Adjustments (1000 KG)

22K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	-1.0	-1.0	-1.0	-7.8	-7.8	-7.8	-14.2	-14.2	-14.2
90	-1.2	-1.2	-1.2	-7.6	-7.6	-7.6	-13.5	-13.5	-13.5
85	-1.4	-1.4	-1.4	-7.3	-7.3	-7.3	-12.8	-12.8	-12.8
80	-1.6	-1.6	-1.6	-7.1	-7.1	-7.1	-12.1	-12.1	-12.1
75	-1.7	-1.7	-1.7	-6.8	-6.8	-6.8	-11.4	-11.4	-11.4
70	-1.8	-1.8	-1.8	-6.5	-6.5	-6.5	-10.7	-10.7	-10.7
65	-1.9	-1.9	-1.9	-6.2	-6.2	-6.2	-10.0	-10.0	-10.0
60	-1.9	-1.9	-1.9	-5.9	-5.9	-5.9	-9.4	-9.4	-9.4
55	-1.9	-1.9	-1.9	-5.6	-5.6	-5.6	-8.8	-8.8	-8.8
50	-2.0	-2.0	-2.0	-5.4	-5.4	-5.4	-8.1	-8.1	-8.1
45	-2.0	-2.0	-2.0	-5.2	-5.2	-5.2	-7.5	-7.5	-7.5
40	-2.1	-2.1	-2.1	-5.0	-5.0	-5.0	-6.9	-6.9	-6.9

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1000	41.9								
1200	78.9	57.3	32.6						
1400		91.7	71.4						
1600			104.4	62.1	30.5				
1800				94.3	64.9	33.4			
2000					97.0	67.8			
2200						99.7	35.7		
2400							57.0		
2600							82.0	45.5	
2800								68.4	34.7
3000								94.8	55.9
3200									80.6

1. **Enter Weight Adjustment table with reported braking action and 22K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust “Good” field length available by -25 m/+20 m for every 5°C above/below 4°C.**
   Adjust “Medium” field length available by -25 m/+20 m for every 5°C above/below 4°C.
   Adjust “Poor” field length available by -40 m/+35 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (22K Derate)
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	-5	-2	0	-14	-11	-9	-27	-25	-22
90	-5	-3	0	-15	-12	-10	-29	-26	-24
85	-6	-3	-1	-16	-13	-11	-30	-28	-25
80	-7	-4	-2	-17	-14	-12	-32	-29	-27
75	-7	-5	-2	-18	-16	-13	-34	-32	-29
70	-8	-6	-3	-20	-17	-15	-37	-34	-32
65	-10	-7	-5	-22	-20	-17	-40	-37	-35
60	-11	-8	-6	-24	-22	-19	-43	-40	-38
55	-12	-9	-7	-26	-24	-21	-45	-43	-40
50	-13	-10	-8	-28	-26	-23	-48	-45	-43
45	-14	-11	-9	-30	-27	-25	-49	-47	-44
40	-14	-11	-9	-31	-28	-26	-50	-48	-45

1. **Obtain V1, VR and V2 for the actual weight using the 22K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Takeoff %N1 (22K Derate)

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

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
60	87.7	88.3	88.7	88.8	88.9	89.1	89.2	89.2	89.1	88.6	88.3	88.7	89.2
55	88.5	89.1	89.5	89.7	89.8	89.9	90.0	90.0	90.0	89.5	89.0	88.8	88.6
50	89.3	89.8	90.4	90.5	90.6	90.7	90.9	90.8	90.8	90.4	89.9	89.7	89.6
45	90.2	90.7	91.2	91.3	91.4	91.5	91.7	91.6	91.6	91.2	90.8	90.7	90.5
40	91.1	91.6	92.1	92.2	92.3	92.4	92.5	92.4	92.4	92.1	91.7	91.6	91.5
35	91.9	92.5	93.0	93.1	93.2	93.2	93.3	93.3	93.2	92.9	92.5	92.5	92.4
30	91.5	92.6	93.8	93.9	94.0	94.0	94.1	94.0	93.9	93.7	93.4	93.3	93.2
25	90.8	91.9	93.1	93.7	94.4	94.8	94.9	94.8	94.8	94.4	94.0	94.0	94.0
20	90.0	91.1	92.3	93.0	93.6	94.3	95.0	95.6	95.6	95.3	94.9	94.8	94.7
15	89.3	90.4	91.6	92.2	92.8	93.6	94.3	94.8	95.3	95.9	96.1	95.9	95.5
10	88.5	89.6	90.8	91.4	92.1	92.8	93.5	94.0	94.5	95.1	95.7	96.4	97.1
5	87.8	88.9	90.0	90.7	91.3	92.0	92.7	93.2	93.7	94.3	94.9	95.6	96.3
0	87.0	88.1	89.2	89.9	90.5	91.2	91.9	92.4	92.9	93.5	94.1	94.8	95.5
-5	86.2	87.3	88.4	89.1	89.7	90.4	91.1	91.6	92.1	92.7	93.3	94.0	94.7
-10	85.4	86.5	87.6	88.3	88.9	89.6	90.3	90.8	91.3	91.9	92.5	93.2	93.9
-15	84.6	85.7	86.8	87.5	88.1	88.8	89.4	90.0	90.5	91.1	91.7	92.4	93.1
-20	83.8	84.9	86.0	86.6	87.3	87.9	88.6	89.1	89.7	90.3	90.8	91.6	92.3
-25	83.0	84.1	85.2	85.8	86.4	87.1	87.8	88.3	88.8	89.4	90.0	90.7	91.5
-30	82.2	83.3	84.4	85.0	85.6	86.3	86.9	87.4	88.0	88.6	89.2	89.9	90.6
-35	81.4	82.4	83.5	84.1	84.7	85.4	86.1	86.6	87.1	87.7	88.3	89.0	89.8
-40	80.6	81.6	82.7	83.3	83.9	84.5	85.2	85.7	86.2	86.8	87.4	88.2	88.9
-45	79.7	80.7	81.8	82.4	83.0	83.7	84.3	84.8	85.3	86.0	86.6	87.3	88.0
-50	78.9	79.9	80.9	81.5	82.1	82.8	83.4	83.9	84.5	85.1	85.7	86.4	87.2

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.9	0.9	0.9

Assumed Temperature Reduced Thrust (22K Derate)

Maximum Assumed Temperature (Table 1 of 3)

Based on 25% Takeoff Thrust Reduction

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
55	73	71	69	67								
50	73	71	69	67	65	63						
45	73	71	69	67	65	63	61	59	57			
40	72	71	69	67	65	63	61	59	57	55		
35	66	66	66	66	65	63	61	59	57	55	53	
30	63	61	61	61	61	61	61	59	57	55	53	51
25	63	61	59	57	56	56	56	56	56	55	53	51
20	63	61	59	57	55	53	51	51	51	50	50	50
15	63	61	59	57	55	53	51	50	47	45	45	45
10 & BELOW	63	61	59	57	55	53	51	50	47	45	43	41

Takeoff %N1 (Table 2 of 3)

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

ASSUMED TEMP (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
75	85.7	86.0	86.7	87.4	88.2	88.9	89.5	90.1	90.2	90.2	90.6	91.1
70	86.6	87.0	87.1	87.1	87.5	88.3	88.9	89.4	89.5	89.6	90.0	90.4
65	87.4	87.8	88.0	88.0	88.2	88.3	88.3	88.8	88.9	88.9	89.4	89.8
60	88.3	88.7	88.8	88.9	89.1	89.2	89.2	89.1	88.6	88.3	88.7	89.2
55	89.1	89.5	89.7	89.8	89.9	90.0	90.0	90.0	89.5	89.0	88.8	88.6
50	89.8	90.4	90.5	90.6	90.7	90.9	90.8	90.8	90.4	89.9	89.7	89.6
45	90.7	91.2	91.3	91.4	91.5	91.7	91.6	91.6	91.2	90.8	90.7	90.5
40	91.6	92.1	92.2	92.3	92.4	92.5	92.4	92.4	92.1	91.7	91.6	91.5
35	92.5	93.0	93.1	93.2	93.2	93.3	93.3	93.2	92.9	92.5	92.5	92.4
30	92.6	93.8	93.9	94.0	94.0	94.1	94.0	93.9	93.7	93.4	93.3	93.2
25	91.9	93.1	93.7	94.4	94.8	94.9	94.8	94.8	94.4	94.0	94.0	94.0
20	91.1	92.3	93.0	93.6	94.3	95.0	95.6	95.6	95.3	94.9	94.8	94.7
15	90.4	91.6	92.2	92.8	93.6	94.3	94.8	95.3	95.9	96.1	95.9	95.5
10	89.6	90.8	91.4	92.1	92.8	93.5	94.0	94.5	95.1	95.7	96.4	97.1
MINIMUM ASSUMED TEMP (°C)	32	30	28	26	24	22	20	18	16	15	12	10

With engine bleed for packs off, increase %N1 by 0.9.

Assumed Temperature Reduced Thrust (22K Derate)

%N1 Adjustment for Temperature Difference (Table 3 of 3)

ASSUMED TEMP MINUS OAT (°C)	OUTSIDE AIR TEMPERATURE (°C)													
	-40	-20	0	5	10	15	20	25	30	35	40	45	50	55
110	11.6													
100	10.3	7.9												
90	10.8	8.4												
80	12.2	7.1	5.0											
70	11.0	7.6	5.4	5.2	3.5									
60	9.6	9.0	4.1	4.0	3.9	3.8	2.1							
50	8.0	7.7	4.5	2.8	2.6	2.7	2.6	2.4	0.8					
40		6.2	5.9	4.7	3.0	2.6	2.7	2.8	2.6	2.5	2.9			
30		4.7	4.6	4.5	4.4	4.2	4.1	4.0	4.0	3.9	3.8	3.7	3.6	
20			3.1	3.0	3.0	3.0	2.9	2.8	2.7	2.7	2.6	2.6	2.5	2.4
10			1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.3	1.3	1.3
0			0	0	0	0	0	0	0	0	0	0	0	0

1. **Determine Maximum Assumed Temperature allowed from Table 1.**
2. **Find Maximum %N1 from Table 2 using the desired assumed temperature (no greater than temperature from Table 1).**
3. **Use the difference between assumed temperature and OAT to determine the %N1 adjustment from Table 3.**
4. **Subtract %N1 adjustment from Maximum %N1 in Table 2.**

Max Climb %N1

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

TAT (°C)	PRESSURE ALTITUDE (FT)/SPEED (KIAS/MACH)									
	0	5000	10000	15000	20000	25000	30000	35000	37000	41000
	280	280	280	280	280	280	280	.78	.78	.78
60	89.4	89.7	89.7	89.8	89.6	91.4	93.0	94.4	94.5	92.8
55	90.2	90.5	90.5	90.7	90.0	90.8	92.4	93.7	93.8	92.1
50	90.9	91.2	91.3	91.5	91.0	90.8	91.7	93.0	93.1	91.4
45	91.6	91.9	92.1	92.3	91.9	91.7	91.7	92.3	92.4	90.7
40	92.4	92.6	92.9	93.1	92.7	92.5	92.5	91.6	91.7	90.0
35	92.9	93.3	93.6	93.8	93.6	93.3	93.3	92.4	91.7	90.1
30	92.2	94.1	94.3	94.6	94.4	94.1	94.0	93.2	92.6	91.1
25	91.5	94.1	95.0	95.2	95.2	94.8	94.7	94.0	93.4	92.1
20	90.7	93.3	95.8	96.0	95.9	95.6	95.4	94.7	94.2	93.0
15	90.0	92.5	95.2	96.8	96.7	96.3	96.1	95.5	95.0	94.0
10	89.2	91.8	94.4	97.1	97.6	97.0	96.7	96.2	95.8	94.9
5	88.4	91.0	93.6	96.3	98.5	97.9	97.4	97.0	96.6	95.8
0	87.7	90.2	92.8	95.5	97.9	99.0	98.4	97.8	97.5	96.7
-5	86.9	89.4	92.0	94.7	97.2	98.9	99.4	98.6	98.3	97.7
-10	86.1	88.6	91.2	93.9	96.4	98.1	99.7	99.5	99.2	98.7
-15	85.3	87.8	90.3	93.1	95.6	97.4	98.9	100.5	100.1	99.7
-20	84.5	87.0	89.5	92.3	94.8	96.6	98.1	100.2	100.7	100.3
-25	83.7	86.1	88.7	91.4	94.1	95.8	97.3	99.3	99.9	99.5
-30	82.9	85.3	87.8	90.6	93.3	95.0	96.5	98.5	99.0	98.7
-35	82.0	84.5	87.0	89.8	92.4	94.1	95.6	97.6	98.2	97.8
-40	81.2	83.6	86.1	88.9	91.6	93.3	94.8	96.8	97.3	96.9

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)					
	0	10	20	30	35	41
ENGINE ANTI-ICE	-0.6	-0.8	-0.9	-0.9	-0.8	-0.8
ENGINE & WING ANTI-ICE*	-1.8	-2.1	-2.5	-2.7	-3.0	-3.0

***Dual bleed sources**

Go-around %N1

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

AIRPORT OAT		TAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
°C	°F		-2000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
57	134	60	91.0	91.8	91.8									
52	125	55	91.7	92.6	92.6	92.5	92.5							
47	116	50	92.5	93.3	93.3	93.3	93.3	93.3	93.2	93.2				
42	108	45	93.3	94.1	94.1	94.1	94.0	94.0	94.0	93.9	93.9	93.8		
37	99	40	94.1	94.9	94.9	94.8	94.8	94.7	94.7	94.6	94.6	94.6	94.5	94.4
32	90	35	94.3	95.8	95.8	95.7	95.7	95.6	95.5	95.5	95.4	95.3	95.3	95.2
27	81	30	93.5	95.7	96.3	96.5	96.5	96.4	96.4	96.3	96.2	96.2	96.1	96.0
22	72	25	92.8	94.9	95.5	96.1	96.7	97.3	97.3	97.2	97.1	97.0	97.0	96.9
17	63	20	92.0	94.2	94.7	95.3	95.9	96.5	97.2	97.9	98.3	98.2	98.1	98.0
12	54	15	91.3	93.4	94.0	94.5	95.1	95.8	96.5	97.2	97.9	98.7	99.4	99.4
7	45	10	90.5	92.6	93.2	93.8	94.4	95.0	95.7	96.4	97.1	97.9	98.7	99.5
2	36	5	89.7	91.8	92.4	93.0	93.6	94.2	94.9	95.6	96.4	97.1	98.0	98.8
-3	27	0	89.0	91.0	91.6	92.2	92.8	93.4	94.1	94.8	95.6	96.4	97.2	98.1
-8	18	-5	88.2	90.2	90.8	91.4	92.0	92.6	93.3	94.0	94.8	95.6	96.4	97.3
-13	9	-10	87.4	89.4	90.0	90.6	91.1	91.8	92.5	93.2	94.0	94.8	95.7	96.5
-17	1	-15	86.6	88.6	89.2	89.7	90.3	90.9	91.7	92.4	93.2	94.0	94.9	95.8
-22	-8	-20	85.8	87.8	88.3	88.9	89.5	90.1	90.8	91.6	92.3	93.2	94.1	95.0
-27	-17	-25	84.9	86.9	87.5	88.1	88.6	89.3	90.0	90.7	91.5	92.3	93.3	94.2
-32	-26	-30	84.1	86.1	86.7	87.2	87.8	88.4	89.2	89.9	90.7	91.5	92.5	93.4
-37	-35	-35	83.3	85.2	85.8	86.3	86.9	87.6	88.3	89.0	89.8	90.7	91.6	92.6
-42	-44	-40	82.4	84.4	84.9	85.5	86.1	86.7	87.4	88.2	89.0	89.8	90.8	91.8
-47	-53	-45	81.6	83.5	84.1	84.6	85.2	85.8	86.6	87.3	88.1	89.0	90.0	90.9
-52	-62	-50	80.7	82.6	83.2	83.7	84.3	84.9	85.7	86.4	87.2	88.1	89.1	90.1

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (FT)											
	-2000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.6	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.9	0.9	1.0	0.9
A/C HIGH	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Climb (280/.76)

Flaps Up, Set Max Climb Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		40	50	60	70	80
40000	**PITCH ATT**	**4.0**	**4.0**	**4.0**		
	V/S (FT/MIN)	1700	1100	600		
30000	**PITCH ATT**	**4.0**	**4.0**	**3.5**	**4.0**	**4.0**
	V/S (FT/MIN)	2500	1900	1500	1100	800
20000	**PITCH ATT**	**7.0**	**6.5**	**6.0**	**6.0**	**6.0**
	V/S (FT/MIN)	4200	3300	2600	2100	1700
10000	**PITCH ATT**	**11.0**	**9.5**	**8.5**	**8.0**	**8.0**
	V/S (FT/MIN)	5600	4400	3600	3000	2500
SEA LEVEL	**PITCH ATT**	**14.5**	**12.5**	**11.0**	**10.0**	**9.5**
	V/S (FT/MIN)	6700	5300	4400	3700	3100

Cruise (.76/280)

Flaps Up, %N1 for Level Flight

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		40	50	60	70	80
40000	**PITCH ATT**	**2.0**	**2.5**	**3.5**		
	%N1	83	85	90		
35000	**PITCH ATT**	**1.0**	**2.0**	**2.5**	**3.0**	**3.5**
	%N1	81	83	84	87	90
30000	**PITCH ATT**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**
	%N1	81	82	83	84	86
25000	**PITCH ATT**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**
	%N1	77	78	79	81	82
20000	**PITCH ATT**	**1.0**	**1.5**	**2.0**	**2.5**	**3.5**
	%N1	74	74	75	77	78
15000	**PITCH ATT**	**1.0**	**1.5**	**2.0**	**3.0**	**3.5**
	%N1	70	71	72	73	74

Descent (.76/280)

Flaps Up, Set Idle Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		40	50	60	70	80
40000	**PITCH ATT**	**-1.5**	**-0.5**	**0.5**	**1.0**	**1.5**
	V/S (FT/MIN)	-2700	-2400	-2300	-2500	-2700
30000	**PITCH ATT**	**-3.5**	**-2.0**	**-1.0**	**0.5**	**0.5**
	V/S (FT/MIN)	-3100	-2600	-2300	-2100	-2000
20000	**PITCH ATT**	**-3.5**	**-2.0**	**-1.0**	**0.0**	**0.5**
	V/S (FT/MIN)	-2800	-2300	-2000	-1900	-1700
10000	**PITCH ATT**	**-3.5**	**-2.0**	**-1.0**	**0.0**	**0.5**
	V/S (FT/MIN	-2500	-2100	-1800	-1700	-1500
SEA LEVEL	**PITCH ATT**	**-3.5**	**-2.5**	**-1.0**	**0.5**	**0.5**
	V/S (FT/MIN)	-2300	-1900	-1700	-1500	-1400

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Holding (VREF40 + 70)

Flaps Up, %N1 for Level Flight

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		40	50	60	70	80
15000	**PITCH ATT**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
	%N1	56	62	66	70	73
	KIAS	178	193	212	229	246
10000	**PITCH ATT**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
	%N1	53	58	62	66	70
	KIAS	178	192	211	228	244
5000	**PITCH ATT**	**5.0**	**5.5**	**5.0**	**5.0**	**5.0**
	%N1	49	54	58	62	66
	KIAS	178	192	210	227	243

Terminal Area (5000 FT)

%N1 for Level Flight

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS UP (GEAR UP)	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
(VREF40 + 70)	%N1	48	54	58	62	65
FLAPS 1 (GEAR UP)	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**
(VREF40 + 50)	%N1	51	56	60	65	68
FLAPS 5 (GEAR UP)	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
(VREF40 + 30)	%N1	51	56	61	65	69
FLAPS 15 (GEAR DOWN)	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
(VREF40 + 20)	%N1	60	66	71	75	79

Final Approach (1500 FT)

Gear Down, %N1 for 3° Glideslope

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS 15	**PITCH ATT**	**2.0**	**2.5**	**2.5**	**2.5**	**2.5**
(VREF15 + 10)	%N1	43	47	51	55	58
FLAPS 30	**PITCH ATT**	**0.5**	**1.0**	**1.0**	**1.0**	**1.0**
(VREF30 + 10)	%N1	47	52	57	60	64
FLAPS 40	**PITCH ATT**	**-0.5**	**0.0**	**0.0**	**0.0**	**0.0**
(VREF40 + 10)	%N1	53	58	63	67	70

Go-Around

Flaps 15, Gear Up, Set Go-Around Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		40	50	60	70	80
10000	**PITCH ATT**	**16.0**	**12.0**	**9.5**	**7.5**	**6.5**
	V/S (FT/MIN)	4100	3200	2500	1900	1400
	KIAS	151	168	183	197	209
5000	**PITCH ATT**	**18.5**	**14.0**	**11.0**	**9.0**	**7.5**
	V/S (FT/MIN)	4600	3600	2900	2300	1800
	KIAS	151	168	183	196	208
SEA LEVEL	**PITCH ATT**	**21.5**	**16.0**	**12.5**	**10.5**	**9.0**
	V/S (FT/MIN)	4900	3900	3200	2600	2100
	KIAS	151	167	182	196	208

Intentionally
Blank

Long Range Cruise Maximum Operating Altitude

Max Cruise Thrust

ISA + 10°C and Below

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
85	32300	-10	34300*	34300*	33800	32200	30800
80	33600	-13	35800*	35800*	35100	33500	32100
75	35000	-16	37100*	37100*	36400	34900	33500
70	36400	-18	38400*	38400*	37900	36300	35000
65	38000	-18	39800*	39800*	39400	37800	36500
60	39600	-18	41000	41000	41000	39500	38200
55	41000	-18	41000	41000	41000	41000	40000
50	41000	-18	41000	41000	41000	41000	41000
45	41000	-18	41000	41000	41000	41000	41000
40	41000	-18	41000	41000	41000	41000	41000

ISA + 15°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
85	32300	-4	33000*	33000*	33000*	32200	30800
80	33600	-7	34700*	34700*	34700*	33500	32100
75	35000	-10	36200*	36200*	36200*	34900	33500
70	36400	-12	37600*	37600*	37600*	36300	35000
65	38000	-12	38900*	38900*	38900*	37800	36500
60	39600	-12	40400*	40400*	40400*	39500	38200
55	41000	-12	41000	41000	41000	41000	40000
50	41000	-12	41000	41000	41000	41000	41000
45	41000	-12	41000	41000	41000	41000	41000
40	41000	-12	41000	41000	41000	41000	41000

ISA + 20°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
85	32300	2	29400*	29400*	29400*	29400*	29400*
80	33600	-1	32200*	32200*	32200*	32200*	32100
75	35000	-4	34700*	34700*	34700*	34700*	33500
70	36400	-7	36200*	36200*	36200*	36200*	35000
65	38000	-7	37700*	37700*	37700*	37700*	36500
60	39600	-7	39100*	39100*	39100*	39100*	38200
55	41000	-7	40500*	40500*	40500*	40500*	40000
50	41000	-7	41000	41000	41000	41000	41000
45	41000	-7	41000	41000	41000	41000	41000
40	41000	-7	41000	41000	41000	41000	41000

***Denotes altitude thrust limited in level flight, 100 fpm residual rate of climb.**

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)								
		25	27	29	31	33	35	37	39	41
85	%N1	85.0	86.4	87.6	88.8	90.3				
	MACH	.735	.759	.776	.788	.792				
	KIAS	308	306	300	292	281				
	FF/ENG	1539	1536	1527	1510	1500				
80	%N1	83.7	85.1	86.4	87.6	88.8	91.1			
	MACH	.715	.743	.765	.780	.790	.790			
	KIAS	299	299	296	289	281	268			
	FF/ENG	1447	1451	1446	1432	1414	1426			
75	%N1	82.1	83.7	85.0	86.4	87.6	88.9	92.6		
	MACH	.692	.723	.750	.770	.784	.792	.788		
	KIAS	289	290	289	285	278	269	255		
	FF/ENG	1348	1362	1363	1353	1338	1321	1366		
70	%N1	80.3	82.0	83.6	85.0	86.3	87.5	89.5		
	MACH	.668	.699	.730	.755	.774	.787	.792		
	KIAS	278	280	281	279	274	267	257		
	FF/ENG	1250	1264	1275	1272	1259	1244	1244		
65	%N1	78.6	80.2	81.8	83.4	84.8	86.1	87.7	90.6	
	MACH	.645	.673	.705	.735	.760	.777	.789	.791	
	KIAS	268	269	271	271	269	263	256	245	
	FF/ENG	1155	1166	1180	1186	1180	1166	1162	1179	
60	%N1	77.0	78.3	79.9	81.6	83.1	84.5	86.2	88.2	91.6
	MACH	.627	.647	.676	.709	.739	.763	.779	.790	.790
	KIAS	260	258	259	261	261	258	252	245	233
	FF/ENG	1076	1070	1082	1093	1096	1088	1086	1085	1111
55	%N1	75.4	76.5	77.8	79.4	81.2	82.7	84.5	86.6	88.7
	MACH	.611	.627	.647	.677	.711	.741	.765	.781	.791
	KIAS	253	249	247	248	250	250	247	241	234
	FF/ENG	1007	990	985	995	1003	1005	1006	1008	1008
50	%N1	73.7	74.8	75.9	77.2	78.9	80.6	82.5	84.8	86.8
	MACH	.595	.610	.626	.646	.676	.710	.741	.765	.781
	KIAS	246	242	238	236	237	239	239	236	230
	FF/ENG	944	921	906	899	906	914	921	928	930
45	%N1	71.5	72.9	74.0	75.2	76.4	78.1	80.2	82.6	84.8
	MACH	.569	.591	.607	.624	.643	.673	.707	.739	.763
	KIAS	235	234	231	227	224	225	227	227	224
	FF/ENG	868	857	838	823	825	828	839	852	859
40	%N1	68.8	70.5	71.9	73.1	74.2	75.4	77.3	79.9	82.3
	MACH	.538	.561	.584	.602	.619	.637	.665	.699	.732
	KIAS	222	222	222	219	215	212	212	214	214
	FF/ENG	801	796	787	769	751	739	742	757	771

Shaded area approximates optimum altitude.

Long Range Cruise Enroute Fuel and Time - Low Altitudes

Ground to Air Miles Conversions

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
295	270	248	230	214	200	190	181	173	165	158
444	406	373	345	321	300	285	272	259	248	238
594	543	498	461	429	400	380	362	346	331	318
744	680	623	576	536	500	476	453	432	414	397
894	817	749	692	643	600	571	544	519	496	476
1045	954	874	808	751	700	666	634	605	579	556
1197	1092	1000	924	858	800	761	725	692	662	635
1349	1230	1126	1039	966	900	856	816	778	745	714
1502	1369	1252	1155	1073	1000	951	906	865	827	793
1655	1508	1379	1272	1181	1100	1046	996	951	909	872
1809	1647	1505	1388	1288	1200	1141	1086	1037	992	951
1963	1787	1632	1505	1396	1300	1236	1177	1123	1074	1030
2118	1927	1760	1621	1504	1400	1331	1268	1210	1157	1109
2274	2068	1888	1738	1612	1500	1426	1358	1296	1239	1188
2430	2209	2015	1856	1720	1600	1521	1448	1381	1321	1267
2587	2350	2143	1972	1828	1700	1616	1538	1467	1403	1346
2744	2492	2271	2090	1936	1800	1711	1628	1553	1486	1425
2902	2634	2400	2207	2044	1900	1805	1719	1639	1568	1504
3060	2777	2529	2325	2153	2000	1900	1809	1725	1650	1582

Reference Fuel And Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		20		24		28	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	1.4	0:42	1.3	0:40	1.1	0:38	0.9	0:37	0.9	0:36
300	2.2	1:02	2.0	0:59	1.7	0:54	1.5	0:53	1.4	0:51
400	3.0	1:22	2.7	1:17	2.3	1:11	2.1	1:09	1.9	1:07
500	3.7	1:42	3.4	1:36	3.0	1:28	2.7	1:25	2.5	1:22
600	4.5	2:02	4.1	1:55	3.6	1:45	3.2	1:42	3.0	1:38
700	5.2	2:22	4.8	2:14	4.2	2:02	3.8	1:58	3.5	1:54
800	6.0	2:43	5.5	2:33	4.8	2:19	4.4	2:14	4.1	2:09
900	6.7	3:03	6.2	2:52	5.5	2:37	4.9	2:31	4.6	2:25
1000	7.5	3:24	6.9	3:11	6.1	2:54	5.5	2:47	5.1	2:41
1100	8.2	3:45	7.6	3:31	6.7	3:11	6.1	3:04	5.7	2:57
1200	8.9	4:06	8.2	3:50	7.3	3:29	6.6	3:20	6.2	3:12
1300	9.7	4:27	8.9	4:10	7.9	3:47	7.2	3:37	6.7	3:28
1400	10.4	4:48	9.6	4:30	8.5	4:04	7.7	3:53	7.2	3:44
1500	11.1	5:10	10.3	4:50	9.1	4:22	8.3	4:10	7.7	4:01
1600	11.8	5:31	10.9	5:10	9.7	4:40	8.8	4:27	8.2	4:17
1700	12.5	5:53	11.6	5:30	10.3	4:58	9.4	4:43	8.7	4:33
1800	13.2	6:15	12.2	5:50	10.9	5:16	9.9	5:00	9.2	4:49
1900	13.9	6:37	12.9	6:11	11.5	5:34	10.4	5:17	9.7	5:05
2000	14.6	6:59	13.6	6:31	12.1	5:53	11.0	5:34	10.2	5:22

Long Range Cruise Enroute Fuel and Time - Low Altitudes

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	40	50	60	70	80
1	-0.1	0.0	0.0	0.1	0.1
2	-0.2	-0.1	0.0	0.1	0.3
3	-0.4	-0.2	0.0	0.2	0.5
4	-0.5	-0.2	0.0	0.3	0.6
5	-0.6	-0.3	0.0	0.4	0.8
6	-0.7	-0.4	0.0	0.5	1.0
7	-0.9	-0.4	0.0	0.6	1.2
8	-1.0	-0.5	0.0	0.7	1.4
9	-1.1	-0.6	0.0	0.8	1.6
10	-1.2	-0.6	0.0	0.9	1.8
11	-1.3	-0.7	0.0	1.0	1.9
12	-1.5	-0.8	0.0	1.1	2.1
13	-1.6	-0.9	0.0	1.2	2.3
14	-1.7	-0.9	0.0	1.3	2.5
15	-1.8	-1.0	0.0	1.4	2.7

Long Range Cruise Enroute Fuel and Time - High Altitudes

Ground to Air Miles Conversions

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
540	505	474	446	422	400	382	366	351	337	324
808	757	710	669	633	600	574	549	527	506	488
1078	1009	947	892	844	800	765	733	703	676	651
1348	1262	1184	1116	1055	1000	956	916	879	845	814
1619	1515	1421	1339	1266	1200	1148	1099	1055	1014	977
1890	1768	1658	1562	1477	1400	1339	1283	1231	1183	1140
2162	2023	1897	1786	1689	1600	1531	1466	1406	1352	1302
2435	2277	2135	2011	1900	1800	1722	1649	1582	1521	1465
2708	2532	2374	2235	2112	2000	1913	1832	1757	1689	1627
2982	2788	2612	2459	2324	2200	2104	2015	1933	1858	1789
3256	3044	2851	2684	2535	2400	2295	2198	2109	2026	1951
3532	3300	3091	2909	2747	2600	2486	2381	2283	2194	2113
3808	3557	3331	3133	2959	2800	2677	2563	2458	2362	2274
4085	3815	3571	3359	3171	3000	2868	2746	2633	2529	2435
4362	4072	3811	3584	3383	3200	3059	2928	2807	2697	2596
4639	4330	4051	3809	3595	3400	3250	3111	2982	2864	2757
4917	4588	4292	4035	3807	3600	3441	3293	3156	3031	2917
5196	4847	4533	4260	4019	3800	3631	3474	3330	3197	3077
5476	5107	4775	4487	4231	4000	3821	3656	3503	3364	3237
5757	5368	5017	4713	4444	4200	4012	3837	3677	3530	3396
6040	5629	5260	4939	4656	4400	4202	4019	3850	3695	3556
6322	5891	5503	5166	4869	4600	4392	4200	4023	3861	3714
6606	6153	5746	5393	5082	4800	4583	4381	4196	4026	3873
6892	6417	5990	5621	5295	5000	4773	4562	4368	4191	4031

Long Range Cruise Enroute Fuel and Time - High Altitudes

Reference Fuel And Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	29		31		33		35		37	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
400	1.9	1:06	1.8	1:04	1.8	1:02	1.7	1:01	1.7	1:01
600	3.0	1:37	2.9	1:34	2.8	1:31	2.7	1:29	2.6	1:28
800	4.0	2:07	3.9	2:03	3.8	1:59	3.6	1:57	3.5	1:55
1000	5.1	2:38	4.9	2:33	4.7	2:28	4.6	2:24	4.5	2:22
1200	6.1	3:10	5.9	3:03	5.7	2:57	5.5	2:53	5.4	2:49
1400	7.1	3:41	6.9	3:34	6.7	3:26	6.5	3:21	6.3	3:17
1600	8.1	4:13	7.9	4:05	7.6	3:56	7.4	3:49	7.2	3:44
1800	9.1	4:45	8.8	4:36	8.6	4:26	8.3	4:18	8.1	4:12
2000	10.1	5:17	9.8	5:07	9.5	4:56	9.2	4:47	9.0	4:40
2200	11.1	5:50	10.8	5:39	10.4	5:26	10.1	5:16	9.9	5:08
2400	12.0	6:22	11.7	6:11	11.4	5:57	11.0	5:45	10.8	5:36
2600	13.0	6:55	12.6	6:43	12.3	6:28	11.9	6:15	11.6	6:04
2800	13.9	7:28	13.6	7:15	13.2	6:59	12.8	6:45	12.5	6:33
3000	14.9	8:01	14.5	7:47	14.1	7:31	13.7	7:15	13.3	7:02
3200	15.8	8:35	15.4	8:20	14.9	8:03	14.5	7:46	14.1	7:31
3400	16.8	9:09	16.3	8:53	15.8	8:35	15.4	8:16	15.0	8:00
3600	17.7	9:42	17.2	9:26	16.7	9:07	16.2	8:48	15.8	8:30
3800	18.6	10:17	18.1	10:00	17.6	9:40	17.1	9:19	16.6	9:00
4000	19.5	10:51	19.0	10:33	18.4	10:12	17.9	9:51	17.4	9:30
4200	20.4	11:25	19.8	11:07	19.3	10:45	18.7	10:23	18.2	10:01
4400	21.3	12:00	20.7	11:41	20.1	11:19	19.5	10:55	19.0	10:31
4600	22.2	12:36	21.6	12:15	21.0	11:52	20.4	11:28	19.8	11:03
4800	23.1	13:11	22.4	12:49	21.8	12:26	21.2	12:01	20.6	11:34
5000	24.0	13:47	23.3	13:24	22.6	12:59	22.0	12:33	21.4	12:06

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	40	50	60	70	80
2	-0.3	-0.2	0.0	0.2	0.7
4	-0.5	-0.3	0.0	0.4	1.3
6	-0.8	-0.5	0.0	0.6	1.8
8	-1.1	-0.6	0.0	0.9	2.3
10	-1.4	-0.8	0.0	1.1	2.7
12	-1.7	-0.9	0.0	1.3	3.2
14	-2.0	-1.0	0.0	1.5	3.6
16	-2.4	-1.2	0.0	1.7	4.0
18	-2.7	-1.4	0.0	1.9	4.4
20	-3.0	-1.5	0.0	2.0	4.8
22	-3.4	-1.7	0.0	2.2	5.1
24	-3.8	-1.8	0.0	2.4	5.4
26	-4.1	-2.0	0.0	2.6	5.7
28	-4.5	-2.2	0.0	2.7	6.0
30	-4.9	-2.4	0.0	2.9	6.3

Long Range Cruise Wind-Altitude Trade

PRESSURE ALTITUDE (1000 FT)	CRUISE WEIGHT (1000 KG)									
	85	80	75	70	65	60	55	50	45	40
41					30	7	0	4	16	33
39				22	4	0	4	15	30	45
37		37	14	2	0	5	15	28	43	56
35	23	7	0	0	6	16	28	41	54	64
33	2	0	2	8	18	29	41	53	62	68
31	0	4	11	21	31	42	52	61	67	70
29	7	15	24	34	43	53	61	67	70	70
27	19	27	36	45	54	61	66	70	70	68
25	31	40	48	55	62	67	70	70	69	64

The above wind factor tables are for calculation of wind required to maintain present range capability at new pressure altitude, i.e., break-even wind.

Method:

1. **Read wind factors for present and new altitudes from table.**
2. **Determine difference (new altitude wind factor minus present altitude wind factor); This difference may be negative or positive.**
3. **Break-even wind at new altitude is present altitude wind plus difference from step 2.**

Descent

.78/280/250

PRESSURE ALTITUDE (FT)	TIME (MIN)	FUEL (KG)	DISTANCE (NM)			
			LANDING WEIGHT (1000 KG)			
			40	50	60	70
41000	27	340	102	119	133	142
39000	26	340	97	114	127	136
37000	25	330	92	108	121	130
35000	24	330	88	103	116	125
33000	24	320	84	99	111	120
31000	23	320	80	94	105	113
29000	22	310	75	88	98	106
27000	21	300	70	82	92	99
25000	20	300	66	77	86	92
23000	19	290	61	71	79	85
21000	18	280	57	66	73	78
19000	17	270	52	61	67	72
17000	15	250	48	55	61	65
15000	14	240	44	50	55	58
10000	11	200	30	34	37	39
5000	7	150	18	19	20	21
1500	4	110	9	9	9	9

Allowances for a straight-in approach are included.

Holding

Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)								
		1500	5000	10000	15000	20000	25000	30000	35000	41000
85	%N1	64.3	67.0	70.7	74.7	78.9	83.0	87.0		
	KIAS	250	251	252	253	255	257	260		
	FF/ENG	1500	1470	1460	1450	1430	1430	1460		
80	%N1	62.6	65.5	69.1	73.2	77.3	81.6	85.5		
	KIAS	242	243	244	245	247	249	252		
	FF/ENG	1420	1390	1380	1370	1340	1340	1360		
75	%N1	60.9	63.9	67.5	71.6	75.6	80.0	83.9	88.2	
	KIAS	235	236	236	238	239	241	243	247	
	FF/ENG	1340	1310	1300	1290	1260	1250	1270	1300	
70	%N1	59.2	62.0	65.9	69.8	73.9	78.3	82.3	86.5	
	KIAS	227	227	228	229	231	232	235	238	
	FF/ENG	1260	1240	1220	1200	1180	1160	1180	1200	
65	%N1	57.4	60.0	64.2	67.8	72.1	76.4	80.5	84.7	
	KIAS	219	219	220	221	222	224	226	228	
	FF/ENG	1180	1160	1140	1120	1100	1080	1090	1110	
60	%N1	55.6	58.1	62.1	65.9	70.1	74.3	78.6	82.7	
	KIAS	210	210	211	212	213	214	216	219	
	FF/ENG	1110	1080	1060	1040	1020	990	1010	1020	
55	%N1	53.6	56.1	59.8	64.0	67.9	72.2	76.5	80.7	87.9
	KIAS	200	201	202	203	204	205	207	209	212
	FF/ENG	1030	1000	980	960	940	920	920	930	980
50	%N1	51.4	53.9	57.5	61.7	65.5	69.9	74.0	78.4	85.5
	KIAS	192	192	192	193	194	195	196	198	201
	FF/ENG	950	920	900	880	860	860	850	850	890
45	%N1	49.1	51.5	55.1	58.9	63.1	67.2	71.4	75.9	82.9
	KIAS	185	185	185	185	185	185	186	187	190
	FF/ENG	880	850	840	820	800	780	770	770	800
40	%N1	46.6	48.9	52.5	56.1	60.4	64.2	68.6	73.0	80.1
	KIAS	178	178	178	178	178	178	178	178	178
	FF/ENG	820	790	760	740	720	710	700	690	710

This table includes 5% additional fuel for holding in a racetrack pattern.

Intentionally
Blank

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF15	ONE REV	NO REV

Dry Runway

MAX MANUAL	1010	70/-60	25/30	-35/125	15/-10	25/-25	35	25	50
AUTOBRAKE MAX	1300	65/-75	30/40	-45/155	0/0	30/-30	60	0	5
AUTOBRAKE 3	1870	105/-120	50/65	-80/260	0/0	55/-55	100	0	0
AUTOBRAKE 2	2385	155/-170	75/95	-105/360	30/-45	70/-70	100	70	70
AUTOBRAKE 1	2640	185/-200	90/115	-125/425	70/-85	80/-80	95	240	335

Good Reported Braking Action

MAX MANUAL	1395	80/-85	40/50	-60/210	35/-30	35/-35	50	75	175
AUTOBRAKE MAX	1485	85/-90	40/55	-65/215	30/-25	35/-40	55	85	190
AUTOBRAKE 3	1870	105/-120	50/65	-80/265	5/0	55/-55	100	5	15
AUTOBRAKE 2	2385	155/-170	75/95	-105/360	30/-45	70/-70	100	70	70
AUTOBRAKE 1	2640	185/-200	90/115	-125/425	70/-85	80/-80	95	240	335

Medium Reported Braking Action

MAX MANUAL	1930	125/-130	60/80	-95/345	90/-70	55/-55	65	215	520
AUTOBRAKE MAX	1965	130/-135	60/85	-100/350	85/-65	55/-55	75	215	520
AUTOBRAKE 3	2065	130/-140	60/85	-100/360	65/-45	60/-60	100	150	450
AUTOBRAKE 2	2440	160/-175	75/100	-115/405	65/-65	70/-75	100	115	250
AUTOBRAKE 1	2655	185/-200	90/120	-130/440	90/-90	80/-80	95	255	395

Poor Reported Braking Action

MAX MANUAL	2545	180/-185	85/120	-145/550	215/-140	70/-75	80	465	1245
AUTOBRAKE MAX	2545	185/-185	90/120	-145/550	220/-145	70/-75	80	465	1245
AUTOBRAKE 3	2560	185/-185	90/120	-145/550	210/-130	70/-75	95	465	1255
AUTOBRAKE 2	2730	190/-200	90/125	-155/565	200/-130	75/-80	100	375	1090
AUTOBRAKE 1	2855	205/-215	100/135	-160/585	205/-145	80/-85	95	440	1080

Reference distance is based on sea level, standard day, no wind or slope, VREF15 approach speed, two-engine detent No. 2 reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 60 m.
For autobrake and manual speedbrakes, increase reference landing distance by 55 m.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF30	ONE REV	NO REV

Dry Runway

MAX MANUAL	960	55/-55	20/30	-35/120	10/-10	20/-20	35	20	40
AUTOBRAKE MAX	1215	60/-65	30/35	-45/150	0/0	30/-30	55	0	5
AUTOBRAKE 3	1725	95/-110	45/60	-75/250	0/0	50/-50	95	0	0
AUTOBRAKE 2	2190	140/-150	65/90	-100/345	30/-40	65/-65	95	60	60
AUTOBRAKE 1	2415	165/-180	80/105	-120/405	65/-75	70/-70	85	195	290

Good Reported Braking Action

MAX MANUAL	1330	75/-80	35/45	-60/205	35/-30	35/-35	50	70	155
AUTOBRAKE MAX	1415	80/-85	40/50	-60/210	30/-25	35/-35	60	75	170
AUTOBRAKE 3	1725	95/-110	45/60	-75/250	5/0	50/-50	95	5	15
AUTOBRAKE 2	2190	140/-150	65/90	-100/345	30/-40	65/-65	95	60	60
AUTOBRAKE 1	2415	165/-180	80/105	-120/405	65/-75	70/-70	85	195	290

Medium Reported Braking Action

MAX MANUAL	1815	115/-120	55/75	-95/335	85/-65	50/-50	65	190	450
AUTOBRAKE MAX	1850	120/-125	55/75	-95/340	80/-60	50/-50	75	190	455
AUTOBRAKE 3	1925	120/-125	55/75	-95/345	65/-45	55/-55	95	140	410
AUTOBRAKE 2	2245	140/-155	70/90	-110/390	65/-60	65/-65	95	105	225
AUTOBRAKE 1	2430	165/-180	80/105	-120/420	85/-80	70/-75	85	210	350

Poor Reported Braking Action

MAX MANUAL	2365	165/-170	80/110	-140/530	205/-135	65/-70	75	400	1045
AUTOBRAKE MAX	2370	165/-170	80/110	-140/530	205/-135	65/-70	80	400	1050
AUTOBRAKE 3	2385	170/-170	80/110	-140/535	200/-125	65/-70	85	400	1055
AUTOBRAKE 2	2525	175/-180	85/115	-145/550	190/-125	70/-75	90	335	925
AUTOBRAKE 1	2630	185/-190	85/120	-150/565	195/-135	75/-80	85	380	930

Reference distance is based on sea level, standard day, no wind or slope, VREF30 approach speed, two-engine detent No. 2 reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 60 m.
For autobrake and manual speedbrakes, increase reference landing distance by 55 m.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 40

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF40	ONE REV	NO REV

Dry Runway

MAX MANUAL	915	55/-50	20/25	-35/115	10/-10	20/-20	35	15	35
AUTOBRAKE MAX	1135	55/-60	25/35	-40/140	0/0	25/-25	55	0	0
AUTOBRAKE 3	1590	85/-100	40/55	-70/235	0/0	45/-45	90	0	0
AUTOBRAKE 2	2030	125/-140	60/80	-95/330	20/-35	60/-60	95	35	35
AUTOBRAKE 1	2260	150/-165	75/95	-115/390	55/-65	65/-65	85	155	220

Good Reported Braking Action

MAX MANUAL	1270	70/-75	35/45	-55/200	35/-30	30/-30	50	65	140
AUTOBRAKE MAX	1350	75/-80	35/45	-60/205	30/-25	35/-35	60	70	150
AUTOBRAKE 3	1600	85/-100	40/55	-70/240	10/-5	45/-45	95	5	15
AUTOBRAKE 2	2030	125/-140	60/80	-95/330	20/-35	60/-60	95	35	35
AUTOBRAKE 1	2260	150/-165	75/95	-115/390	55/-65	65/-65	85	155	220

Medium Reported Braking Action

MAX MANUAL	1730	105/-115	50/70	-90/330	85/-65	45/-45	65	170	405
AUTOBRAKE MAX	1750	110/-120	55/70	-90/335	75/-60	45/-50	75	170	405
AUTOBRAKE 3	1800	110/-120	55/70	-95/340	70/-45	50/-50	90	150	390
AUTOBRAKE 2	2090	130/-145	60/85	-105/375	55/-55	60/-60	95	75	190
AUTOBRAKE 1	2275	150/-165	75/95	-115/405	80/-75	65/-65	85	170	275

Poor Reported Braking Action

MAX MANUAL	2245	155/-160	75/100	-140/520	200/-130	60/-65	75	360	930
AUTOBRAKE MAX	2250	155/-160	75/105	-140/520	200/-130	60/-65	75	360	930
AUTOBRAKE 3	2260	155/-165	75/105	-140/525	195/-125	60/-65	85	360	935
AUTOBRAKE 2	2370	160/-165	75/105	-140/535	185/-120	65/-70	90	290	830
AUTOBRAKE 1	2470	170/-180	80/110	-145/550	190/-130	70/-75	85	335	815

Reference distance is based on sea level, standard day, no wind or slope, VREF40 approach speed, two-engine detent No. 2 reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 55 m.
For autobrake and manual speedbrakes, increase reference landing distance by 45 m.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Airspeed Unreliable (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1075	80/-65	25/35	-40/130	15/-10	25/-25	N/A	30	60
AUTOBRAKE MAX	1435	70/-80	35/45	-50/165	5/-5	35/-35	N/A	0	5
AUTOBRAKE 2	2550	165/-180	85/110	-110/370	50/-55	75/-75	N/A	165	180

Good Reported Braking Action

MAX MANUAL	1475	80/-85	40/55	-60/215	35/-30	40/-40	N/A	90	205
AUTOBRAKE MAX	1600	85/-95	45/60	-65/225	30/-25	40/-40	N/A	100	230
AUTOBRAKE 2	2550	165/-180	85/110	-110/370	55/-55	75/-75	N/A	165	180

Medium Reported Braking Action

MAX MANUAL	2025	130/-135	65/85	-100/350	90/-70	55/-55	N/A	240	595
AUTOBRAKE MAX	2080	130/-140	65/90	-100/355	85/-65	55/-60	N/A	245	605
AUTOBRAKE 3	2255	135/-145	70/90	-105/370	60/-45	65/-65	N/A	145	460

Poor Reported Braking Action

MAX MANUAL	2635	185/-190	90/125	-145/550	210/-140	75/-80	N/A	505	1385
AUTOBRAKE MAX	2635	185/-190	90/125	-145/550	210/-135	75/-80	N/A	500	1380
AUTOBRAKE 3	2685	185/-190	90/125	-150/555	195/-125	75/-80	N/A	485	1375

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Airspeed Unreliable (Flaps 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1025	60/-60	25/30	-35/125	15/-10	25/-25	N/A	25	55
AUTOBRAKE MAX	1335	60/-70	30/40	-45/155	5/-5	30/-35	N/A	0	5
AUTOBRAKE 2	2345	150/-160	75/95	-105/355	45/-50	70/-70	N/A	140	160

Good Reported Braking Action

MAX MANUAL	1415	75/-80	40/50	-60/210	35/-30	35/-35	N/A	80	185
AUTOBRAKE MAX	1525	80/-90	40/55	-65/220	30/-30	40/-40	N/A	90	205
AUTOBRAKE 2	2345	150/-160	75/95	-105/355	45/-50	70/-70	N/A	140	160

Medium Reported Braking Action

MAX MANUAL	1915	120/-125	60/80	-95/340	85/-70	50/-55	N/A	215	520
AUTOBRAKE MAX	1965	120/-130	60/80	-95/345	80/-65	55/-55	N/A	215	530
AUTOBRAKE 3	2100	120/-135	60/85	-100/360	60/-50	60/-60	N/A	135	420

Poor Reported Braking Action

MAX MANUAL	2460	170/-170	85/115	-140/535	200/-130	65/-70	N/A	435	1165
AUTOBRAKE MAX	2470	170/-175	85/115	-140/535	200/-125	70/-75	N/A	430	1160
AUTOBRAKE 3	2510	170/-175	85/115	-145/540	190/-125	70/-75	N/A	425	1165

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Airspeed Unreliable (Flaps 40)

VREF40

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	985	55/-55	20/30	-35/120	15/-10	20/-20	N/A	20	45
AUTOBRAKE MAX	1245	55/-65	30/35	-45/150	5/0	30/-30	N/A	0	0
AUTOBRAKE 2	2195	135/-150	70/90	-100/340	40/-45	65/-65	N/A	105	110

Good Reported Braking Action

MAX MANUAL	1360	70/-80	35/50	-60/205	35/-30	35/-35	N/A	75	170
AUTOBRAKE MAX	1455	75/-85	40/50	-60/215	30/-25	35/-35	N/A	85	185
AUTOBRAKE 2	2195	135/-150	70/90	-100/340	40/-45	65/-65	N/A	105	110

Medium Reported Braking Action

MAX MANUAL	1830	110/-120	55/75	-95/335	85/-65	50/-50	N/A	195	465
AUTOBRAKE MAX	1870	115/-125	60/80	-95/340	80/-60	50/-50	N/A	195	475
AUTOBRAKE 3	1965	115/-125	60/80	-100/350	60/-50	55/-55	N/A	135	405

Poor Reported Braking Action

MAX MANUAL	2345	160/-165	80/110	-140/525	195/-130	65/-70	N/A	395	1035
AUTOBRAKE MAX	2355	160/-165	80/110	-140/525	195/-125	65/-70	N/A	390	1035
AUTOBRAKE 3	2380	160/-165	80/110	-140/530	190/-125	65/-70	N/A	395	1045

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

All Flaps Up Landing

VREF40 + 55

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	1330	185/-85	50/105	-45/205	20/-15	35/-35	45	45	95
AUTOBRAKE MAX	1855	85/-90	45/70	-60/195	5/-5	50/-50	75	5	20
AUTOBRAKE 2	3360	195/-225	115/150	-130/430	75/-85	105/-105	100	280	330
Good Reported Braking Action									
MAX MANUAL	1755	85/-95	50/65	-65/230	40/-35	45/-50	45	110	255
AUTOBRAKE MAX	2000	90/-100	55/75	-75/245	30/-25	55/-55	70	85	225
AUTOBRAKE 2	3360	195/-225	115/150	-130/430	75/-85	105/-105	100	280	330
Medium Reported Braking Action									
MAX MANUAL	2495	145/-155	80/110	-110/385	105/-85	70/-75	65	315	775
AUTOBRAKE MAX	2580	150/-160	85/115	-110/390	100/-80	75/-75	75	325	800
AUTOBRAKE 3	2950	145/-170	90/120	-120/420	65/-60	90/-90	110	165	510
Poor Reported Braking Action									
MAX MANUAL	3320	220/-225	120/165	-165/605	250/-170	95/-100	80	690	1915
AUTOBRAKE MAX	3325	215/-225	120/165	-165/605	245/-160	100/-100	90	685	1905
AUTOBRAKE 3	3445	210/-225	120/165	-170/615	220/-150	100/-105	110	600	1840

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

ANTISKID INOPERATIVE (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1795	105/-110	50/65	-80/290	55/-45	45/-45	60	145	345
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	2015	125/-130	60/80	-100/350	85/-65	50/-55	70	215	530
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2585	180/-180	85/120	-145/545	200/-135	70/-75	80	460	1280
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	3450	260/-260	120/175	-245/1005	625/-305	85/-105	95	1100	3915
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

ANTISKID INOPERATIVE (Flaps 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1695	95/-105	45/60	-80/280	55/-45	40/-45	60	125	300
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1895	115/-120	55/75	-95/340	80/-65	50/-50	65	185	455
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2415	165/-165	80/105	-140/530	190/-125	65/-70	80	395	1075
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	3205	235/-235	110/155	-235/980	590/-285	75/-100	90	945	3215
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

ANTISKID INOPERATIVE (Flaps 40)

VREF40

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1615	90/-100	45/60	-80/275	55/-45	40/-40	60	115	265
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1805	105/-115	50/70	-95/335	80/-60	45/-45	65	170	405
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2290	150/-155	70/100	-140/520	185/-120	60/-65	80	355	950
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	3040	220/-225	100/145	-230/960	575/-275	70/-95	85	860	2860
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Jammed or Restricted Flight Controls (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1005	70/-60	25/30	-35/125	10/-10	20/-25	35	25	50
AUTOBRAKE MAX	1310	65/-75	30/40	-45/155	5/-5	30/-30	65	0	5
AUTOBRAKE 2	2360	155/-170	75/100	-105/355	35/-50	70/-70	95	100	100

Good Reported Braking Action

MAX MANUAL	1380	75/-80	35/50	-60/205	35/-30	35/-35	50	80	185
AUTOBRAKE MAX	1485	85/-90	40/55	-60/215	30/-25	35/-35	55	90	205
AUTOBRAKE 2	2360	155/-170	75/100	-105/355	35/-50	70/-70	95	100	100

Medium Reported Braking Action

MAX MANUAL	1900	125/-130	60/80	-95/340	85/-65	50/-55	65	225	550
AUTOBRAKE MAX	1935	125/-130	60/80	-95/345	80/-65	50/-55	75	225	555
AUTOBRAKE 3	2055	125/-135	60/85	-100/355	60/-40	55/-60	100	145	465

Poor Reported Braking Action

MAX MANUAL	2480	180/-180	85/120	-145/540	205/-135	70/-75	75	475	1310
AUTOBRAKE MAX	2480	180/-180	85/120	-145/540	205/-135	70/-75	80	475	1305
AUTOBRAKE 3	2500	180/-180	85/120	-145/540	200/-120	70/-75	95	475	1310

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

LEADING EDGE FLAPS TRANSIT (Flaps 15)

VREF15 + 15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1130	80/-70	25/35	-40/135	15/-15	25/-25	35	30	70
AUTOBRAKE MAX	1500	70/-80	35/45	-50/170	5/-5	40/-40	65	0	5
AUTOBRAKE 2	2725	175/-190	90/115	-115/385	50/-60	85/-85	100	155	160

Good Reported Braking Action

MAX MANUAL	1570	85/-95	45/60	-65/220	40/-35	40/-40	50	105	240
AUTOBRAKE MAX	1690	90/-100	45/60	-65/230	35/-30	45/-45	60	115	260
AUTOBRAKE 2	2730	175/-190	90/115	-115/385	50/-60	85/-85	100	160	160

Medium Reported Braking Action

MAX MANUAL	2170	140/-145	70/95	-100/365	95/-75	60/-60	70	275	695
AUTOBRAKE MAX	2210	140/-150	70/95	-105/365	90/-70	60/-65	75	280	700
AUTOBRAKE 3	2375	140/-150	75/100	-110/380	65/-45	70/-70	110	175	570

Poor Reported Braking Action

MAX MANUAL	2825	200/-205	100/140	-155/570	225/-150	80/-85	80	580	1620
AUTOBRAKE MAX	2825	200/-205	100/140	-155/570	230/-155	80/-85	85	575	1615
AUTOBRAKE 3	2855	200/-200	100/140	-155/570	215/-130	80/-85	100	565	1615

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

LOSS OF SYSTEM A (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1120	70/-65	25/35	-40/135	15/-15	25/-25	45	35	60
AUTOBRAKE MAX	1300	65/-75	30/40	-45/155	0/0	30/-30	60	0	10
AUTOBRAKE 2	2465	150/-175	75/95	-110/365	0/-10	75/-75	140	0	0

Good Reported Braking Action

MAX MANUAL	1620	95/-100	45/60	-70/235	50/-40	40/-45	70	135	275
AUTOBRAKE MAX	1630	95/-105	45/65	-70/235	40/-35	45/-45	75	135	275
AUTOBRAKE 2	2465	150/-175	75/95	-110/365	0/-10	75/-75	140	0	0

Medium Reported Braking Action

MAX MANUAL	2235	150/-155	75/100	-110/380	115/-90	60/-65	90	350	840
AUTOBRAKE MAX	2220	150/-155	75/100	-105/380	120/-95	60/-65	90	345	830
AUTOBRAKE 3	2220	150/-155	75/100	-105/380	120/-85	60/-65	90	345	830

Poor Reported Braking Action

MAX MANUAL	2905	215/-215	105/145	-160/590	265/-175	80/-85	105	710	2025
AUTOBRAKE MAX	2900	215/-215	105/150	-160/590	265/-180	80/-85	105	710	2025
AUTOBRAKE 3	2900	215/-215	105/150	-160/590	265/-180	80/-85	105	710	2025

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

LOSS OF SYSTEM A (Flaps 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1060	65/-55	25/35	-40/130	15/-15	25/-25	45	30	50
AUTOBRAKE MAX	1215	60/-65	30/35	-45/145	0/0	30/-30	55	10	15
AUTOBRAKE 2	2260	135/-155	65/85	-105/350	0/-10	70/-70	135	0	0

Good Reported Braking Action

MAX MANUAL	1535	85/-95	45/60	-65/225	45/-40	40/-40	70	120	240
AUTOBRAKE MAX	1550	90/-95	45/60	-65/230	40/-35	40/-40	75	120	240
AUTOBRAKE 2	2260	135/-155	65/85	-105/350	0/-10	70/-70	135	0	0

Medium Reported Braking Action

MAX MANUAL	2090	135/-140	65/90	-105/370	110/-85	55/-60	85	305	710
AUTOBRAKE MAX	2085	135/-140	70/90	-105/370	115/-90	55/-60	90	300	705
AUTOBRAKE 3	2085	135/-140	70/90	-105/370	115/-80	55/-60	90	300	705

Poor Reported Braking Action

MAX MANUAL	2695	195/-195	95/130	-155/570	250/-165	75/-80	100	605	1650
AUTOBRAKE MAX	2695	195/-195	95/135	-155/570	250/-165	75/-80	100	605	1650
AUTOBRAKE 3	2695	195/-195	95/135	-155/570	250/-165	75/-80	100	605	1650

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

LOSS OF SYSTEM A (Flaps 40)

VREF40

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	1015	60/-55	25/30	-35/125	15/-15	25/-25	50	30	45
AUTOBRAKE MAX	1140	55/-60	25/35	-40/140	5/0	25/-25	55	10	20
AUTOBRAKE 2	2075	125/-140	60/80	-100/335	0/-5	60/-60	130	0	0
Good Reported Braking Action									
MAX MANUAL	1460	80/-90	40/55	-65/225	45/-40	35/-40	70	105	210
AUTOBRAKE MAX	1470	85/-90	40/55	-65/225	40/-35	40/-40	75	105	210
AUTOBRAKE 2	2075	125/-140	60/80	-100/335	0/-5	60/-60	130	0	0
Medium Reported Braking Action									
MAX MANUAL	1970	125/-135	60/85	-100/360	105/-85	55/-55	85	265	615
AUTOBRAKE MAX	1970	125/-135	60/85	-100/360	110/-85	55/-55	85	265	615
AUTOBRAKE 3	1970	125/-135	60/85	-100/360	110/-80	55/-55	90	265	615
Poor Reported Braking Action									
MAX MANUAL	2525	180/-185	85/120	-150/560	240/-155	70/-75	95	525	1400
AUTOBRAKE MAX	2530	180/-185	90/125	-150/560	245/-160	70/-75	95	530	1405
AUTOBRAKE 3	2530	180/-185	90/125	-150/560	245/-160	70/-75	95	530	1405

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

LOSS OF SYSTEM A AND SYSTEM B (Flaps 15)

VREF15

BRAKING CONFIGURATION	REF DIST 65000 KG LANDING WEIGHT	WT ADJ PER 5000 KG ABV/BLW 65000 KG	ALT ADJ PER 1000 FT STD/HIGH*	WIND ADJ PER 10 KTS HEAD/ TAIL WIND	SLOPE ADJ PER 1% DOWN/ UP HILL	TEMP ADJ PER 10°C ABV/ BLW ISA	APP SPD ADJ PER 5 KTS ABOVE VREF	REVERSE THRUST ADJ ONE REV	REVERSE THRUST ADJ NO REV
Dry Runway									
MAX MANUAL	1570	80/-90	40/50	-60/195	35/-35	40/-40	75	-10	65
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								
Good Reported Braking Action									
MAX MANUAL	2290	135/-145	65/90	-100/335	100/-80	60/-60	105	95	440
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								
Medium Reported Braking Action									
MAX MANUAL	3035	200/-210	100/140	-150/525	215/-160	80/-85	120	365	1415
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								
Poor Reported Braking Action									
MAX MANUAL	3770	275/-275	135/190	-210/785	475/-270	100/-110	130	815	3380
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

LOSS OF SYSTEM B (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1140	55/-60	25/35	-45/145	20/-15	25/-25	40	40	70
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1630	95/-100	45/65	-75/255	50/-45	45/-45	60	140	285
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2215	150/-155	70/100	-115/410	125/-95	60/-65	75	340	815
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	2835	210/-210	100/140	-170/640	295/-180	75/-85	90	665	1870
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

MANUAL REVERSION (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1570	80/-90	40/50	-60/195	35/-35	40/-40	75	-10	65
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	2290	135/-145	65/90	-100/335	100/-80	60/-60	105	95	440
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	3035	200/-210	100/140	-150/525	215/-160	80/-85	120	365	1415
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	3770	275/-275	135/190	-210/785	475/-270	100/-110	130	815	3380
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

One Engine Inoperative Landing (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1020	75/-65	25/30	-35/130	15/-10	25/-25	35	0	25
AUTOBRAKE MAX	1300	70/-75	30/40	-45/155	0/0	30/-30	60	0	0
AUTOBRAKE 2	2450	150/-170	75/95	-110/365	10/-25	75/-75	120	0	0

Good Reported Braking Action

MAX MANUAL	1440	80/-85	40/50	-65/215	40/-35	40/-40	50	0	100
AUTOBRAKE MAX	1545	85/-95	40/55	-65/225	35/-30	40/-40	60	0	110
AUTOBRAKE 2	2450	150/-170	75/95	-110/365	10/-25	75/-75	120	0	0

Medium Reported Braking Action

MAX MANUAL	2075	135/-140	65/85	-105/370	110/-85	60/-60	70	0	310
AUTOBRAKE MAX	2115	135/-145	65/85	-105/375	105/-80	60/-60	80	0	315
AUTOBRAKE 3	2165	135/-150	65/85	-105/380	90/-65	60/-65	100	0	295

Poor Reported Braking Action

MAX MANUAL	2850	200/-210	95/130	-165/605	290/-185	85/-85	90	0	765
AUTOBRAKE MAX	2850	200/-210	95/130	-165/605	290/-185	85/-85	95	0	765
AUTOBRAKE 3	2875	205/-210	95/130	-165/610	280/-180	85/-85	100	0	775

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

One Engine Inoperative Landing (Flaps 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	970	60/-55	20/30	-35/125	15/-10	20/-20	35	0	25
AUTOBRAKE MAX	1215	60/-65	30/35	-45/150	0/0	30/-30	55	0	0
AUTOBRAKE 2	2240	135/-150	65/85	-105/350	10/-25	65/-65	110	0	0

Good Reported Braking Action

MAX MANUAL	1370	75/-80	35/50	-60/210	35/-30	35/-35	50	0	90
AUTOBRAKE MAX	1465	80/-90	40/50	-65/220	35/-30	35/-40	60	0	100
AUTOBRAKE 2	2240	135/-150	65/85	-105/350	10/-25	65/-65	110	0	0

Medium Reported Braking Action

MAX MANUAL	1940	120/-130	60/80	-100/360	105/-80	55/-55	70	0	265
AUTOBRAKE MAX	1975	125/-135	60/80	-100/365	95/-75	55/-55	80	0	270
AUTOBRAKE 3	2015	125/-135	60/80	-105/365	90/-65	55/-60	90	0	260

Poor Reported Braking Action

MAX MANUAL	2625	180/-190	85/115	-155/585	265/-170	75/-80	85	0	635
AUTOBRAKE MAX	2625	180/-190	85/115	-155/585	270/-165	75/-80	90	0	635
AUTOBRAKE 3	2655	185/-190	90/120	-160/585	260/-170	75/-80	90	0	640

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Stabilizer Trim Inoperative (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1005	70/-60	25/30	-35/125	10/-10	20/-25	35	25	50
AUTOBRAKE MAX	1310	65/-75	30/40	-45/155	5/-5	30/-30	65	0	5
AUTOBRAKE 2	2360	155/-170	75/100	-105/355	35/-50	70/-70	95	100	100

Good Reported Braking Action

MAX MANUAL	1380	75/-80	35/50	-60/205	35/-30	35/-35	50	80	185
AUTOBRAKE MAX	1485	85/-90	40/55	-60/215	30/-25	35/-35	55	90	205
AUTOBRAKE 2	2360	155/-170	75/100	-105/355	35/-50	70/-70	95	100	100

Medium Reported Braking Action

MAX MANUAL	1900	125/-130	60/80	-95/340	85/-65	50/-55	65	225	550
AUTOBRAKE MAX	1935	125/-130	60/80	-95/345	80/-65	50/-55	75	225	555
AUTOBRAKE 3	2055	125/-135	60/85	-100/355	60/-40	55/-60	100	145	465

Poor Reported Braking Action

MAX MANUAL	2480	180/-180	85/120	-145/540	205/-135	70/-75	75	475	1310
AUTOBRAKE MAX	2480	180/-180	85/120	-145/540	205/-135	70/-75	80	475	1305
AUTOBRAKE 3	2500	180/-180	85/120	-145/540	200/-120	70/-75	95	475	1310

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Asymmetry (1 ≤ Flap Lever <15)

VREF40 + 30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1110	90/-65	25/40	-40/135	15/-15	25/-25	35	30	60
AUTOBRAKE MAX	1510	70/-75	35/45	-50/170	5/-5	40/-40	65	0	5
AUTOBRAKE 2	2730	165/-185	90/115	-115/385	55/-60	85/-85	100	165	175

Good Reported Braking Action

MAX MANUAL	1525	80/-85	40/55	-60/215	35/-30	40/-40	45	90	210
AUTOBRAKE MAX	1665	80/-90	45/60	-65/225	30/-25	45/-45	65	95	225
AUTOBRAKE 2	2735	160/-185	90/115	-115/385	55/-65	85/-85	95	165	175

Medium Reported Braking Action

MAX MANUAL	2125	125/-135	70/90	-100/360	90/-75	60/-60	65	255	625
AUTOBRAKE MAX	2180	130/-140	70/95	-100/360	85/-70	60/-60	75	260	640
AUTOBRAKE 3	2385	125/-140	70/95	-110/380	60/-45	70/-70	110	150	470

Poor Reported Braking Action

MAX MANUAL	2795	190/-195	100/135	-150/565	220/-150	80/-85	80	545	1510
AUTOBRAKE MAX	2790	185/-195	100/135	-150/565	220/-145	80/-85	85	540	1500
AUTOBRAKE 3	2845	185/-190	100/135	-155/570	205/-130	80/-85	105	525	1495

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Asymmetry (Flap Lever 15 or 25)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1005	70/-60	25/30	-35/125	10/-10	20/-25	35	25	50
AUTOBRAKE MAX	1310	65/-75	30/40	-45/155	5/-5	30/-30	65	0	5
AUTOBRAKE 2	2360	155/-170	75/100	-105/355	35/-50	70/-70	95	100	100

Good Reported Braking Action

MAX MANUAL	1380	75/-80	35/50	-60/205	35/-30	35/-35	50	80	185
AUTOBRAKE MAX	1485	85/-90	40/55	-60/215	30/-25	35/-35	55	90	205
AUTOBRAKE 2	2360	155/-170	75/100	-105/355	35/-50	70/-70	95	100	100

Medium Reported Braking Action

MAX MANUAL	1900	125/-130	60/80	-95/340	85/-65	50/-55	65	225	550
AUTOBRAKE MAX	1935	125/-130	60/80	-95/345	80/-65	50/-55	75	225	555
AUTOBRAKE 3	2055	125/-135	60/85	-100/355	60/-40	55/-60	100	145	465

Poor Reported Braking Action

MAX MANUAL	2480	180/-180	85/120	-145/540	205/-135	70/-75	75	475	1310
AUTOBRAKE MAX	2480	180/-180	85/120	-145/540	205/-135	70/-75	80	475	1305
AUTOBRAKE 3	2500	180/-180	85/120	-145/540	200/-120	70/-75	95	475	1310

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Asymmetry (Flap Lever 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	960	55/-55	20/30	-35/120	10/-10	20/-20	35	20	45
AUTOBRAKE MAX	1215	60/-65	30/35	-45/150	5/0	30/-30	60	0	5
AUTOBRAKE 2	2165	140/-150	65/90	-100/340	30/-45	65/-65	90	85	85

Good Reported Braking Action

MAX MANUAL	1315	70/-75	35/45	-60/200	30/-30	35/-35	50	75	165
AUTOBRAKE MAX	1410	75/-85	35/50	-60/210	30/-25	35/-35	60	80	185
AUTOBRAKE 2	2165	140/-150	65/90	-100/340	35/-45	65/-65	90	85	85

Medium Reported Braking Action

MAX MANUAL	1790	115/-120	55/75	-90/330	80/-65	50/-50	65	195	480
AUTOBRAKE MAX	1820	115/-120	55/75	-95/335	75/-60	50/-50	70	200	480
AUTOBRAKE 3	1910	115/-125	55/75	-95/345	60/-40	50/-55	95	140	425

Poor Reported Braking Action

MAX MANUAL	2315	160/-165	80/105	-140/525	195/-125	60/-65	75	410	1100
AUTOBRAKE MAX	2320	165/-165	80/110	-140/525	195/-130	65/-70	75	410	1100
AUTOBRAKE 3	2335	165/-165	80/110	-140/525	190/-115	65/-70	90	410	1110

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Disagree (1 ≤ Indicated Flaps <15)

VREF40 + 30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1110	90/-65	25/40	-40/135	15/-15	25/-25	35	30	60
AUTOBRAKE MAX	1510	70/-75	35/45	-50/170	5/-5	40/-40	65	0	5
AUTOBRAKE 2	2730	165/-185	90/115	-115/385	55/-60	85/-85	100	165	175

Good Reported Braking Action

MAX MANUAL	1525	80/-85	40/55	-60/215	35/-30	40/-40	45	90	210
AUTOBRAKE MAX	1665	80/-90	45/60	-65/225	30/-25	45/-45	65	95	225
AUTOBRAKE 2	2735	160/-185	90/115	-115/385	55/-65	85/-85	95	165	175

Medium Reported Braking Action

MAX MANUAL	2125	125/-135	70/90	-100/360	90/-75	60/-60	65	255	625
AUTOBRAKE MAX	2180	130/-140	70/95	-100/360	85/-70	60/-60	75	260	640
AUTOBRAKE 3	2385	125/-140	70/95	-110/380	60/-45	70/-70	110	150	470

Poor Reported Braking Action

MAX MANUAL	2795	190/-195	100/135	-150/565	220/-150	80/-85	80	545	1510
AUTOBRAKE MAX	2790	185/-195	100/135	-150/565	220/-145	80/-85	85	540	1500
AUTOBRAKE 3	2845	185/-190	100/135	-155/570	205/-130	80/-85	105	525	1495

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Disagree (15 ≤ Indicated Flaps <30)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1005	70/-60	25/30	-35/125	10/-10	20/-25	35	25	50
AUTOBRAKE MAX	1310	65/-75	30/40	-45/155	5/-5	30/-30	65	0	5
AUTOBRAKE 2	2360	155/-170	75/100	-105/355	35/-50	70/-70	95	100	100

Good Reported Braking Action

MAX MANUAL	1380	75/-80	35/50	-60/205	35/-30	35/-35	50	80	185
AUTOBRAKE MAX	1485	85/-90	40/55	-60/215	30/-25	35/-35	55	90	205
AUTOBRAKE 2	2360	155/-170	75/100	-105/355	35/-50	70/-70	95	100	100

Medium Reported Braking Action

MAX MANUAL	1900	125/-130	60/80	-95/340	85/-65	50/-55	65	225	550
AUTOBRAKE MAX	1935	125/-130	60/80	-95/345	80/-65	50/-55	75	225	555
AUTOBRAKE 3	2055	125/-135	60/85	-100/355	60/-40	55/-60	100	145	465

Poor Reported Braking Action

MAX MANUAL	2480	180/-180	85/120	-145/540	205/-135	70/-75	75	475	1310
AUTOBRAKE MAX	2480	180/-180	85/120	-145/540	205/-135	70/-75	80	475	1305
AUTOBRAKE 3	2500	180/-180	85/120	-145/540	200/-120	70/-75	95	475	1310

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Disagree (30 ≤ Indicated Flaps <40)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	960	55/-55	20/30	-35/120	10/-10	20/-20	35	20	45
AUTOBRAKE MAX	1215	60/-65	30/35	-45/150	5/0	30/-30	60	0	5
AUTOBRAKE 2	2165	140/-150	65/90	-100/340	30/-45	65/-65	90	85	85

Good Reported Braking Action

MAX MANUAL	1315	70/-75	35/45	-60/200	30/-30	35/-35	50	75	165
AUTOBRAKE MAX	1410	75/-85	35/50	-60/210	30/-25	35/-35	60	80	185
AUTOBRAKE 2	2165	140/-150	65/90	-100/340	35/-45	65/-65	90	85	85

Medium Reported Braking Action

MAX MANUAL	1790	115/-120	55/75	-90/330	80/-65	50/-50	65	195	480
AUTOBRAKE MAX	1820	115/-120	55/75	-95/335	75/-60	50/-50	70	200	480
AUTOBRAKE 3	1910	115/-125	55/75	-95/345	60/-40	50/-55	95	140	425

Poor Reported Braking Action

MAX MANUAL	2315	160/-165	80/105	-140/525	195/-125	60/-65	75	410	1100
AUTOBRAKE MAX	2320	165/-165	80/110	-140/525	195/-130	65/-70	75	410	1100
AUTOBRAKE 3	2335	165/-165	80/110	-140/525	190/-115	65/-70	90	410	1110

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flaps Up Landing

VREF40 + 40

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1185	110/-70	30/70	-40/140	15/-15	30/-30	45	30	70
AUTOBRAKE MAX	1645	75/-80	40/55	-55/180	5/-5	40/-45	70	5	10
AUTOBRAKE 2	2970	175/-195	100/130	-120/400	65/-70	90/-90	95	205	235

Good Reported Braking Action

MAX MANUAL	1600	80/-90	45/60	-65/220	35/-30	40/-45	45	90	205
AUTOBRAKE MAX	1795	85/-95	50/65	-70/235	25/-25	45/-50	65	80	200
AUTOBRAKE 2	2970	175/-195	100/130	-120/400	65/-70	90/-90	95	205	235

Medium Reported Braking Action

MAX MANUAL	2255	135/-140	70/95	-105/365	95/-75	65/-65	65	260	625
AUTOBRAKE MAX	2330	135/-145	75/100	-105/370	90/-75	65/-65	70	265	645
AUTOBRAKE 3	2605	135/-155	80/105	-115/395	60/-55	75/-80	105	145	435

Poor Reported Braking Action

MAX MANUAL	2990	200/-205	105/145	-155/580	230/-155	85/-90	80	565	1530
AUTOBRAKE MAX	2995	195/-205	105/145	-155/580	230/-150	85/-90	90	560	1520
AUTOBRAKE 3	3080	190/-205	105/145	-160/585	210/-140	90/-95	100	520	1495

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Recommended Brake Cooling Schedule

Reference Brake Energy Per Brake (Millions of Foot Pounds)

		WIND CORRECTED BRAKES ON SPEED (KIAS)*																	
		80			100			120			140			160			180		
WEIGHT (1000 KG)	OAT (°C)	PRESSURE ALTITUDE (1000 FT)																	
		0	5	10	0	5	10	0	5	10	0	5	10	0	5	10	0	5	10
80	0	15.1	17.0	19.3	22.4	25.3	28.9	30.9	35.0	40.2	40.4	45.9	53.0	50.8	57.9	67.3	60.8	69.6	81.2
	10	15.6	17.6	20.0	23.1	26.1	29.8	31.9	36.2	41.5	41.8	47.5	54.8	52.5	59.9	69.5	62.8	71.9	83.9
	15	15.8	17.8	20.2	23.5	26.5	30.3	32.4	36.7	42.1	42.4	48.2	55.6	53.3	60.7	70.5	63.7	72.9	85.1
	20	16.0	18.1	20.5	23.8	26.9	30.7	32.8	37.2	42.7	42.9	48.8	56.3	54.0	61.5	71.4	64.6	73.9	86.2
	30	16.4	18.5	21.1	24.4	27.6	31.5	33.7	38.2	43.8	44.0	50.0	57.7	55.3	63.1	73.2	66.2	75.7	88.4
	40	16.6	18.7	21.3	24.7	27.9	31.9	34.1	38.7	44.4	44.7	50.9	58.8	56.3	64.3	74.8	67.5	77.4	90.5
	50	16.6	18.7	21.3	24.8	28.0	32.1	34.3	39.0	44.9	45.2	51.5	59.7	57.1	65.4	76.3	68.7	79.0	92.9
70	0	13.7	15.4	17.5	20.2	22.8	26.0	27.7	31.3	35.9	36.1	41.0	47.2	45.3	51.6	59.7	54.9	62.7	72.9
	10	14.2	15.9	18.1	20.8	23.5	26.8	28.6	32.4	37.1	37.3	42.3	48.7	46.8	53.3	61.6	56.7	64.8	75.4
	15	14.4	16.2	18.4	21.1	23.9	27.2	29.0	32.8	37.6	37.8	43.0	49.4	47.5	54.0	62.5	57.5	65.7	76.4
	20	14.6	16.4	18.6	21.4	24.2	27.6	29.4	33.3	38.1	38.4	43.5	50.1	48.1	54.8	63.4	58.3	66.5	77.4
	30	14.9	16.8	19.1	22.0	24.8	28.3	30.2	34.1	39.1	39.3	44.6	51.4	49.3	56.1	64.9	59.8	68.2	79.4
	40	15.1	17.0	19.3	22.2	25.1	28.6	30.5	34.6	39.6	39.9	45.3	52.2	50.1	57.1	66.2	60.9	69.6	81.2
	50	15.1	17.0	19.3	22.3	25.2	28.8	30.7	34.8	40.0	40.2	45.8	52.9	50.7	58.0	67.4	61.8	70.9	83.0
60	0	12.3	13.9	15.7	18.0	20.3	23.1	24.4	27.6	31.6	31.7	35.9	41.2	39.6	45.0	51.8	48.1	54.8	63.5
	10	12.7	14.3	16.3	18.5	20.9	23.8	25.2	28.5	32.6	32.7	37.1	42.6	40.9	46.5	53.6	49.7	56.6	65.6
	15	12.9	14.6	16.5	18.8	21.2	24.2	25.6	29.0	33.1	33.2	37.6	43.2	41.5	47.1	54.4	50.4	57.4	66.5
	20	13.1	14.8	16.7	19.1	21.5	24.5	26.0	29.4	33.5	33.6	38.1	43.8	42.0	47.8	55.1	51.1	58.2	67.4
	30	13.4	15.1	17.2	19.6	22.1	25.1	26.6	30.1	34.4	34.5	39.1	44.9	43.1	49.0	56.5	52.3	59.6	69.1
	40	13.6	15.3	17.3	19.8	22.3	25.4	26.9	30.5	34.9	35.0	39.7	45.6	43.8	49.8	57.5	53.2	60.7	70.5
	50	13.5	15.3	17.3	19.8	22.4	25.5	27.0	30.6	35.1	35.2	40.0	46.0	44.2	50.4	58.3	53.9	61.7	71.9
50	0	11.0	12.3	14.0	15.7	17.7	20.2	21.2	23.9	27.3	27.2	30.8	35.3	33.8	38.3	44.1	40.9	46.4	53.6
	10	11.3	12.7	14.4	16.3	18.3	20.8	21.9	24.7	28.2	28.1	31.8	36.5	34.9	39.6	45.5	42.2	48.0	55.4
	15	11.5	12.9	14.7	16.5	18.6	21.1	22.2	25.1	28.6	28.6	32.3	37.0	35.4	40.2	46.2	42.8	48.7	56.2
	20	11.6	13.1	14.9	16.7	18.9	21.4	22.5	25.4	29.0	28.9	32.8	37.5	35.9	40.7	46.8	43.4	49.3	56.9
	30	11.9	13.4	15.2	17.2	19.3	22.0	23.1	26.1	29.7	29.7	33.6	38.4	36.8	41.8	48.0	44.5	50.6	58.4
	40	12.1	13.6	15.4	17.3	19.5	22.2	23.4	26.4	30.1	30.1	34.0	39.0	37.4	42.4	48.8	45.2	51.4	59.4
	50	12.0	13.6	15.4	17.3	19.6	22.3	23.4	26.5	30.3	30.2	34.2	39.3	37.6	42.8	49.3	45.7	52.1	60.3
40	0	9.6	10.8	12.3	13.5	15.2	17.3	17.9	20.2	23.0	22.8	25.8	29.4	28.1	31.8	36.4	33.7	38.2	43.9
	10	10.0	11.2	12.7	14.0	15.8	17.9	18.5	20.9	23.8	23.6	26.6	30.4	29.0	32.8	37.6	34.8	39.5	45.4
	15	10.1	11.4	12.9	14.2	16.0	18.1	18.8	21.2	24.1	23.9	27.0	30.8	29.4	33.3	38.2	35.3	40.0	46.0
	20	10.2	11.5	13.1	14.4	16.2	18.4	19.1	21.5	24.5	24.2	27.4	31.3	29.8	33.8	38.7	35.8	40.6	46.6
	30	10.5	11.8	13.4	14.8	16.6	18.9	19.6	22.1	25.1	24.9	28.1	32.1	30.6	34.6	39.7	36.7	41.6	47.8
	40	10.6	11.9	13.5	14.9	16.8	19.1	19.8	22.3	25.4	25.2	28.4	32.5	31.0	35.1	40.2	37.2	42.2	48.6
	50	10.6	11.9	13.5	14.9	16.8	19.1	19.8	22.3	25.5	25.2	28.6	32.7	31.1	35.3	40.6	37.5	42.6	49.1

***To correct for wind, enter table with the brakes on speed minus one half the headwind or plus 1.5 times the tailwind. If ground speed is used for brakes on speed, ignore wind and enter table with sea level, 15°C.**

ADVISORY INFORMATION

Recommended Brake Cooling Schedule

Adjusted Brake Energy Per Brake (Millions of Foot Pounds)

No Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)								
EVENT		10	20	30	40	50	60	70	80	90
RTO MAX MAN		10	20	30	40	50	60	70	80	90
LANDING	MAX MAN	7.8	16.3	25.3	34.7	44.7	55.0	65.7	76.6	87.9
	MAX AUTO	7.5	15.4	23.6	32.4	41.8	51.8	62.5	74.1	86.5
	AUTOBRAKE 3	7.3	14.7	22.3	30.2	38.6	47.6	57.4	68.1	80.0
	AUTOBRAKE 2	7.0	13.8	20.5	27.4	34.8	42.7	51.5	61.3	72.4
	AUTOBRAKE 1	6.7	13.1	19.2	25.3	31.8	38.8	46.6	55.4	65.5

Two Engine Detent Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)								
EVENT		10	20	30	40	50	60	70	80	90
RTO MAX MAN		10	20	30	40	50	60	70	80	90
LANDING	MAX MAN	7.0	14.6	22.8	31.4	40.5	49.9	59.7	69.8	80.0
	MAX AUTO	5.8	12.3	19.5	27.2	35.6	44.5	53.9	63.7	74.1
	AUTOBRAKE 3	4.3	9.2	14.7	20.7	27.2	34.4	42.0	50.2	59.0
	AUTOBRAKE 2	2.5	5.6	9.1	13.1	17.8	23.0	28.8	35.2	42.3
	AUTOBRAKE 1	1.8	3.8	6.1	8.8	11.9	15.5	19.6	24.4	29.8

Cooling Time (Minutes) - Category C Steel Brakes

(Note: A placard showing carbon brakes configuration will be put at the Center Forward Panel upon modification.)

	EVENT ADJUSTED BRAKE ENERGY (MILLIONS OF FOOT POUNDS)								
	16 & BELOW	17	20	23	25	28	32	33 TO 48	49 & ABOVE
	BRAKE TEMPERATURE MONITOR SYSTEM INDICATION ON CDS								
	UP TO 2.4	2.6	3.1	3.5	3.9	4.4	4.9	5.0 TO 7.5	7.5 & ABOVE
INFLIGHT GEAR DOWN	NO SPECIAL PROCEDURE REQUIRED	1	2	3	4	5	6	CAUTION	FUSE PLUG MELT ZONE
GROUND		10	20	30	40	50	60		

Cooling Time (Minutes) - Category N Carbon Brakes

	EVENT ADJUSTED BRAKE ENERGY (MILLIONS OF FOOT POUNDS)								
	16 & BELOW	17	19	20.9	23.5	26.9	29.4	30 TO 41	41 & ABOVE
	BRAKE TEMPERATURE MONITOR SYSTEM INDICATION ON CDS								
	UP TO 2.5	2.6	3	3.3	3.8	4.5	4.9	5.0 TO 7.1	7.1 & ABOVE
INFLIGHT GEAR DOWN	NO SPECIAL PROCEDURE REQUIRED	1	4	5	6	7	7.6	CAUTION	FUSE PLUG MELT ZONE
GROUND		6.7	16.0	24.1	34.2	45.9	53.3		

Observe maximum quick turnaround limit.
Table shows energy per brake added by a single stop with all brakes operating. Energy is assumed to be equally distributed among the operating brakes. Total energy is the sum of residual energy plus energy added.
Add 1.0 million foot pounds per brake for each taxi mile.

When in caution zone, wheel fuse plugs may melt. Delay takeoff and inspect after one hour. If overheat occurs after takeoff, extend gear soon for at least 7 minutes.

When in fuse plug melt zone, clear runway immediately. Unless required, do not set parking brake. Do not approach gear or attempt to taxi for one hour. Tire, wheel and brake replacement may be required. If overheat occurs after takeoff, extend gear soon for at least 12 minutes.

Brake temperature monitor system (BTMS) indication on CDS systems page may be used 10 to 15 minutes after airplane has come to a complete stop or inflight with gear retracted to determine recommended cooling schedule.

Performance Inflight Chapter PI

Engine Inoperative Section 43

ENGINE INOP

Initial Max Continuous %N1

Based on .79M, A/C high and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT)								
	25	27	29	31	33	35	37	39	41
20	96.1	95.9	95.6	95.5	95.2	94.8	94.3	94.0	93.2
15	96.7	96.5	96.2	96.1	96.0	95.5	95.1	94.8	94.1
10	97.3	97.2	96.8	96.7	96.7	96.2	95.8	95.6	95.0
5	97.5	97.9	97.6	97.4	97.4	97.0	96.6	96.4	95.9
0	96.8	98.1	98.5	98.3	98.2	97.8	97.5	97.2	96.8
-5	96.0	97.3	98.5	99.2	99.1	98.6	98.3	98.1	97.8
-10	95.2	96.5	97.7	99.0	99.9	99.5	99.2	99.0	98.7
-15	94.4	95.8	96.9	98.2	99.5	100.4	100.1	99.9	99.7
-20	93.6	95.0	96.2	97.4	98.7	99.8	100.4	100.2	100.0
-25	92.8	94.2	95.4	96.6	97.9	99.0	99.6	99.4	99.2
-30	91.9	93.4	94.6	95.8	97.0	98.2	98.7	98.5	98.3
-35	91.1	92.6	93.7	94.9	96.2	97.3	97.9	97.7	97.5
-40	90.3	91.8	92.9	94.1	95.3	96.5	97.0	96.8	96.6

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)								
	25	27	29	31	33	35	37	39	41
ENGINE ANTI-ICE	-1.2	-1.1	-1.0	-0.9	-0.8	-0.8	-0.8	-0.8	-0.8
ENGINE & WING ANTI-ICE	-4.2	-4.4	-4.5	-4.7	-5.0	-4.8	-4.8	-4.8	-4.8

ENGINE INOP

Max Continuous %N1
37000 FT to 29000 FT Pressure Altitudes

37000 FT PRESS ALT		TAT (°C)											
KIAS	M	-55	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0
160	.51	96.0	97.0	97.9	98.7	99.6	98.9	98.1	96.9	95.6	94.0	92.5	91.1
200	.63	95.4	96.3	97.2	98.1	98.9	99.8	99.5	98.7	97.8	96.8	95.6	94.5
240	.74	94.4	95.3	96.2	97.1	98.0	98.8	99.7	100.1	99.3	98.5	97.7	96.7
280	.86	93.7	94.6	95.5	96.4	97.2	98.1	98.9	99.7	100.5	100.2	99.3	98.5

35000 FT PRESS ALT		TAT (°C)											
KIAS	M	-55	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0
160	.49	95.9	96.8	97.7	98.6	99.5	99.2	98.4	97.3	96.1	94.7	93.3	92.0
200	.60	95.5	96.4	97.3	98.2	99.1	100.0	99.9	98.9	98.0	97.0	95.8	94.7
240	.71	94.4	95.3	96.2	97.1	98.0	98.8	99.6	100.2	99.5	98.9	98.0	97.0
280	.82	93.2	94.0	94.9	95.8	96.6	97.5	98.3	99.1	99.9	99.7	98.9	98.1

33000 FT PRESS ALT		TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
160	.47	96.8	97.7	98.5	99.4	100.2	99.3	98.5	97.3	96.0	94.6	93.2	92.0
200	.58	96.4	97.3	98.2	99.1	99.9	100.8	99.9	99.0	98.0	96.8	95.6	94.5
240	.68	95.3	96.2	97.1	97.9	98.8	99.6	100.4	100.2	99.6	98.7	97.7	96.7
280	.79	93.6	94.5	95.4	96.2	97.1	97.9	98.7	99.5	99.9	99.1	98.2	97.4
320	.89	93.0	93.9	94.7	95.6	96.4	97.2	98.1	98.9	99.7	100.4	100.0	99.2

31000 FT PRESS ALT		TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
160	.45	96.7	97.6	98.5	99.4	100.3	100.4	99.5	98.5	97.3	95.9	94.5	93.2
200	.55	96.5	97.3	98.2	99.1	100.0	100.8	101.0	100.1	99.1	98.0	96.7	95.5
240	.66	95.0	95.9	96.8	97.6	98.5	99.3	100.2	100.7	99.9	99.1	98.1	97.1
280	.76	93.2	94.0	94.9	95.7	96.6	97.4	98.2	99.0	99.8	99.1	98.2	97.3
320	.85	91.8	92.6	93.5	94.3	95.1	95.9	96.7	97.5	98.3	99.1	99.3	98.4

29000 FT PRESS ALT		TAT (°C)											
KIAS	M	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
160	.43	97.5	98.4	99.3	100.1	101.0	100.5	99.6	98.5	97.2	95.7	94.4	93.1
200	.53	96.9	97.8	98.7	99.5	100.4	101.2	100.7	99.7	98.7	97.5	96.2	95.1
240	.63	95.7	96.5	97.4	98.2	99.1	99.9	100.7	100.4	99.5	98.6	97.5	96.6
280	.73	93.6	94.4	95.2	96.1	96.9	97.7	98.5	99.3	99.4	98.5	97.5	96.8
320	.82	91.4	92.3	93.1	93.9	94.7	95.5	96.3	97.0	97.8	98.6	97.8	97.0
360	.91	91.4	92.3	93.1	93.9	94.7	95.5	96.3	97.0	97.8	98.6	99.3	99.4

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)				
	29	31	33	35	37
ENGINE ANTI-ICE ON	-0.9	-0.9	-0.8	-0.8	-0.8
ENGINE & WING ANTI-ICE ON	-4.1	-4.3	-4.5	-4.7	-4.7

ENGINE INOP

Max Continuous %N1
27000 FT to 20000 FT Pressure Altitudes

27000 FT PRESS ALT		TAT (°C)											
KIAS	M	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
160	.41	97.3	98.2	99.1	100.0	100.8	101.5	100.6	99.6	98.4	97.0	95.7	94.4
200	.51	96.3	97.2	98.1	98.9	99.8	100.6	101.1	100.2	99.2	98.1	96.9	95.7
240	.60	95.0	95.9	96.7	97.6	98.4	99.2	100.1	100.7	99.7	98.7	97.7	96.8
280	.70	93.0	93.8	94.6	95.5	96.3	97.1	97.9	98.7	99.4	98.7	97.7	96.9
320	.79	90.9	91.7	92.6	93.4	94.2	95.0	95.7	96.5	97.3	98.0	97.9	97.2
360	.88	90.2	91.0	91.8	92.7	93.5	94.3	95.1	95.9	96.6	97.4	98.2	98.7

25000 FT PRESS ALT		TAT (°C)											
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
160	.39	98.2	99.0	99.9	100.7	101.6	101.7	100.7	99.6	98.4	97.0	95.8	94.5
200	.49	96.8	97.7	98.5	99.4	100.2	101.0	100.9	99.9	98.9	97.7	96.6	95.5
240	.58	95.1	95.9	96.8	97.6	98.4	99.2	100.0	99.8	98.9	97.9	96.9	96.0
280	.67	93.2	94.1	94.9	95.7	96.5	97.3	98.1	98.8	98.9	97.9	96.9	96.2
320	.76	90.9	91.8	92.6	93.4	94.2	95.0	95.8	96.6	97.3	97.9	97.2	96.5
360	.85	89.6	90.5	91.3	92.1	93.0	93.8	94.6	95.4	96.2	97.0	97.7	97.5

24000 FT PRESS ALT		TAT (°C)											
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
160	.38	97.7	98.5	99.4	100.3	101.1	101.9	100.8	99.7	98.5	97.2	96.0	94.7
200	.48	96.4	97.2	98.1	98.9	99.7	100.6	101.0	99.9	98.9	97.8	96.7	95.6
240	.57	94.7	95.6	96.4	97.2	98.0	98.8	99.6	99.9	99.0	97.9	97.0	96.1
280	.66	93.0	93.8	94.6	95.4	96.2	97.0	97.8	98.6	99.1	98.0	97.0	96.3
320	.75	90.6	91.4	92.3	93.1	93.9	94.7	95.5	96.3	97.1	97.8	97.2	96.5
360	.83	89.0	89.8	90.7	91.5	92.4	93.2	94.0	94.8	95.6	96.4	97.2	97.2

22000 FT PRESS ALT		TAT (°C)											
KIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
160	.37	97.5	98.4	99.2	100.1	100.9	101.0	99.9	98.7	97.5	96.3	95.2	94.0
200	.46	96.3	97.1	98.0	98.8	99.6	100.4	100.1	98.9	97.8	96.8	95.8	94.8
240	.55	94.8	95.6	96.4	97.2	98.0	98.8	99.6	99.1	98.1	97.1	96.2	95.4
280	.63	93.2	94.0	94.8	95.6	96.4	97.1	97.9	98.7	98.4	97.4	96.6	95.8
320	.72	90.9	91.8	92.6	93.4	94.2	95.0	95.8	96.6	97.4	97.5	96.8	96.1
360	.80	89.0	89.9	90.7	91.6	92.4	93.2	94.0	94.8	95.6	96.4	97.0	96.4

20000 FT PRESS ALT		TAT (°C)											
KIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
160	.35	96.5	97.4	98.2	99.0	99.8	100.6	100.2	98.9	97.7	96.6	95.5	94.4
200	.44	95.4	96.2	97.0	97.9	98.7	99.4	100.2	99.1	97.8	96.8	95.8	94.9
240	.53	93.9	94.7	95.5	96.3	97.1	97.9	98.7	99.3	98.2	97.1	96.2	95.4
280	.61	92.4	93.3	94.1	94.8	95.6	96.4	97.2	97.9	98.5	97.6	96.7	95.9
320	.69	90.3	91.1	92.0	92.8	93.6	94.4	95.2	96.0	96.8	97.6	96.9	96.2
360	.77	88.5	89.3	90.2	91.0	91.8	92.6	93.5	94.3	95.1	95.8	96.6	96.4

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)				
	20	22	24	25	27
ENGINE ANTI-ICE ON	-0.9	-0.9	-1.0	-1.0	-1.0
ENGINE & WING ANTI-ICE ON	-3.6	-3.8	-3.8	-3.9	-4.0

ENGINE INOP

Max Continuous %N1
18000 FT to 12000 FT Pressure Altitudes

18000 FT PRESS ALT		TAT (°C)											
KIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
160	.34	96.0	96.8	97.6	98.4	99.2	100.0	98.9	97.5	96.5	95.5	94.5	93.5
200	.42	95.1	95.9	96.7	97.5	98.2	99.0	99.3	98.0	96.7	95.9	95.0	94.1
240	.51	93.7	94.5	95.2	96.0	96.8	97.6	98.3	98.2	97.1	96.2	95.4	94.6
280	.59	92.0	92.9	93.7	94.5	95.3	96.1	96.8	97.6	97.5	96.6	95.8	95.1
320	.67	90.3	91.1	92.0	92.8	93.6	94.4	95.2	96.0	96.8	96.9	96.2	95.5
360	.75	88.7	89.5	90.4	91.2	92.0	92.8	93.6	94.4	95.2	96.0	96.4	95.8

16000 FT PRESS ALT		TAT (°C)											
KIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
160	.33	95.0	95.8	96.6	97.4	98.2	99.0	99.4	98.2	97.0	96.1	95.2	94.2
200	.41	93.9	94.7	95.5	96.3	97.1	97.8	98.6	98.2	97.0	96.0	95.2	94.4
240	.49	92.5	93.3	94.1	94.9	95.7	96.5	97.2	98.0	97.3	96.3	95.5	94.7
280	.57	91.0	91.8	92.6	93.5	94.3	95.1	95.9	96.6	97.4	96.7	95.8	95.1
320	.64	89.4	90.3	91.1	91.9	92.8	93.6	94.4	95.2	95.9	96.7	96.1	95.5
360	.72	88.0	88.9	89.7	90.6	91.4	92.2	93.0	93.8	94.6	95.4	96.2	95.8

14000 FT PRESS ALT		TAT (°C)											
KIAS	M	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
160	.31	94.9	95.7	96.5	97.3	98.0	98.8	99.2	98.2	97.3	96.4	95.5	94.6
200	.39	93.6	94.4	95.2	96.0	96.7	97.5	98.3	97.5	96.5	95.7	94.9	94.1
240	.47	92.1	92.9	93.8	94.6	95.4	96.2	96.9	97.4	96.5	95.6	94.8	94.1
280	.54	90.9	91.7	92.5	93.4	94.2	95.0	95.8	96.5	96.8	96.0	95.2	94.5
320	.62	89.6	90.4	91.2	92.1	92.9	93.7	94.5	95.3	96.1	96.2	95.5	94.8
360	.69	88.3	89.1	89.9	90.7	91.6	92.4	93.2	94.0	94.8	95.5	95.8	95.2

12000 FT PRESS ALT		TAT (°C)											
KIAS	M	-20	-15	-10	-5	0	5	10	15	20	25	30	35
160	.30	94.8	95.6	96.4	97.1	97.9	98.6	97.9	96.8	95.9	95.2	94.4	93.5
200	.38	92.7	93.5	94.3	95.1	95.9	96.7	97.1	96.1	95.1	94.4	93.6	92.8
240	.45	91.6	92.5	93.3	94.1	94.9	95.7	96.4	96.4	95.5	94.7	94.0	93.2
280	.52	90.6	91.4	92.2	93.0	93.8	94.6	95.4	96.2	95.9	95.1	94.4	93.7
320	.60	89.5	90.3	91.2	92.0	92.8	93.6	94.4	95.2	96.0	95.5	94.8	94.1
360	.67	88.3	89.1	90.0	90.8	91.6	92.4	93.2	93.9	94.7	95.5	95.1	94.4

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)			
	12	14	16	18
ENGINE ANTI-ICE ON	-0.9	-0.9	-0.9	-0.9
ENGINE & WING ANTI-ICE ON	-3.2	-3.4	-3.4	-3.5

ENGINE INOP

Max Continuous %N1
10000 FT to 1000 FT Pressure Altitudes

10000 FT PRESS ALT		TAT (°C)											
KIAS	M	-20	-15	-10	-5	0	5	10	15	20	25	30	35
160	.29	92.7	93.5	94.4	95.2	95.9	96.7	97.5	96.5	95.6	94.9	94.2	93.4
200	.36	91.3	92.1	93.0	93.8	94.6	95.4	96.1	96.1	95.2	94.4	93.7	92.9
240	.43	90.3	91.1	92.0	92.8	93.6	94.4	95.2	95.9	95.4	94.6	93.8	93.1
280	.51	89.5	90.3	91.1	91.9	92.7	93.5	94.3	95.1	95.7	95.0	94.2	93.5
320	.58	88.6	89.4	90.2	91.0	91.8	92.6	93.4	94.2	95.0	95.4	94.7	93.9
360	.65	87.5	88.3	89.2	90.0	90.8	91.6	92.3	93.1	93.9	94.7	95.0	94.3
5000 FT PRESS ALT		TAT (°C)											
KIAS	M	-10	-5	0	5	10	15	20	25	30	35	40	45
160	.26	90.5	91.4	92.2	93.0	93.8	94.5	95.1	94.4	93.6	92.9	92.2	91.4
200	.33	90.0	90.8	91.6	92.4	93.2	93.9	94.7	94.4	93.7	93.0	92.3	91.5
240	.40	89.2	90.0	90.8	91.6	92.4	93.2	93.9	94.4	93.7	92.9	92.2	91.5
280	.46	88.5	89.3	90.1	90.9	91.7	92.5	93.3	94.0	94.0	93.2	92.5	91.8
320	.53	87.8	88.6	89.4	90.2	90.9	91.7	92.5	93.2	94.0	93.6	92.9	92.2
360	.59	86.9	87.7	88.5	89.3	90.1	90.8	91.6	92.3	93.1	93.8	93.3	92.6
3000 FT PRESS ALT		TAT (°C)											
KIAS	M	-5	0	5	10	15	20	25	30	35	40	45	50
160	.26	90.5	91.3	92.1	92.8	93.6	94.4	94.6	93.9	93.2	92.4	91.6	90.7
200	.32	89.9	90.7	91.5	92.3	93.1	93.8	94.6	94.0	93.3	92.5	91.8	91.0
240	.38	88.8	89.6	90.4	91.2	92.0	92.7	93.5	93.5	92.8	92.0	91.3	90.6
280	.45	88.3	89.1	89.9	90.6	91.4	92.2	92.9	93.7	93.1	92.4	91.7	91.0
320	.51	87.6	88.4	89.2	90.0	90.7	91.5	92.2	93.0	93.5	92.8	92.0	91.3
360	.57	86.8	87.6	88.4	89.1	89.9	90.6	91.4	92.1	92.8	93.1	92.4	91.7
1000 FT PRESS ALT		TAT (°C)											
KIAS	M	-5	0	5	10	15	20	25	30	35	40	45	50
160	.25	89.0	89.8	90.6	91.4	92.2	92.9	93.7	93.4	92.7	91.9	91.2	90.3
200	.31	88.7	89.5	90.3	91.0	91.8	92.6	93.3	93.7	93.0	92.2	91.5	90.7
240	.37	87.8	88.6	89.4	90.2	90.9	91.7	92.5	93.2	92.8	92.0	91.3	90.6
280	.43	87.3	88.1	88.8	89.6	90.4	91.1	91.9	92.6	93.1	92.3	91.6	90.9
320	.49	86.7	87.5	88.2	89.0	89.8	90.5	91.3	92.0	92.7	92.7	91.9	91.2
360	.55	85.9	86.7	87.5	88.2	89.0	89.7	90.5	91.2	91.9	92.6	92.3	91.6

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)			
	1	3	5	10
ENGINE ANTI-ICE ON	-0.6	-0.8	-0.8	-0.8
ENGINE & WING ANTI-ICE ON	-2.9	-3.0	-2.7	-3.2

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

WEIGHT (1000 KG)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFTDOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
85	81	269	16300	14700	12300
80	76	262	18400	16800	14900
75	72	254	20400	19000	17300
70	67	246	22500	21200	19700
65	62	238	24700	23500	22100
60	57	229	26800	25800	24600
55	53	219	29100	28100	27000
50	48	209	31200	30400	29400
45	43	199	33300	32600	31700
40	38	187	35600	34900	34000

Includes APU fuel burn.

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown/LRC Cruise Range Capability

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
138	128	120	112	106	100	95	90	86	82	78
275	256	239	225	212	200	190	180	172	164	157
413	384	359	337	317	300	284	270	258	246	235
551	512	479	449	423	400	379	360	344	328	314
689	640	598	562	529	500	474	451	429	410	392
826	768	718	674	635	600	569	541	515	492	471
964	896	838	786	741	700	664	631	601	574	549
1102	1025	957	898	846	800	758	721	687	656	628
1240	1153	1077	1011	952	900	853	811	773	738	706
1377	1281	1197	1123	1058	1000	948	901	859	820	785
1515	1409	1317	1235	1164	1100	1043	991	945	902	863
1653	1537	1436	1348	1270	1200	1138	1081	1030	984	942
1792	1666	1556	1460	1375	1300	1232	1171	1116	1066	1020
1930	1794	1676	1573	1481	1400	1327	1261	1202	1148	1098
2068	1922	1796	1685	1587	1500	1422	1351	1288	1230	1177
2207	2051	1916	1798	1693	1600	1517	1441	1373	1312	1255
2345	2180	2036	1910	1799	1700	1611	1531	1459	1393	1333
2484	2309	2156	2023	1905	1800	1706	1621	1545	1475	1411

Driftdown/Cruise Fuel and Time

AIR DIST (NM)	FUEL REQUIRED (1000 KG)										TIME (HR:MIN)
	WEIGHT AT START OF DRIFTDOWN (1000 KG)										
	40	45	50	55	60	65	70	75	80	85	
100	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0:17
200	0.8	0.8	0.9	0.9	1.0	1.0	1.1	1.1	1.2	1.2	0:33
300	1.2	1.3	1.4	1.5	1.6	1.7	1.7	1.8	1.9	2.0	0:50
400	1.6	1.8	1.9	2.0	2.2	2.3	2.4	2.6	2.7	2.9	1:06
500	2.0	2.2	2.4	2.6	2.8	3.0	3.1	3.3	3.5	3.7	1:23
600	2.4	2.7	2.9	3.1	3.3	3.6	3.8	4.0	4.2	4.5	1:39
700	2.8	3.1	3.4	3.6	3.9	4.2	4.4	4.7	5.0	5.2	1:56
800	3.2	3.6	3.9	4.2	4.5	4.8	5.0	5.4	5.7	6.0	2:12
900	3.6	4.0	4.3	4.7	5.0	5.4	5.7	6.0	6.4	6.8	2:29
1000	4.0	4.4	4.8	5.2	5.6	6.0	6.3	6.7	7.1	7.6	2:46
1100	4.4	4.8	5.3	5.7	6.1	6.6	6.9	7.4	7.8	8.3	3:02
1200	4.8	5.3	5.7	6.2	6.7	7.1	7.6	8.1	8.6	9.1	3:19
1300	5.2	5.7	6.2	6.7	7.2	7.7	8.2	8.7	9.3	9.8	3:36
1400	5.5	6.1	6.6	7.2	7.7	8.3	8.8	9.4	10.0	10.6	3:52
1500	5.9	6.5	7.1	7.7	8.3	8.9	9.4	10.0	10.7	11.3	4:09
1600	6.3	6.9	7.5	8.2	8.8	9.4	10.0	10.7	11.3	12.1	4:26
1700	6.6	7.3	8.0	8.6	9.3	10.0	10.6	11.3	12.0	12.8	4:43
1800	7.0	7.7	8.4	9.1	9.8	10.5	11.2	12.0	12.7	13.5	4:59

Includes APU fuel burn.
Driftdown at optimum driftdown speed and cruise at long range cruise speed.

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Altitude Capability

100 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
85	9500	6400	3400
80	12400	9500	6500
75	15300	12800	9800
70	18400	15800	13200
65	21100	18600	16300
60	23700	21800	19400
55	26300	24700	22400
50	29000	27700	25800
45	31400	30500	29200
40	33800	33000	31800

With engine anti-ice on, decrease altitude capability by 2000 ft.
With engine and wing anti-ice on, decrease altitude capability by 6500 ft.

ENGINE INOP

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)									
		10	15	17	19	21	23	25	27	29	31
85	%N1	91.8									
	MACH	.561									
	KIAS	311									
	FF/ENG	3067									
80	%N1	90.1	94.0								
	MACH	.545	.590								
	KIAS	302	299								
	FF/ENG	2875	2870								
75	%N1	88.4	92.5	94.0							
	MACH	.528	.579	.593							
	KIAS	293	293	288							
	FF/ENG	2684	2709	2674							
70	%N1	86.5	90.7	92.3	94.0						
	MACH	.510	.562	.582	.595						
	KIAS	282	284	283	278						
	FF/ENG	2494	2518	2520	2481						
65	%N1	84.5	88.7	90.4	92.2	93.9					
	MACH	.491	.542	.563	.584	.596					
	KIAS	271	274	274	273	268					
	FF/ENG	2306	2327	2330	2330	2295					
60	%N1	82.3	86.5	88.3	90.0	91.9	93.7	96.4			
	MACH	.471	.521	.543	.564	.585	.597	.614			
	KIAS	261	263	263	263	263	258	254			
	FF/ENG	2124	2137	2139	2140	2143	2114	2146			
55	%N1	80.2	84.2	85.9	87.7	89.5	91.4	93.3	96.2		
	MACH	.453	.498	.520	.541	.563	.585	.597	.614		
	KIAS	250	251	252	252	253	252	247	244		
	FF/ENG	1954	1948	1950	1950	1953	1958	1938	1971		
50	%N1	77.8	81.6	83.4	85.2	87.0	88.7	90.7	92.7	95.7	
	MACH	.434	.475	.495	.516	.538	.561	.583	.596	.613	
	KIAS	240	239	239	240	241	241	241	236	233	
	FF/ENG	1791	1764	1762	1762	1764	1767	1777	1765	1793	
45	%N1	75.5	79.1	80.6	82.3	84.1	85.9	87.7	89.7	91.8	94.8
	MACH	.415	.452	.469	.489	.511	.533	.556	.578	.593	.610
	KIAS	229	227	227	227	228	229	229	229	225	222
	FF/ENG	1636	1594	1582	1575	1577	1580	1586	1600	1593	1613
40	%N1	73.0	76.2	77.8	79.4	81.0	82.8	84.6	86.4	88.3	90.7
	MACH	.395	.429	.445	.462	.480	.502	.525	.548	.571	.589
	KIAS	218	215	215	214	214	215	216	216	216	214
	FF/ENG	1485	1434	1416	1402	1392	1394	1400	1410	1421	1424

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Diversion Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
298	272	249	230	214	200	190	180	172	164	158
600	547	501	462	429	400	379	361	344	328	315
903	823	753	694	644	600	570	542	517	494	473
1209	1100	1005	926	859	800	759	721	687	657	630
1516	1379	1259	1159	1075	1000	949	902	859	820	786
1825	1659	1513	1393	1290	1200	1139	1082	1031	984	943
2137	1940	1768	1626	1506	1400	1328	1262	1202	1147	1099
2450	2222	2024	1860	1722	1600	1518	1442	1373	1311	1256
2766	2507	2281	2095	1938	1800	1707	1622	1544	1474	1412
3083	2792	2539	2331	2155	2000	1896	1801	1715	1637	1568

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		18		22		26	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	1.4	0:43	1.2	0:41	1.1	0:39	1.0	0:38	0.9	0:37
400	2.8	1:23	2.6	1:19	2.4	1:14	2.2	1:11	2.1	1:09
600	4.3	2:04	3.9	1:57	3.6	1:50	3.4	1:45	3.2	1:42
800	5.7	2:46	5.2	2:36	4.9	2:26	4.5	2:19	4.4	2:14
1000	7.1	3:28	6.6	3:15	6.1	3:03	5.7	2:53	5.5	2:47
1200	8.5	4:10	7.9	3:55	7.3	3:40	6.8	3:28	6.6	3:21
1400	9.8	4:53	9.1	4:36	8.5	4:18	8.0	4:02	7.7	3:54
1600	11.2	5:36	10.4	5:16	9.7	4:55	9.1	4:38	8.7	4:28
1800	12.5	6:20	11.7	5:58	10.9	5:34	10.2	5:13	9.8	5:02
2000	13.9	7:05	12.9	6:39	12.0	6:13	11.3	5:49	10.8	5:36

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)								
	40	45	50	55	60	65	70	75	80
1	-0.1	-0.1	-0.1	0.0	0.0	0.1	0.1	0.2	0.3
2	-0.3	-0.2	-0.1	-0.1	0.0	0.2	0.3	0.6	0.8
3	-0.4	-0.3	-0.2	-0.1	0.0	0.3	0.5	0.9	1.2
4	-0.6	-0.4	-0.3	-0.1	0.0	0.3	0.7	1.2	1.6
5	-0.7	-0.5	-0.4	-0.2	0.0	0.4	0.9	1.4	2.0
6	-0.8	-0.6	-0.4	-0.2	0.0	0.5	1.1	1.7	2.4
7	-1.0	-0.8	-0.5	-0.3	0.0	0.6	1.2	2.0	2.8
8	-1.1	-0.9	-0.6	-0.3	0.0	0.6	1.4	2.2	3.2
9	-1.3	-1.0	-0.7	-0.3	0.0	0.7	1.5	2.4	3.5
10	-1.4	-1.1	-0.7	-0.4	0.0	0.7	1.6	2.6	3.8
11	-1.6	-1.2	-0.8	-0.4	0.0	0.8	1.7	2.8	4.1
12	-1.7	-1.3	-0.9	-0.4	0.0	0.8	1.9	3.0	4.4
13	-1.9	-1.4	-0.9	-0.5	0.0	0.9	2.0	3.2	4.7
14	-2.0	-1.5	-1.0	-0.5	0.0	0.9	2.0	3.4	4.9

Includes APU fuel burn.

ENGINE INOP

MAX CONTINUOUS THRUST

Holding

Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)							
		1500	5000	10000	15000	20000	25000	30000	35000
85	%N1	81.1	84.1	88.3	92.8				
	KIAS	250	251	252	253				
	FF/ENG	2740	2730	2750	2800				
80	%N1	79.5	82.4	86.5	91.0				
	KIAS	242	243	244	245				
	FF/ENG	2580	2570	2570	2610				
75	%N1	77.8	80.5	84.7	89.1	95.0			
	KIAS	235	236	236	238	239			
	FF/ENG	2420	2400	2400	2420	2490			
70	%N1	76.0	78.6	82.8	87.1	92.1			
	KIAS	227	227	228	229	231			
	FF/ENG	2260	2240	2230	2250	2270			
65	%N1	74.0	76.7	80.8	85.0	89.7	97.7		
	KIAS	219	219	220	221	222	224		
	FF/ENG	2100	2090	2070	2070	2080	2230		
60	%N1	71.7	74.6	78.5	82.8	87.4	93.7		
	KIAS	210	210	211	212	213	214		
	FF/ENG	1950	1930	1910	1910	1910	1970		
55	%N1	69.4	72.3	76.3	80.5	84.9	90.0		
	KIAS	200	201	202	203	204	205		
	FF/ENG	1800	1770	1750	1740	1730	1760		
50	%N1	66.9	69.7	73.8	77.8	82.3	87.0	94.9	
	KIAS	192	192	192	193	194	195	196	
	FF/ENG	1650	1620	1600	1580	1570	1570	1680	
45	%N1	64.2	66.9	70.9	75.0	79.4	84.0	89.6	
	KIAS	185	185	185	185	185	185	186	
	FF/ENG	1500	1470	1440	1420	1400	1400	1450	
40	%N1	61.1	64.0	67.8	72.0	76.2	80.7	85.4	94.0
	KIAS	178	178	178	178	178	178	178	178
	FF/ENG	1350	1330	1300	1270	1250	1240	1260	1360

This table includes 5% additional fuel for holding in a racetrack pattern.

ENGINE INOP

ADVISORY INFORMATION

Gear Down Landing Rate of Climb Available

Flaps 15

TAT (°C)	RATE OF CLIMB (FT/MIN)					
	PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
52	-220	-290				
50	-200	-270	-370			
48	-170	-240	-350			
46	-140	-210	-320	-430		
44	-120	-190	-300	-410		
42	-90	-160	-270	-380	-490	
40	-60	-130	-250	-360	-470	
38	-30	-110	-220	-330	-450	-560
36	-20	-80	-190	-310	-420	-540
34	-10	-50	-160	-280	-400	-520
32	-10	-30	-140	-260	-370	-490
30	-10	-30	-110	-230	-350	-470
20	0	-30	-100	-170	-240	-340
10	0	-20	-90	-170	-240	-320
0	10	-20	-90	-160	-240	-320
-20	10	-10	-90	-160	-250	-330
-40	10	-10	-90	-170	-250	-340

Rate of climb capability shown is valid for 60000 kg, gear down at VREF15+5.
Decrease rate of climb 130 ft/min per 5000 kg greater than 60000 kg.
Increase rate of climb 180 ft/min per 5000 kg less than 60000 kg.

Flaps 30

TAT (°C)	RATE OF CLIMB (FT/MIN)					
	PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
52	-400	-470				
50	-370	-440	-550			
48	-350	-420	-530			
46	-320	-400	-500	-610		
44	-300	-370	-480	-590		
42	-270	-340	-460	-570	-680	
40	-250	-320	-430	-540	-660	
38	-220	-290	-410	-520	-640	-750
36	-200	-270	-380	-500	-610	-730
34	-200	-240	-360	-470	-590	-710
32	-200	-220	-330	-450	-570	-690
30	-200	-220	-300	-420	-540	-660
20	-200	-220	-290	-360	-440	-540
10	-190	-220	-290	-370	-440	-530
0	-190	-220	-290	-370	-450	-530
-20	-200	-220	-300	-380	-460	-550
-40	-200	-230	-310	-390	-480	-570

Rate of climb capability shown is valid for 60000 kg, gear down at VREF30+5.
Decrease rate of climb 130 ft/min per 5000 kg greater than 60000 kg.
Increase rate of climb 180 ft/min per 5000 kg less than 60000 kg.

GEAR DOWN

Long Range Cruise Altitude Capability

Max Cruise Thrust, 100 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
85	15500	12500	9300
80	18400	15500	12600
75	21100	18500	15700
70	23700	21500	18600
65	26100	24400	21800
60	28600	27100	25300
55	30800	29600	28100
50	32900	31900	30700
45	35100	34100	33000
40	37500	36500	35400

GEAR DOWN

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)								
		10	21	23	25	27	29	31	33	35
85	%N1	85.9								
	MACH	.482								
	KIAS	267								
	FF/ENG	2421								
80	%N1	84.2								
	MACH	.468								
	KIAS	259								
	FF/ENG	2271								
75	%N1	82.5	91.7							
	MACH	.454	.554							
	KIAS	251	248							
	FF/ENG	2123	2101							
70	%N1	80.6	89.8	91.7						
	MACH	.440	.541	.557						
	KIAS	243	242	240						
	FF/ENG	1977	1960	1950						
65	%N1	78.6	87.9	89.5	91.6	94.5				
	MACH	.425	.524	.543	.560	.578				
	KIAS	235	234	233	231	229				
	FF/ENG	1835	1812	1806	1805	1836				
60	%N1	76.5	85.6	87.4	89.1	91.3	94.5			
	MACH	.409	.504	.525	.544	.562	.580			
	KIAS	226	225	225	224	222	220			
	FF/ENG	1696	1661	1661	1658	1664	1696			
55	%N1	74.4	83.3	85.0	86.8	88.5	90.9	94.1		
	MACH	.393	.484	.504	.525	.545	.562	.581		
	KIAS	217	216	216	216	215	213	211		
	FF/ENG	1559	1515	1512	1515	1517	1523	1555		
50	%N1	71.9	80.7	82.5	84.2	86.0	87.8	90.2	93.5	
	MACH	.376	.463	.482	.502	.523	.544	.561	.580	
	KIAS	207	206	206	206	206	205	203	201	
	FF/ENG	1424	1371	1367	1368	1374	1377	1381	1411	
45	%N1	69.1	78.0	79.7	81.4	83.1	85.0	86.8	89.1	92.5
	MACH	.358	.441	.458	.477	.498	.520	.541	.559	.578
	KIAS	197	196	196	196	196	196	195	193	191
	FF/ENG	1294	1231	1224	1224	1230	1235	1237	1239	1265
40	%N1	66.2	74.9	76.6	78.3	80.0	81.8	83.6	85.5	87.7
	MACH	.340	.417	.434	.452	.471	.491	.513	.535	.554
	KIAS	187	185	185	185	185	185	185	185	183
	FF/ENG	1170	1098	1085	1083	1089	1092	1094	1096	1097

GEAR DOWN

Long Range Cruise Enroute Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
324	290	260	236	217	200	188	178	168	160	153
654	583	523	474	435	400	377	357	338	321	307
989	880	787	713	653	600	566	535	507	483	461
1329	1181	1054	953	871	800	754	713	676	643	614
1674	1484	1322	1194	1090	1000	943	891	844	803	766
2024	1791	1593	1436	1310	1200	1131	1069	1013	962	918
2381	2103	1865	1680	1530	1400	1320	1247	1181	1122	1070
2743	2417	2140	1924	1751	1600	1508	1424	1348	1280	1221
3113	2737	2418	2171	1972	1800	1695	1600	1514	1438	1371

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		20		24		28	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	2.4	0:49	2.2	0:47	1.9	0:44	1.7	0:42	1.6	0:41
400	4.9	1:36	4.5	1:31	4.0	1:25	3.7	1:20	3.5	1:17
600	7.4	2:25	6.8	2:17	6.1	2:06	5.7	1:59	5.4	1:54
800	9.8	3:14	9.1	3:03	8.1	2:48	7.6	2:38	7.2	2:31
1000	12.1	4:04	11.3	3:50	10.1	3:30	9.5	3:18	9.0	3:08
1200	14.4	4:56	13.5	4:39	12.1	4:14	11.3	3:58	10.7	3:46
1400	16.7	5:49	15.6	5:28	14.0	4:58	13.1	4:40	12.4	4:24
1600	18.9	6:43	17.7	6:18	15.9	5:44	14.9	5:22	14.1	5:03
1800	21.1	7:38	19.7	7:10	17.7	6:30	16.6	6:05	15.7	5:43

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	40	50	60	70	80
2	-0.3	-0.2	0.0	0.3	0.7
4	-0.7	-0.3	0.0	0.6	1.3
6	-1.0	-0.5	0.0	0.9	2.0
8	-1.3	-0.7	0.0	1.2	2.6
10	-1.7	-0.8	0.0	1.4	3.2
12	-2.0	-1.0	0.0	1.6	3.7
14	-2.4	-1.2	0.0	1.8	4.2
16	-2.7	-1.3	0.0	2.0	4.6
18	-3.0	-1.5	0.0	2.2	5.0
20	-3.4	-1.7	0.0	2.4	5.3
22	-3.7	-1.8	0.0	2.5	5.6

GEAR DOWN

Descent

VREF40 + 70 KIAS

PRESSURE ALTITUDE (FT)	TIME (MIN)	FUEL (KG)	DISTANCE (NM)
41000	21	280	91
39000	20	270	86
37000	19	270	81
35000	19	260	77
33000	18	260	72
31000	17	250	68
29000	17	250	64
27000	16	240	60
25000	15	230	56
23000	14	230	52
21000	13	220	48
19000	13	210	44
17000	12	200	40
15000	11	190	36
10000	8	170	26
5000	6	140	16
1500	4	110	9

Allowances for a straight-in approach are included.

GEAR DOWN

Holding

Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)							
		1500	5000	10000	15000	20000	25000	30000	35000
85	%N1	75.8	78.5	82.7	87.0	92.0			
	KIAS	230	230	230	230	230			
	FF/ENG	2240	2230	2220	2240	2260			
80	%N1	74.2	77.0	81.1	85.4	90.0			
	KIAS	225	225	225	225	225			
	FF/ENG	2120	2110	2100	2100	2110			
75	%N1	72.5	75.4	79.4	83.7	88.3	94.8		
	KIAS	220	220	220	220	220	220		
	FF/ENG	2000	1990	1970	1970	1970	2050		
70	%N1	70.8	73.7	77.6	81.9	86.4	91.8		
	KIAS	216	216	216	216	216	216		
	FF/ENG	1890	1870	1850	1840	1840	1870		
65	%N1	69.0	71.9	75.9	80.1	84.5	89.3		
	KIAS	211	211	211	211	211	211		
	FF/ENG	1770	1750	1730	1720	1710	1730		
60	%N1	67.1	69.8	74.0	78.0	82.5	87.1	94.3	
	KIAS	204	204	204	204	204	204	204	
	FF/ENG	1660	1630	1610	1600	1580	1590	1670	
55	%N1	65.1	67.8	71.9	75.9	80.3	84.8	90.4	
	KIAS	198	198	198	198	198	198	198	
	FF/ENG	1540	1520	1490	1480	1460	1460	1500	
50	%N1	62.8	65.6	69.6	73.7	78.0	82.4	87.1	
	KIAS	192	192	192	192	192	192	192	
	FF/ENG	1430	1400	1380	1360	1330	1330	1350	
45	%N1	60.3	63.3	67.1	71.4	75.5	79.9	84.5	91.5
	KIAS	185	185	185	185	185	185	185	185
	FF/ENG	1310	1290	1270	1250	1220	1210	1220	1270
40	%N1	57.9	60.6	64.6	68.7	72.9	77.3	81.7	86.8
	KIAS	178	178	178	178	178	178	178	178
	FF/ENG	1200	1180	1160	1130	1110	1090	1100	1110

This table includes 5% additional fuel for holding in a racetrack pattern.

Intentionally
Blank

GEAR DOWN
ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

WEIGHT (1000 KG)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFTDOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
75	70	218	1500		
70	66	213	4700	2200	
65	61	208	8000	5900	3400
60	57	202	11100	9300	7100
55	52	196	14000	12900	10900
50	47	190	16900	16000	14800
45	43	183	19800	18700	17600
40	38	176	22800	21700	20600

Includes APU fuel burn.

Long Range Cruise Altitude Capability

100 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
65	1600		
60	6300	3200	
55	10600	8200	5300
50	14400	13000	10400
45	18000	16900	15700
40	21700	20500	19300

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)									
		5	7	9	11	13	15	17	19	21	23
60	%N1	90.2	91.9								
	MACH	.364	.375								
	KIAS	220	219								
	FF/ENG	3192	3191								
55	%N1	87.8	89.3	91.0	92.8						
	MACH	.351	.362	.374	.387						
	KIAS	212	211	210	209						
	FF/ENG	2924	2909	2906	2913						
50	%N1	85.3	86.7	88.2	89.9	91.7	94.2				
	MACH	.338	.348	.359	.371	.384	.398				
	KIAS	204	203	202	201	200	199				
	FF/ENG	2672	2647	2630	2626	2633	2657				
45	%N1	82.7	84.0	85.4	86.9	88.6	90.4	92.7	96.6		
	MACH	.325	.334	.344	.355	.367	.380	.393	.408		
	KIAS	196	195	193	192	191	190	189	189		
	FF/ENG	2432	2400	2374	2356	2351	2352	2359	2417		
40	%N1	79.8	81.1	82.5	83.9	85.4	87.0	88.8	90.8	94.1	98.4
	MACH	.311	.320	.329	.339	.349	.361	.374	.387	.402	.418
	KIAS	188	186	184	183	182	181	180	179	179	178
	FF/ENG	2206	2166	2133	2107	2088	2076	2069	2065	2101	2201

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Diversion Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
172	151	134	120	109	100	93	88	83	78	75
352	308	270	242	219	200	187	175	165	156	148
533	465	408	364	330	300	280	262	246	232	220
716	623	545	486	440	400	373	349	328	309	293
900	783	684	609	551	500	466	436	409	385	365
1086	943	823	733	661	600	559	523	490	462	438
1273	1105	964	856	772	700	652	610	572	538	510
1462	1267	1103	980	883	800	745	696	652	614	581
1653	1431	1245	1104	994	900	838	782	733	690	653
1845	1595	1386	1228	1105	1000	931	868	813	765	724

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)					
	6		10		14	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
100	1.3	0:27	1.1	0:26	1.0	0:26
200	2.6	0:53	2.4	0:50	2.3	0:48
300	3.9	1:18	3.7	1:15	3.6	1:11
400	5.2	1:44	4.9	1:39	4.8	1:35
500	6.5	2:10	6.1	2:04	6.0	1:58
600	7.8	2:37	7.3	2:29	7.1	2:22
700	9.1	3:03	8.5	2:55	8.3	2:46
800	10.3	3:30	9.7	3:20	9.4	3:10
900	11.6	3:58	10.9	3:46	10.5	3:35
1000	12.8	4:25	12.0	4:12	11.6	3:59

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	40	50	60	70	80
1	-0.2	-0.1	0.0	0.1	0.3
2	-0.3	-0.2	0.0	0.3	0.6
3	-0.5	-0.3	0.0	0.5	1.0
4	-0.6	-0.3	0.0	0.7	1.3
5	-0.8	-0.4	0.0	0.9	1.7
6	-1.0	-0.5	0.0	1.0	2.0
7	-1.1	-0.6	0.0	1.2	2.4
8	-1.3	-0.7	0.0	1.4	2.7
9	-1.5	-0.7	0.0	1.6	3.1
10	-1.6	-0.8	0.0	1.8	3.5
11	-1.8	-0.9	0.0	1.9	3.8
12	-1.9	-1.0	0.0	2.1	4.2
13	-2.1	-1.1	0.0	2.3	4.5
14	-2.3	-1.1	0.0	2.5	4.9

Includes APU fuel burn.

GEAR DOWN
ENGINE INOP

MAX CONTINUOUS THRUST

Holding

Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)			
		1500	5000	10000	15000
70	%N1	89.4			
	KIAS	216			
	FF/ENG	3610			
65	%N1	87.4	90.5		
	KIAS	211	211		
	FF/ENG	3360	3380		
60	%N1	85.2	88.2	92.9	
	KIAS	204	204	204	
	FF/ENG	3110	3110	3150	
55	%N1	82.9	85.9	90.4	
	KIAS	198	198	198	
	FF/ENG	2860	2860	2880	
50	%N1	80.4	83.4	87.7	92.8
	KIAS	192	192	192	192
	FF/ENG	2630	2620	2620	2670
45	%N1	77.8	80.7	85.0	89.6
	KIAS	185	185	185	185
	FF/ENG	2400	2380	2380	2400
40	%N1	75.1	77.8	82.1	86.5
	KIAS	178	178	178	178
	FF/ENG	2180	2160	2140	2140

This table includes 5% additional fuel for holding in a racetrack pattern.

Introduction

This chapter contains information to supplement performance data from the Flight Management Computer (FMC). In addition, sufficient inflight data is provided to complete a flight with the FMC inoperative. In the event of conflict between data presented in this chapter and that contained in the approved Airplane Flight Manual, the Flight Manual shall always take precedence.

General

Takeoff Speeds

The speeds presented in the Takeoff Speeds table as well as FMC computed takeoff speeds can be used for all performance conditions except where adjustments must be made to V1 for clearway, stopway, anti-skid inoperative, thrust reversers inoperative, improved climb, contaminated runway situations or brake energy limits. 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 will not help this condition as the minimum control speeds are determined at the actual temperature and therefore are not reduced.

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

V1(MCG)

Regulations prohibit scheduling takeoff with a V1 less than minimum V1 for control on the ground, V1(MCG). It is therefore necessary to compare the adjusted V1 to V1(MCG). The V1(MCG) presented in this manual is conservative for all weight and bleed configurations.

To find V1(MCG) enter the V1(MCG) table with the airport pressure altitude and actual OAT. If the adjusted V1 is less than V1(MCG), set V1 equal to V1(MCG). If the adjusted VR is less than V1(MCG), set VR equal to V1(MCG), and determine a new V2 by adding the difference between the normal VR and V1(MCG) to the normal V2. No takeoff weight adjustment is necessary provided that the actual field length exceeds the minimum field length shown in the Field and Climb Limit Weight table in chapter Performance Dispatch.

Clearway and Stopway V1 Adjustments

Maximum allowable clearway limits are provided for guidance when more precise data is not available. Use of clearway is not allowed on wet runways.

Takeoff speed adjustments are to be applied to V1 speed when using takeoff weights based on the use of clearway and stopway.

Adjust V1 speed by the amount shown in the table. The adjusted V1 speed must not exceed VR. If the adjusted V1 speed is greater than VR, reduce V1 to equal VR.

Stab Trim

To find takeoff stabilizer trim setting, enter Stab Trim Setting table with anticipated brake release weight and center of gravity (C.G. % MAC) and read required stabilizer trim units.

VREF

This table contains flaps 40, 30 and 15 reference speeds for a given weight.

With autothrottles disengaged an approach speed wind correction (max 20 knots) of 1/2 steady headwind component + gust increment above steady wind is recommended. Do not apply a wind correction for tailwinds. The maximum command speed should not exceed landing flap placard speed minus 5 knots.

Flap Maneuver Speeds

This table provides flap maneuver speeds for various flap settings. During flap retraction, selection of the next flap position is initiated when reaching the maneuver speed for the existing flap position. During flap retraction, at least adequate maneuver capability or 30° of bank (15° of bank and 15° overshoot) to stick shaker is provided at the flap retraction speed. Full maneuver capability or at least 40° of bank (25° of bank and 15° overshoot) is provided when the airplane has accelerated to the recommended maneuver speed for the selected flap position.

During flap extension, selection of the flaps to the next flap position should be made when approaching, and before decelerating below, the maneuver speed for the existing flap position. The flap extension speed schedule varies with airplane weight and provides full maneuver capability or at least 40° of bank (25° of bank and 15° overshoot) to stick shaker at all weights.

Slush/Standing Water Takeoff

Experience has shown that aircraft performance may deteriorate significantly on runways covered with snow, slush, standing water or ice. Therefore, reductions in field/obstacle limited takeoff weight and revised takeoff speeds are necessary. The tables are intended for guidance in accordance with advisory material and assume an engine failure at the critical point during the takeoff.

The entire runway is assumed to be completely covered by a contaminant of uniform thickness and density. Therefore this information is conservative when operating under typical cold weather conditions where patches of slush exist and some degree of sanding is common. Takeoffs in slush depths greater than 13 mm (0.5 inches) are not recommended because of possible airplane damage as a result of slush impingement on the airplane structure. The use of assumed temperature for reduced thrust is not allowed on contaminated runways. Interpolation for slush/standing water depths between the values shown is permitted.

Takeoff weight determination:

1. Enter the Weight Adjustment table with the dry field/obstacle limit weight to obtain the weight reduction for the slush/standing water depth and airport pressure altitude.
2. Adjust field length available for temperature by amount shown beneath V1(MCG) limit weight table.
3. Enter the V1(MCG) Limit Weight table with the adjusted field length and pressure altitude to obtain the slush/standing water limit weight with respect to minimum field length required for V1(MCG) speed.

4. The maximum allowable takeoff weight in slush/standing water is the lesser of the limit weights found in steps 1 and 3.

Takeoff speed determination:

1. Determine takeoff speeds V1, VR and V2 for actual brake release weight using the Dry Runway Takeoff Speeds table for the appropriate flap setting and thrust rating.
2. If V1(MCG) limited, set V1=V1(MCG). If not limited by V1(MCG) considerations, enter the V1 Adjustment table with actual brake release weight to determine the V1 reduction to apply to V1 speed. If the adjusted V1 is less than V1(MCG), set V1=V1(MCG).

Slippery Runway Takeoff

Airplane braking action is reported as good, medium or poor, depending on existing runway conditions. If braking action is reported as good, conditions should not be expected to be as good as on clean, dry runways. The value "good" is comparative and is intended to mean that airplanes should not experience braking or directional control difficulties when stopping. The performance level used to calculate the "good" data is consistent with wet runway testing done on early Boeing jets. The performance level used to calculate the "poor" data reflects a runway covered with wet ice. Performance is based on a 15 ft screen height at the end of the runway. The tables provided are used in the same manner as the Slush/Standing Water tables.

Anti-Skid Inoperative

When operating with anti-skid inoperative, the field limit weight and V1 must be reduced to account for the effect on accelerate-stop performance. Anti-skid inoperative is only allowed on a dry runway. A simplified method which conservatively accounts for the effects of anti-skid inoperative is to reduce the normal dry field/obstacle limited weight by 7850 kg and the V1 associated with the reduced weight by the amount shown in the table below.

ANTI-SKID INOPERATIVE V1 ADJUSTMENTS

FIELD LENGTH (M)	V1 ADJUSTMENT (KIAS)
2000	-18
2500	-15
3000	-13
3500	-12
4000	-10

If the resulting V1 is less than V1(MCG), takeoff is permitted with V1 set equal to V1(MCG) provided the dry accelerate-stop distance adjusted for wind and slope exceeds approximately 5700 ft.

If the resulting V1 is less than V1(MCG), takeoff is permitted with V1 set equal to V1(MCG) provided the dry accelerate-stop distance adjusted for wind and slope exceeds approximately 1750 m.

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

Thrust Reverser Inoperative

When dispatching on a wet runway with both thrust reversers operative, an operative anti-skid system, and all brakes operating, regulations allow deceleration credit for one thrust reverser in the engine failure case and two thrust reversers in the all engine stop case.

When dispatching on a wet runway with one thrust reverser inoperative, the field/obstacle limited weight and V1 must be reduced to account for the effect on accelerate-stop performance. A simplified method, which conservatively accounts for this, is to reduce the normal wet runway/field/obstacle limited weight by 1050 kg and the V1 associated with the reduced weight by 2 knots.

If the resulting V1 is less than minimum V1, takeoff is permitted with V1 set equal to V1(MCG) provided the accelerate-stop distance available adjusted for wind and slope exceeds approximately 1200 m.

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

Takeoff %N1

To find Max Takeoff %N1 based on normal engine bleed for air conditioning packs on, enter Takeoff %N1 Table with airport pressure altitude and airport OAT and read %N1. Apply %N1 adjustments as provided when applicable.

Assumed Temperature Reduced Thrust

Regulations permit the use of up to 25% takeoff thrust reduction for operation with assumed temperature reduced thrust. Use of assumed temperature reduced thrust is not allowed with anti-skid inoperative or on runways contaminated with standing water, ice, slush, or snow. Use of assumed temperature reduced thrust is not recommended if potential windshear conditions exist.

To find the maximum allowable assumed temperature enter the Maximum Assumed Temperature table with airport pressure altitude and OAT. Compare this temperature to that at which the airplane is performance limited as determined from available takeoff performance data. Next, enter the Maximum Takeoff %N1 table with airport pressure altitude and the lower of the two temperatures previously determined, to obtain a maximum takeoff %N1. Do not use an assumed temperature less than the minimum assumed temperature shown. Enter the %N1 Adjustment table with OAT and the difference between the assumed and actual OAT to obtain a %N1 adjustment. Subtract the %N1 adjustment from the maximum takeoff %N1 found previously to determine the assumed temperature reduced thrust %N1.

Apply %N1 adjustments as provided when applicable.

Max Climb %N1

This table shows Max Climb %N1 for a 280/.78 climb speed schedule, normal engine bleed for packs on or off and anti-ice off. Enter the table with airport pressure altitude and TAT and read %N1. %N1 adjustments are shown for anti-ice operation.

Go-around %N1

To find Max Go-around %N1 based on normal engine bleed for packs on (AUTO) and anti-ice on or off, enter the Go-around %N1 table with airport pressure altitude and reported OAT or TAT and read %N1. For packs OFF or HIGH operation, apply the %N1 adjustment shown below the table.

Flight with Unreliable Airspeed / Turbulent Air Penetration

Pitch attitude and average %N1 information is provided for use in all phases of flight in the event of unreliable airspeed/Mach indications resulting from blocking or freezing of the pitot system. Loss of radome or turbulent air may also cause unreliable airspeed/Mach indications. The cruise table in this section may also be used for turbulent air penetration.

Pitch attitude is shown in bold type for emphasis since altitude and/or vertical speed indications may also be unreliable.

All Engines

Long Range Cruise Maximum Operating Altitude

These tables provide the maximum operating altitude in the same manner as the FMC. Maximum altitudes are shown for a given cruise weight and maneuver capability. This table considers both thrust and buffet limits, providing the more limiting of the two. Any data that is thrust limited is denoted by an asterisk and represents only a thrust limited condition in level flight with 100 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 15° may cause the airplane to lose speed and/or altitude. The altitudes shown in the table are limited to the maximum certified altitude of 41000 ft.

Long Range Cruise Control

These tables provide target %N1, Long Range Cruise Mach number, IAS and standard day fuel flow per engine for the airplane weight and pressure altitude. As indicated by the shaded area, at optimum altitude .79M approximates the Long Range Cruise Mach schedule.

Long Range Cruise Enroute Fuel and Time

Long Range Cruise Enroute Fuel and Time tables are provided to determine remaining time and fuel required to destination. The data is based on Long Range Cruise and .78/280/250 descent. Tables are presented for low altitudes and high altitudes.

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

APU Operation During Flight

For APU operation during flight, increase fuel flow according to the table in the Engine Inoperative text section.

Long Range Cruise Wind-Altitude Trade

Wind is a factor which may justify operations considerably below optimum altitude. For example, a favorable wind component may have an effect on ground speed which more than compensates for the loss in air range.

Using this table, it is possible to determine the break-even wind (advantage necessary or disadvantage that can be tolerated) to maintain the same range at another altitude and long range cruise speed. The tables make no allowance for climb or descent time, fuel or distance, and are based on comparing ground fuel mileage.

Descent

Time, fuel, and distance for descent are shown for a .78/280/250 descent speed schedule. Enter the table with top of descent pressure altitude and read distance, time and fuel. Data is based on flight idle thrust descent in zero wind. Allowances are included for a straight-in approach with gear down and landing flaps at the outer marker.

Holding

Target %N1, indicated airspeed and fuel flow per engine information is tabulated for holding with flaps up based on the FMC optimum holding speed schedule. This is the higher of the maximum endurance speed and the maneuvering speed. Small variations in airspeed will not appreciably affect the overall endurance time. Enter the table with weight and pressure altitude to read %N1, IAS and fuel flow per engine.

Advisory Information

Normal Configuration Landing Distance

The normal configuration distance tables are provided as advisory information to help determine the actual landing distance performance of the airplane for different runway surface conditions and brake configurations.

Flaps 15, 30, and 40 landing distances and adjustments are provided for dry runways as well as runways with good, medium, and poor reported braking action, which are commonly referred to as slippery runway conditions.

If the surface is affected by water, snow or ice, and the braking action is reported as "good", conditions should not be expected to be as good as on clean, dry runways. The value "good" is comparative and is intended to mean that airplanes should not experience braking or directional control difficulties when landing. The performance level used to calculate the "good" data is consistent with wet runway testing done on early Boeing jets. The performance level used to calculate "poor" data reflects runways covered with wet ice.

Dry runway landing performance is shown for max manual braking configuration and autobrake settings max, 3, 2, and 1. The autobrake performance may be used to assist in the selection of the most desirable autobrake setting for a given field length. Selection of an autobrake setting results in a constant rate of deceleration. Maximum effort manual braking should achieve shorter landing distance than the max autobrake setting. The reference landing distance is a reference distance from 50 ft above the threshold to stop based on a reference landing weight and normal approach speed for the selected landing flap at sea level, zero wind, zero slope, and two engine detent reverse thrust. Subsequent columns provide adjustments for off-reference landing weight, altitude, wind, slope, temperature, speed, and reverse thrust. Each adjustment is independently added to the reference landing distance.

Non-normal Configuration Landing Distance

Advisory information is provided to support non-normal configurations that affect the landing performance of the airplane. Landing distances and adjustments are provided for dry runways and runways with good, medium, and poor reported braking action.

Enter the table with the applicable non-normal configuration and read the normal approach speed. The reference landing distance is a reference distance from 50 ft above the threshold to stop based on a reference landing weight and speed at sea level, zero wind, and zero slope. Subsequent columns provide adjustments for off-reference landing weight, altitude, wind, slope, and speed conditions. Each adjustment is independently added to the reference landing distance. Landing distance includes the effect of reverse thrust.

Recommended Brake Cooling Schedule

Advisory information is provided to assist in avoiding the problems associated with hot brakes. For normal operation, most landings are at weights below the AFM quick turnaround limit weight.

Use of the recommended cooling schedule will help avoid brake overheat and fuse plug problems that could result from repeated landings at short time intervals or a rejected takeoff.

Enter the Recommended Brake Cooling Schedule table with the airplane weight and brakes on speed, adjusted for wind at the appropriate temperature and altitude condition. Instructions for applying wind adjustments are included below the table. Linear interpolation may be used to obtain intermediate values. The resulting number is the reference brake energy per brake in millions of foot-pounds, and represents the amount of energy absorbed by each brake during a rejected takeoff. Notes providing adjustments for wind are included below the table.

To determine the energy per brake absorbed during landing, enter the appropriate Adjusted Brake Energy Per Brake table (No Reverse Thrust or 2 Engine Reverse) with the reference brake energy per brake and the type of braking used during landing (Max Manual, Max Auto, or Autobrake). The resulting number is the adjusted brake energy per brake and represents the energy absorbed in each brake during the landing.

The recommended cooling time is found in the appropriate (steel or carbon brakes) final table by entering with the adjusted brake energy per brake. Times are provided for ground cooling and inflight gear down cooling.

Brake Temperature Monitor System (BTMS) indications are also shown. If brake cooling is determined from the BTMS, use the hottest brake indication 10 to 15 minutes after the airplane has come to a complete stop, or inflight with gear retracted to determine recommended cooling schedule.

Engine Inoperative

Initial Max Continuous %N1

The Initial Max Continuous %N1 setting for use following an engine failure is shown. The table is based on the typical all engine cruise speed of .79M to provide a target %N1 setting at the start of driftdown. Once driftdown is established, the Max Continuous %N1 table should be used to determine %N1 for the given conditions.

Max Continuous %N1

Power setting is based on one engine operating with one A/C pack operating and all anti-ice bleeds off. Enter the table with pressure altitude, TAT, and IAS or Mach to read %N1.

It is desirable to maintain engine thrust level within the limits of the Max Cruise thrust rating. However, where thrust level in excess of Max Cruise rating is required, such as for meeting terrain clearance, ATC altitude assignments, or to attain maximum range capability, it is permissible to use the thrust needed up to the Max Continuous thrust rating. The Max Continuous thrust rating is intended primarily for emergency use at the discretion of the pilot and is the maximum thrust that may be used continuously.

Driftdown Speed/Level Off Altitude

The table shows optimum driftdown speed as a function of cruise weight at start of driftdown. Also shown are the approximate weight and pressure altitude at which the airplane will level off considering 100 ft/min residual rate of climb.

The level off altitude is dependent on air temperature (ISA deviation).

Driftdown/LRC Range Capability

This table shows the range capability from the start of driftdown. Driftdown is continued to level off altitude. As weight decreases due to fuel burn, the airplane is accelerated to Long Range Cruise speed. Cruise is continued at level off altitude and Long Range Cruise speed.

To determine fuel required, enter the Ground to Air Miles Conversion table with the desired ground distance and adjust for anticipated winds to obtain air distance to destination. Then enter the Driftdown/Cruise Fuel and Time table with air distance and weight at start of driftdown to determine fuel and time required. If altitudes other than the level off altitude is used, fuel and time required may be obtained by using the Engine Inoperative Long Range Cruise Enroute Fuel and Time table.

Long Range Cruise Altitude Capability

The table shows the maximum altitude that can be maintained at a given weight and air temperature (ISA deviation), based on Long Range Cruise speed, Max Continuous thrust, and 100 ft/min residual rate of climb.

Long Range Cruise Control

The table provides target %N1, engine inoperative Long Range Cruise Mach number, IAS and fuel flow for the airplane weight and pressure altitude. The fuel flow values in this table reflect single engine fuel burn.

APU Operation During Flight

For APU operation during flight, increase fuel flow according to the following table. These increments include the APU fuel flow and the effect of increased drag from the APU door.

PRESSURE ALTITUDE (1000 FT)	APU FUEL FLOW (KG/HR)
39	45
35	45
31	50
25	60
20	65
15	75
10	85
5	95

Long Range Cruise Diversion Fuel and Time

Tables are provided for crews to determine the fuel and time required to proceed to an alternate airfield with one engine inoperative. The data is based on single engine Long Range Cruise speed and .78/280/250 descent. Enter with Air Distance as determined from the Ground to Air Miles Conversion table and read Fuel and Time required at the cruise pressure altitude. Adjust the fuel obtained for deviation from the reference weight at checkpoint as required by entering the off reference fuel adjustments table with the fuel required for the reference weight and the actual weight at checkpoint. Read fuel required and time for the actual weight.

Holding

Single engine holding data is provided in the same format as the all engine holding data and is based on the same assumptions.

Gear Down Landing Rate of Climb Available

Rate of climb data is provided as guidance information in the event an engine inoperative landing (manual or autoland) is planned. The tables show gear down rate of climb available for Flaps 15 and Flaps 30. Enter the table with TAT and pressure altitude to read rate of climb available. Apply adjustments shown to correct for weight.

Alternate Mode EEC

Introduction

No takeoff speed adjustments or other performance adjustments are required of Electronic Engine Control (EEC) in the alternate mode (ALTN EEC switch illuminated) for the 7B18, -7B20, -7B22, -7B24 and -7B24A engine thrust ratings.

Operation with derate and/or assumed temperature reduced thrust is not permitted with the EEC in alternate mode.

Gear Down

This section contains performance for airplane operation with the landing gear extended. The data is based on engine bleeds for normal air conditioning.

Note: The Flight Management Computer System (FMCS) does not contain special provisions for operation with landing gear extended. As a result, the FMCS may generate inappropriate enroute speed schedules, display non-conservative predictions of fuel burn, estimated time of arrival (ETA), maximum altitude, and compute overly shallow descent path. An accurate estimated time of arrival (ETA) is available if current speed or Mach is entered into the VNAV cruise page.

Tables for gear down performance in this section are identical in format and used in the same manner as tables for the gear up configuration previously described.

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Performance Inflight — Chapter PI

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737-800W CFM56-7B26 KG M FAA CATC/N

Performance Inflight Chapter PI

Pkg Model Identification Section 50

General

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

Serial and tabulation number are supplied by Boeing.

Registry Number	Serial Number	Tabulation Number
B-5552	37425	YF048
B-5551	36697	YF049
B-5151	34255	YK622
B-5152	34256	YK623
B-5308	32687	YK624
B-5309	32689	YK625
B-5382	36540	YK626
B-5383	35631	YK627
B-5386	35634	YK628

Registry Number	Serial Number	Tabulation Number
B-5385	35633	YK629
B-5388	35635	YK630
B-5318	30723	YK967
B-5319	35102	YL076
B-5355	35104	YL077
B-5389	35636	YL541
B-5432	35641	YL542
B-5433	35642	YL543
B-5435	35644	YL544
B-5563	38012	YL545
B-5565	38015	YL546
B-5595	38017	YL547
B-5603	38020	YL548
B-5605	38022	YL549
B-5602	36824	YL550
B-5601	36823	YL551
B-5791	39930	YS177
B-5845	39931	YS178
B-5792	41790	YS191
B-5846	41791	YS192
B-5688	41792	YS193
B-5847	41793	YS194
B-7195	43885	YT519
B-7196	43886	YT520
B-7560	43887	YT521

Performance Inflight — Chapter PI

General — Section 50

Takeoff Speeds - Dry Runway

V1, VR, V2 for Max Takeoff Thrust

WEIGHT (1000 KG)	FLAPS 1			FLAPS 5			FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
90	169	171	175	161	163	168									
85	163	166	171	157	159	164	156	157	162						
80	158	160	167	152	154	160	151	152	158	148	149	155	145	146	153
75	153	155	162	147	148	156	146	147	154	142	144	151	140	141	149
70	147	149	158	141	143	152	140	141	150	137	138	147	135	136	145
65	141	143	153	135	137	147	134	136	146	131	133	143	129	130	140
60	135	136	148	129	131	143	128	129	141	125	126	138	123	124	136
55	128	129	143	123	124	137	122	123	136	119	120	133	117	118	131
50	121	122	137	116	117	132	115	116	130	112	113	128	110	111	126
45	113	114	131	109	110	126	108	108	125	105	106	122	103	104	120
40	105	106	125	101	102	120	100	101	119	98	99	117	96	97	115

Check V1(MCG).

V1, VR, V2 Adjustments*

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

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
90	-4	-2	0	1	1	-2	-2	-1	0	0	0	0	1
80	-3	-2	0	1	1	-2	-1	-1	0	0	0	1	1
70	-2	-1	0	1	1	-2	-1	-1	0	0	1	1	1
60	-2	-1	0	1	1	-2	-1	-1	0	0	1	1	1
50	-1	0	0	0	1	-2	-1	0	0	0	1	1	1
40	0	0	0	0	0	-2	-1	0	0	0	0	0	0

***V1 not to exceed VR.**

V1(MCG)

Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	95	93					
60	140	95	93	92	90			
50	122	97	95	92	90	88	86	83
40	104	101	99	96	93	89	86	83
30	86	104	103	100	96	92	88	85
20	68	104	104	101	98	94	90	87
-60	-76	106	105	102	99	95	92	89

Takeoff Speeds - Wet Runway

V1, VR, V2 for Max Takeoff Thrust

WEIGHT (1000 KG)	FLAPS 1			FLAPS 5			FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
90	164	171	175	156	164	168									
85	157	166	171	150	159	164	151	157	162						
80	151	160	167	145	154	160	145	152	158	141	149	155	140	146	153
75	145	155	162	139	148	156	139	147	154	136	144	151	134	141	149
70	139	149	158	133	143	152	133	141	150	130	138	147	128	136	145
65	133	143	153	127	137	148	127	136	146	124	133	143	122	130	140
60	126	136	148	121	131	143	120	129	141	117	126	138	115	124	136
55	119	129	143	114	124	137	113	123	136	111	120	133	109	118	131
50	111	122	137	107	117	132	106	116	130	104	113	128	102	111	126
45	104	114	131	99	110	126	99	108	125	96	106	122	95	104	120
40	96	106	125	92	102	120	91	101	119	89	99	117	87	97	115

Check V1(MCG).

V1, VR, V2 Adjustment*

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

Slope and Wind V1 Adjustment*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
90	-5	-3	0	3	6	-3	-2	-1	0	1	2	2	3
80	-5	-2	0	3	5	-4	-2	-1	0	1	2	2	3
70	-4	-2	0	2	4	-4	-2	-1	0	1	1	2	3
60	-3	-1	0	2	3	-4	-3	-1	0	1	2	2	3
50	-2	-1	0	1	3	-4	-3	-1	0	1	2	3	4
40	-1	0	0	1	2	-5	-3	-1	0	1	3	4	5

***V1 not to exceed VR.**

V1(MCG)

Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	95	93					
60	140	95	93	92	90			
50	122	97	95	92	90	88	86	83
40	104	101	99	96	93	89	86	83
30	86	104	103	100	96	92	88	85
20	68	104	104	101	98	94	90	87
-60	-76	106	105	102	99	95	92	89

Maximum Allowable Clearway

FIELD LENGTH (M)	DRY RUNWAY MAX ALLOWABLE CLEARWAY FOR V1 REDUCTION (M)
1200	150
1600	180
2000	210
2400	240
2800	270
3200	290

Clearway and Stopway V1 Adjustments

CLEARWAY MINUS STOPWAY (M)	NORMAL V1 (KIAS)							
	DRY RUNWAY				WET RUNWAY			
	100	120	140	160	100	120	140	160
300	-5	-4	-3	-4				
200	-5	-4	-3	-3				
100	-3	-2	-2	-2				
0	0	0	0	0	0	0	0	0
-100	1	1	1	1	2	2	2	1
-200	1	1	1	1	4	3	2	2
-300	1	1	1	1	6	5	3	2

Use of clearway not allowed on wet runways.
V1 not to exceed VR.

Stab Trim Setting

Max Takeoff Thrust

Flaps 1 and 5

WEIGHT (1000 KG)	C.G. (%MAC)									
	6	9	14	18	22	26	30	32	33	36
80	8 1/2	8 1/2	7 1/2	7	6 1/4	5 1/2	4 3/4	4 1/2	4 1/4	3 3/4
70	8 1/4	7 3/4	7	6 1/4	5 3/4	5	4 1/4	4	3 3/4	3 1/2
60	7 1/4	7	6 1/4	5 3/4	5	4 1/2	3 3/4	3 1/2	3 1/4	3
50	6 1/2	6 1/4	5 1/2	5	4 1/4	3 3/4	3 1/4	3	2 3/4	2 3/4
45	6 1/4	5 3/4	5	4 1/2	4	3 1/2	3	2 3/4	2 3/4	2 3/4
35	6 1/4	5 3/4	5	4 1/2	4	3 1/2	3	2 3/4	2 3/4	2 3/4

Flaps 10, 15 and 25

WEIGHT (1000 KG)	C.G. (%MAC)									
	6	9	11	16	24	28	29	31	33	36
80	8 1/2	8 1/2	8 1/4	6 1/2	5	4 1/4	4	3 1/2	3 1/4	2 3/4
70	8 1/2	8 1/4	7 1/2	6	4 1/2	3 1/2	3 1/2	3	2 3/4	2 3/4
60	7 3/4	7	6 1/2	5 1/4	3 3/4	3	3	2 3/4	2 3/4	2 3/4
50	6 1/4	5 3/4	5 1/4	4 1/4	3	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4
45	5 1/4	4 3/4	4 1/2	3 3/4	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4
35	5 1/4	4 3/4	4 1/2	3 3/4	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4

VREF

WEIGHT (1000 KG)	FLAPS		
	40	30	15
85	160	168	177
80	155	163	172
75	151	158	167
70	146	153	161
65	141	148	156
60	135	142	149
55	128	136	143
50	122	129	136
45	115	122	128
40	108	115	121

Flap Maneuver Speeds

FLAP POSITION	MANEUVER SPEED
UP	VREF40 + 70
1	VREF40 + 50
5	VREF40 + 30
10	VREF40 + 30
15	VREF40 + 20
25	VREF40 + 10
30	VREF30
40	VREF40

ADVISORY INFORMATION

Slush/Standing Water Takeoff

Maximum Reverse Thrust

Weight Adjustments (1000 KG)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	-12.8	-15.3	-17.8	-15.8	-18.2	-20.7	-21.9	-24.4	-26.9
90	-11.8	-14.3	-16.8	-14.3	-16.8	-19.3	-19.7	-22.1	-24.6
85	-10.7	-13.2	-15.7	-12.9	-15.4	-17.9	-17.4	-19.9	-22.4
80	-9.7	-12.2	-14.7	-11.5	-14.0	-16.5	-15.2	-17.7	-20.2
75	-8.8	-11.2	-13.7	-10.2	-12.7	-15.2	-13.2	-15.7	-18.2
70	-7.8	-10.3	-12.8	-8.9	-11.4	-13.9	-11.4	-13.9	-16.4
65	-6.9	-9.4	-11.9	-7.8	-10.3	-12.8	-9.7	-12.2	-14.7
60	-6.0	-8.5	-11.0	-6.7	-9.2	-11.7	-8.1	-10.6	-13.1
55	-5.2	-7.7	-10.2	-5.7	-8.2	-10.6	-6.7	-9.2	-11.7
50	-4.3	-6.8	-9.3	-4.7	-7.2	-9.7	-5.5	-8.0	-10.5
45	-3.5	-6.0	-8.5	-3.7	-6.2	-8.7	-4.2	-6.7	-9.2
40	-2.7	-5.2	-7.7	-2.8	-5.3	-7.8	-3.0	-5.5	-8.0

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1200							33.1		
1400	41.6			45.3	30.9		51.5	37.4	
1600	61.6	46.2		65.2	49.9	32.5	71.0	56.1	39.0
1800	83.3	66.6	47.9	86.7	70.2	51.6	91.8	75.8	57.7
2000		88.7	68.4		92.0	72.0		96.8	77.6
2200			90.8			93.9			98.7

1. **Enter Weight Adjustment table with slush/standing water depth and dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -35 m/+35 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-14	-9	-4	-8	-3	0	0	0	0
85	-16	-11	-6	-10	-5	0	0	0	0
80	-17	-12	-7	-12	-7	-2	0	0	0
75	-19	-14	-9	-14	-9	-4	-1	0	0
70	-20	-15	-10	-15	-10	-5	-4	0	0
65	-21	-16	-11	-17	-12	-7	-7	-2	0
60	-22	-17	-12	-19	-14	-9	-11	-6	-1
55	-23	-18	-13	-20	-15	-10	-14	-9	-4
50	-24	-19	-14	-22	-17	-12	-17	-12	-7
45	-25	-20	-15	-23	-18	-13	-19	-14	-9
40	-25	-20	-15	-24	-19	-14	-20	-15	-10

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff

No Reverse Thrust

Weight Adjustments (1000 KG)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-15.1	-17.5	-20.0	-17.6	-20.1	-22.6	-23.0	-25.5	-28.0
85	-13.9	-16.4	-18.9	-16.1	-18.6	-21.1	-20.6	-23.1	-25.6
80	-12.8	-15.3	-17.8	-14.5	-17.0	-19.5	-18.3	-20.8	-23.3
75	-11.7	-14.2	-16.7	-13.1	-15.6	-18.1	-16.1	-18.6	-21.1
70	-10.6	-13.1	-15.6	-11.7	-14.2	-16.7	-14.2	-16.7	-19.2
65	-9.6	-12.1	-14.5	-10.4	-12.9	-15.4	-12.3	-14.8	-17.3
60	-8.5	-11.0	-13.5	-9.2	-11.7	-14.2	-10.7	-13.2	-15.7
55	-7.6	-10.1	-12.6	-8.1	-10.6	-13.1	-9.2	-11.7	-14.2
50	-6.6	-9.1	-11.6	-7.0	-9.5	-12.0	-7.9	-10.4	-12.9
45	-5.7	-8.2	-10.7	-6.0	-8.5	-11.0	-6.7	-9.2	-11.7
40	-4.8	-7.3	-9.8	-5.1	-7.6	-10.1	-5.7	-8.2	-10.7

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1800							43.4		
2000				43.2			69.3	41.4	
2200	58.6			77.0	40.7		95.7	67.4	39.5
2400	98.8	55.6			74.5	38.2		93.7	65.4
2600		95.7	52.7			71.9			91.7
2800			92.7						

1. **Enter Weight Adjustment table with slush/standing water depth and dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -50 m/+50 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-23	-16	-8	-12	-5	0	0	0	0
85	-25	-18	-10	-16	-8	-1	0	0	0
80	-27	-20	-12	-19	-11	-4	0	0	0
75	-29	-22	-14	-22	-14	-7	-2	0	0
70	-31	-24	-16	-25	-17	-10	-8	0	0
65	-33	-26	-18	-28	-20	-13	-13	-6	0
60	-35	-28	-20	-30	-23	-15	-18	-11	-3
55	-37	-29	-22	-33	-26	-18	-23	-16	-8
50	-39	-31	-24	-36	-28	-21	-28	-20	-13
45	-41	-33	-26	-38	-31	-23	-32	-25	-17
40	-42	-35	-27	-41	-33	-26	-37	-29	-22

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff

Maximum Reverse Thrust

Weight Adjustment (1000 KG)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	-0.8	-0.8	-0.8	-6.5	-6.5	-6.5	-11.6	-11.6	-11.6
90	-1.0	-1.0	-1.0	-6.3	-6.3	-6.3	-11.1	-11.1	-11.1
85	-1.2	-1.2	-1.2	-6.2	-6.2	-6.2	-10.6	-10.6	-10.6
80	-1.3	-1.3	-1.3	-6.0	-6.0	-6.0	-10.1	-10.1	-10.1
75	-1.5	-1.5	-1.5	-5.8	-5.8	-5.8	-9.5	-9.5	-9.5
70	-1.6	-1.6	-1.6	-5.6	-5.6	-5.6	-9.0	-9.0	-9.0
65	-1.6	-1.6	-1.6	-5.3	-5.3	-5.3	-8.4	-8.4	-8.4
60	-1.6	-1.6	-1.6	-5.0	-5.0	-5.0	-7.8	-7.8	-7.8
55	-1.5	-1.5	-1.5	-4.7	-4.7	-4.7	-7.2	-7.2	-7.2
50	-1.4	-1.4	-1.4	-4.3	-4.3	-4.3	-6.5	-6.5	-6.5
45	-1.3	-1.3	-1.3	-4.0	-4.0	-4.0	-5.9	-5.9	-5.9
40	-1.2	-1.2	-1.2	-3.6	-3.6	-3.6	-5.2	-5.2	-5.2

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1000	39.0								
1200	72.3	57.4	41.9						
1400	103.3	89.3	75.0	46.0	30.2				
1600				69.9	53.4	37.4			
1800				95.2	77.7	60.9	41.3		
2000					103.3	85.7	55.8	40.3	
2200							71.5	54.8	39.3
2400							88.7	70.4	53.8
2600								87.5	69.3
2800									86.3
3000									104.5

1. **Enter Weight Adjustment table with reported braking action and dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust “Good” field length available by -20 m/+20 m for every 5°C above/below 4°C.**
   Adjust “Medium” field length available by -20 m/+20 m for every 5°C above/below 4°C.
   Adjust “Poor” field length available by -40 m/+40 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff

Maximum Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-4	-2	0	-13	-10	-8	-24	-21	-19
85	-6	-3	-1	-15	-12	-10	-26	-24	-21
80	-7	-4	-2	-17	-14	-12	-29	-26	-24
75	-8	-5	-3	-18	-16	-13	-31	-28	-26
70	-9	-6	-4	-20	-17	-15	-33	-30	-28
65	-9	-7	-4	-21	-19	-16	-35	-32	-30
60	-10	-8	-5	-22	-20	-17	-37	-34	-32
55	-11	-9	-6	-24	-21	-19	-38	-36	-33
50	-12	-9	-7	-25	-22	-20	-40	-37	-35
45	-13	-10	-8	-26	-24	-21	-41	-39	-36
40	-14	-11	-9	-27	-25	-22	-42	-40	-37

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG).V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff

No Reverse Thrust

Weight Adjustments (1000 KG)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-2.6	-2.6	-2.6	-9.3	-9.3	-9.3	-15.0	-15.0	-15.0
85	-2.8	-2.8	-2.8	-9.1	-9.1	-9.1	-14.4	-14.4	-14.4
80	-2.9	-2.9	-2.9	-9.0	-9.0	-9.0	-13.7	-13.7	-13.7
75	-3.1	-3.1	-3.1	-8.7	-8.7	-8.7	-13.1	-13.1	-13.1
70	-3.1	-3.1	-3.1	-8.4	-8.4	-8.4	-12.3	-12.3	-12.3
65	-3.2	-3.2	-3.2	-8.0	-8.0	-8.0	-11.4	-11.4	-11.4
60	-3.1	-3.1	-3.1	-7.5	-7.5	-7.5	-10.5	-10.5	-10.5
55	-3.0	-3.0	-3.0	-7.0	-7.0	-7.0	-9.5	-9.5	-9.5
50	-2.8	-2.8	-2.8	-6.4	-6.4	-6.4	-8.4	-8.4	-8.4
45	-2.6	-2.6	-2.6	-5.7	-5.7	-5.7	-7.3	-7.3	-7.3
40	-2.3	-2.3	-2.3	-5.0	-5.0	-5.0	-6.0	-6.0	-6.0

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1200	34.7								
1300	65.5								
1400	84.9	52.6							
1500		75.9	34.7						
1600		93.4	65.5						
1700			84.9						
1900				45.2					
2000				72.7					
2100				94.6	52.9				
2200					78.5				
2300					99.9	60.0			
2400						84.0			
3100							53.6		
3200							74.6		
3300							93.5	35.6	
3400								59.1	
3500								79.5	
3600								98.2	41.8
3700									64.5
3800									84.2

1. **Enter Weight Adjustment table with reported braking action and dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -30 m/+30 m for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -30 m/+30 m for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -50 m/+50 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-7	0	0	-19	-11	-4	-38	-30	-23
85	-8	-1	0	-21	-14	-6	-41	-34	-26
80	-9	-2	0	-23	-16	-8	-45	-38	-30
75	-11	-3	0	-26	-18	-11	-49	-41	-34
70	-12	-5	0	-28	-21	-13	-52	-45	-37
65	-14	-6	0	-31	-24	-16	-56	-48	-41
60	-15	-8	0	-34	-26	-19	-59	-52	-44
55	-17	-9	-2	-37	-29	-22	-63	-55	-48
50	-19	-11	-4	-40	-32	-25	-66	-59	-51
45	-21	-13	-6	-43	-36	-28	-69	-62	-54
40	-23	-15	-8	-47	-39	-32	-73	-65	-58

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Takeoff %N1

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

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
60	94.8	95.4	95.8	95.9	96.0	96.1	96.2	96.3	96.2	95.9	95.8	95.7	95.7
55	95.4	96.0	96.5	96.6	96.7	96.8	96.9	97.1	96.9	96.6	96.3	95.7	95.0
50	96.0	96.6	97.1	97.3	97.4	97.6	97.7	97.8	97.7	97.4	97.1	96.6	96.1
45	96.8	97.4	97.8	98.0	98.1	98.3	98.4	98.5	98.4	98.1	97.8	97.5	97.1
40	97.4	98.1	98.6	98.7	98.8	98.9	99.0	99.2	99.1	98.8	98.5	98.4	98.1
35	98.0	98.7	99.4	99.5	99.6	99.7	99.8	99.9	99.8	99.5	99.2	99.1	99.0
30	97.6	98.8	100.3	100.3	100.4	100.4	100.5	100.5	100.4	100.3	100.0	99.9	99.9
25	96.8	98.1	99.5	100.1	100.7	100.8	100.7	100.7	100.7	100.7	100.6	100.6	100.7
20	96.0	97.3	98.8	99.3	99.9	100.2	100.5	100.8	100.8	100.9	100.8	100.8	100.8
15	95.2	96.5	98.0	98.6	99.2	99.5	99.8	100.1	100.5	100.9	101.1	101.1	101.1
10	94.5	95.8	97.2	97.8	98.4	98.7	99.0	99.4	99.7	100.1	100.5	101.0	101.5
5	93.7	95.0	96.4	97.0	97.6	98.0	98.3	98.6	99.0	99.4	99.8	100.3	100.7
0	92.9	94.2	95.6	96.3	96.9	97.2	97.5	97.9	98.2	98.6	99.0	99.5	100.0
-5	92.0	93.4	94.8	95.5	96.1	96.4	96.7	97.1	97.5	97.9	98.3	98.7	99.2
-10	91.2	92.6	94.0	94.7	95.3	95.6	96.0	96.3	96.7	97.1	97.5	98.0	98.4
-15	90.4	91.7	93.2	93.9	94.5	94.8	95.2	95.6	95.9	96.3	96.7	97.2	97.6
-20	89.6	90.9	92.4	93.0	93.7	94.0	94.4	94.8	95.2	95.6	95.9	96.4	96.8
-25	88.7	90.1	91.6	92.2	92.9	93.2	93.6	94.0	94.4	94.8	95.2	95.6	96.0
-30	87.9	89.2	90.7	91.4	92.0	92.4	92.8	93.2	93.6	94.0	94.3	94.8	95.2
-35	87.0	88.4	89.9	90.5	91.2	91.6	91.9	92.4	92.8	93.1	93.5	94.0	94.4
-40	86.1	87.5	89.0	89.7	90.3	90.7	91.1	91.5	91.9	92.3	92.7	93.1	93.6
-45	85.3	86.6	88.2	88.8	89.5	89.9	90.3	90.7	91.1	91.5	91.9	92.3	92.7
-50	84.4	85.7	87.3	87.9	88.6	89.0	89.4	89.9	90.3	90.6	91.0	91.5	91.9

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.9	1.0

Assumed Temperature Reduced Thrust

Maximum Assumed Temperature (Table 1 of 3)

Based on 25% Takeoff Thrust Reduction

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
55	73	71	69	67								
50	73	71	69	67	65	63						
45	73	71	69	67	65	63	61	59	57			
40	73	71	69	67	65	63	61	59	57	55		
35	71	71	69	67	65	63	61	59	57	55	53	
30	69	67	67	67	65	63	61	59	57	55	53	51
25	69	67	66	64	65	63	61	59	57	55	53	51
20	69	67	66	64	64	63	61	59	57	55	53	51
15	69	67	66	64	64	63	61	59	57	55	53	51
10 & BELOW	69	67	66	64	64	63	61	59	57	55	53	51

Takeoff %N1 (Table 2 of 3)

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

ASSUMED TEMP (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
75	93.4	93.7	94.2	94.7	95.4	96.1	96.9	97.3	97.6	97.8	97.8	97.7
70	94.1	94.4	94.4	94.4	94.7	95.4	96.2	96.6	96.9	97.1	97.1	97.1
65	94.8	95.1	95.2	95.2	95.3	95.4	95.5	96.0	96.2	96.5	96.4	96.4
60	95.4	95.8	95.9	96.0	96.1	96.2	96.3	96.2	95.9	95.8	95.7	95.7
55	96.0	96.5	96.6	96.7	96.8	96.9	97.1	96.9	96.6	96.3	95.7	95.0
50	96.6	97.1	97.3	97.4	97.6	97.7	97.8	97.7	97.4	97.1	96.6	96.1
45	97.4	97.8	98.0	98.1	98.3	98.4	98.5	98.4	98.1	97.8	97.5	97.1
40	98.1	98.6	98.7	98.8	98.9	99.0	99.2	99.1	98.8	98.5	98.4	98.1
35	98.7	99.4	99.5	99.6	99.7	99.8	99.9	99.8	99.5	99.2	99.1	99.0
30	98.8	100.3	100.3	100.4	100.4	100.5	100.5	100.4	100.3	100.0	99.9	99.9
25	98.1	99.5	100.1	100.7	100.8	100.7	100.7	100.7	100.7	100.6	100.6	100.7
20	97.3	98.8	99.3	99.9	100.2	100.5	100.8	100.8	100.9	100.8	100.8	100.8
15	96.5	98.0	98.6	99.2	99.5	99.8	100.1	100.5	100.9	101.1	101.1	101.1
10	95.8	97.2	97.8	98.4	98.7	99.0	99.4	99.7	100.1	100.5	101.0	101.5
MINIMUM ASSUMED TEMP (°C)	32	30	28	26	24	22	20	18	16	15	12	10

With engine bleed for packs off, increase %N1 by 1.0.

Assumed Temperature Reduced Thrust

%N1 Adjustment for Temperature Difference (Table 3 of 3)

ASSUMED TEMP MINUS OAT (°C)	OUTSIDE AIR TEMPERATURE (°C)													
	-40	-20	0	5	10	15	20	25	30	35	40	45	50	55
110	14.9													
100	14.9	10.9												
90	14.0	11.7												
80	12.9	11.6	7.8											
70	11.2	10.7	8.6	7.8	6.3									
60	9.2	9.5	8.5	8.4	7.1	6.3	4.9							
50	7.8	7.8	7.5	7.1	6.9	7.0	5.6	4.9	3.4					
40		6.0	6.2	6.1	5.9	5.8	5.7	5.6	4.7	4.4	5.3			
30		4.6	4.6	4.6	4.6	4.5	4.4	4.3	4.3	4.2	4.1	4.0	3.9	
20			2.9	3.0	3.0	3.0	3.0	3.0	2.9	2.9	2.8	2.8	2.7	2.6
10			1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.4
0			0	0	0	0	0	0	0	0	0	0	0	0

1. **Determine Maximum Assumed Temperature allowed from Table 1.**
2. **Find Maximum %N1 from Table 2 using the desired assumed temperature (no greater than temperature from Table 1).**
3. **Use the difference between assumed temperature and OAT to determine the %N1 adjustment from Table 3.**
4. **Subtract %N1 adjustment from Maximum %N1 in Table 2.**

Takeoff Speeds - Dry Runway (24K Derate)

V1, VR, V2

WEIGHT (1000 KG)	FLAPS 1			FLAPS 5			FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
90	172	172	174												
85	166	167	170	159	160	163									
80	160	162	166	154	155	159									
75	155	156	161	149	150	155	148	148	153	145	145	150	142	142	148
70	149	150	157	143	144	151	142	143	149	139	140	146	137	137	144
65	143	144	152	137	138	147	136	137	145	133	134	142	131	131	139
60	137	138	147	131	132	142	130	131	140	127	128	137	125	125	135
55	130	131	142	124	125	136	123	124	135	121	121	132	118	119	130
50	122	123	136	118	118	131	116	117	129	114	115	127	112	112	125
45	115	116	130	110	111	125	109	110	124	107	107	121	105	105	119
40	107	108	124	103	103	119	102	102	118	99	100	116	97	98	114

Check V1(MCG).

V1, VR, V2 Adjustments*

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

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
90	-4	-2	0	0	0	-2	-1	-1	0	0	0	0	0
80	-3	-2	0	1	1	-2	-1	-1	0	0	0	1	1
70	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
60	-1	-1	0	1	1	-1	-1	0	0	0	1	1	1
50	-1	0	0	0	0	-2	-1	0	0	0	0	0	0
40	0	0	0	0	0	-2	-1	0	0	0	0	0	0

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	90	88					
60	140	90	88	87	85			
50	122	92	90	87	85	83	81	79
40	104	97	95	91	88	84	81	79
30	86	100	99	95	92	88	85	81
20	68	100	99	97	95	92	88	85
-60	-76	101	101	98	96	94	91	89

Takeoff Speeds - Wet Runway (24K Derate)

V1, VR, V2

WEIGHT (1000 KG)	FLAPS 1			FLAPS 5			FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
90	167	172	174												
85	161	167	170	154	160	163									
80	155	162	166	148	155	159									
75	149	156	161	142	150	155	142	148	153	139	145	150	137	142	148
70	142	150	157	136	144	151	136	143	149	133	140	146	131	137	144
65	136	144	152	130	138	147	129	137	145	127	134	142	125	131	139
60	129	138	147	123	132	142	123	131	140	120	128	137	118	125	135
55	122	131	142	116	125	136	116	124	135	113	121	132	111	119	130
50	114	123	136	109	118	131	109	117	129	106	115	127	104	112	125
45	107	116	130	102	111	125	101	110	124	99	107	121	97	105	119
40	98	108	124	94	103	119	93	102	118	92	100	115	90	98	114

Check V1(MCG).

V1, VR, V2 Adjustment*

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

Slope and Wind V1 Adjustment*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
90	-6	-3	0	3	6	-3	-2	-1	0	1	1	2	2
80	-5	-3	0	3	5	-3	-2	-1	0	1	1	2	2
70	-4	-2	0	2	4	-3	-2	-1	0	1	1	2	2
60	-3	-2	0	2	3	-4	-2	-1	0	1	1	2	3
50	-2	-1	0	1	3	-4	-3	-1	0	1	2	3	3
40	-1	0	0	1	2	-5	-3	-1	0	1	2	3	4

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	90	88					
60	140	90	88	87	85			
50	122	92	90	87	85	83	81	79
40	104	97	95	91	88	84	81	79
30	86	100	99	95	92	88	85	81
20	68	100	99	97	95	92	88	85
-60	-76	101	101	98	96	94	91	89

Maximum Allowable Clearway (24K Derate)

FIELD LENGTH (M)	DRY RUNWAY MAX ALLOWABLE CLEARWAY FOR V1 REDUCTION (M)
1200	150
1600	180
2000	210
2400	240
2800	270
3200	290

Clearway and Stopway V1 Adjustments (24K Derate)

CLEARWAY MINUS STOPWAY (M)	NORMAL V1 (KIAS)							
	DRY RUNWAY				WET RUNWAY			
	100	120	140	160	100	120	140	160
300	-5	-4	-3	-4				
200	-5	-4	-3	-3				
100	-3	-2	-2	-2				
0	0	0	0	0	0	0	0	0
-100	1	1	1	1	3	2	1	1
-200	1	1	1	1	6	4	2	1
-300	1	1	1	1	7	6	3	1

Use of clearway not allowed on wet runways.
V1 not to exceed VR.

Stab Trim Setting (24K Derate)

Flaps 1 and 5

WEIGHT (1000 KG)	C.G. (%MAC)									
	6	8	10	14	18	22	26	33	34	36
80	8 1/2	8 1/2	8 1/2	7 3/4	7	6 1/4	5 3/4	4 1/2	4 1/4	4
70	8 1/2	8 1/4	8	7 1/4	6 1/2	6	5 1/4	4	4	3 1/2
60	7 3/4	7 1/2	7	6 1/2	6	5 1/4	4 3/4	3 1/2	3 1/2	3 1/4
50	7	6 1/2	6 1/4	5 3/4	5 1/4	4 1/2	4	3	2 3/4	2 3/4
45	6 1/2	6 1/4	6	5 1/4	4 3/4	4 1/4	3 3/4	2 3/4	2 3/4	2 3/4
35	6 1/2	6 1/4	6	5 1/4	43/4	4 1/4	3 3/4	2 3/4	2 3/4	2 3/4

Flaps 10, 15 and 25

WEIGHT (1000 KG)	C.G. (%MAC)									
	6	8	9	10	16	26	29	32	34	36
80	8 1/2	8 1/2	8 1/2	8 1/2	7	4 3/4	4 1/4	3 1/2	3 1/4	2 3/4
70	8 1/2	8 1/4	8	7 3/4	6 1/4	4 1/4	3 1/2	3	2 3/4	2 3/4
60	7 3/4	7 1/4	7	6 3/4	5 1/2	3 1/2	3	2 3/4	2 3/4	2 3/4
50	6 1/4	6	5 3/4	5 3/4	4 3/4	3	2 3/4	2 3/4	2 3/4	2 3/4
45	5 3/4	5 1/2	5 1/4	5	4 1/4	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4
35	5 3/4	5 1/2	5 1/4	5	4 1/4	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4

ADVISORY INFORMATION

Slush/Standing Water Takeoff (24K Derate)

Maximum Reverse Thrust

Weight Adjustments (1000 KG)

24K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	-13.2	-15.4	-17.7	-16.5	-18.7	-21.0	-25.2	-27.5	-29.8
90	-12.1	-14.4	-16.6	-15.0	-17.2	-19.5	-22.3	-24.6	-26.9
85	-11.0	-13.3	-15.6	-13.5	-15.7	-18.0	-19.5	-21.8	-24.0
80	-10.0	-12.3	-14.5	-12.0	-14.3	-16.5	-16.8	-19.1	-21.3
75	-9.0	-11.3	-13.5	-10.6	-12.9	-15.2	-14.4	-16.6	-18.9
70	-8.0	-10.3	-12.6	-9.3	-11.6	-13.9	-12.2	-14.4	-16.7
65	-7.1	-9.4	-11.6	-8.1	-10.4	-12.7	-10.2	-12.5	-14.8
60	-6.2	-8.5	-10.7	-7.0	-9.2	-11.5	-8.6	-10.8	-13.1
55	-5.3	-7.6	-9.9	-5.9	-8.2	-10.5	-7.1	-9.4	-11.7
50	-4.5	-6.8	-9.1	-4.9	-7.2	-9.5	-5.9	-8.2	-10.5
45	-3.7	-6.0	-8.2	-3.9	-6.2	-8.5	-4.7	-7.0	-9.3
40	-2.9	-5.1	-7.4	-3.0	-5.2	-7.5	-3.5	-5.8	-8.1

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1200				32.5			39.1		
1400	50.5	33.8		53.8	37.5		58.9	43.8	
1600	72.4	55.7		75.1	58.8	32.9	78.6	63.6	39.5
1800	94.4	77.6	50.9	96.4	80.2	54.2	98.4	83.3	59.3
2000		99.6	72.9		101.5	75.5		103.1	79.0
2200			94.8			96.8			98.8

1. **Enter Weight Adjustment table with slush/standing water depth and 24K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -30 m/+30 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (24K Derate)
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-13	-8	-3	-7	-2	0	0	0	0
85	-14	-9	-4	-8	-3	0	0	0	0
80	-15	-10	-5	-9	-4	0	0	0	0
75	-16	-11	-6	-11	-6	-1	0	0	0
70	-18	-13	-8	-12	-7	-2	0	0	0
65	-19	-14	-9	-14	-9	-4	-4	0	0
60	-20	-15	-10	-16	-11	-6	-7	-2	0
55	-21	-16	-11	-18	-13	-8	-11	-6	-1
50	-22	-17	-12	-20	-15	-10	-15	-10	-5
45	-23	-18	-13	-21	-16	-11	-17	-12	-7
40	-23	-18	-13	-21	-16	-11	-18	-13	-8

1. **Obtain V1, VR and V2 for the actual weight using the 24K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (24K Derate)

No Reverse Thrust

Weight Adjustments (1000 KG)

24K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-15.0	-17.5	-20.1	-18.1	-20.6	-23.1	-24.6	-27.1	-29.6
85	-14.0	-16.5	-19.0	-16.5	-19.1	-21.6	-22.0	-24.5	-27.0
80	-12.9	-15.4	-18.0	-15.0	-17.5	-20.0	-19.4	-22.0	-24.5
75	-11.8	-14.4	-16.9	-13.5	-16.0	-18.6	-17.1	-19.6	-22.1
70	-10.8	-13.3	-15.9	-12.1	-14.6	-17.2	-14.9	-17.5	-20.0
65	-9.8	-12.3	-14.8	-10.8	-13.3	-15.8	-13.0	-15.5	-18.0
60	-8.7	-11.3	-13.8	-9.5	-12.0	-14.6	-11.2	-13.7	-16.2
55	-7.7	-10.2	-12.8	-8.3	-10.8	-13.3	-9.6	-12.1	-14.6
50	-6.7	-9.2	-11.7	-7.1	-9.7	-12.2	-8.2	-10.7	-13.2
45	-5.7	-8.2	-10.7	-6.1	-8.6	-11.1	-7.0	-9.5	-12.0
40	-4.7	-7.2	-9.7	-5.0	-7.6	-10.1	-6.0	-8.5	-11.0

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1600							32.3		
1700							46.2		
1800				33.4			60.1		
1900	30.7			52.9			74.1	39.9	
2000	54.1			70.9			88.2	53.8	
2100	75.7			87.8	44.3			67.8	33.7
2200	95.8	43.7			63.0			81.8	47.6
2300		66.2			80.3	35.4		95.9	61.5
2400		86.8	33.1		96.9	54.7			75.5
2500			56.4			72.6			89.6
2600			77.7			89.4			
2700			97.8						

1. **Enter Weight Adjustment table with slush/standing water depth and 24K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -40 m/+40 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (24K Derate)

No Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-20	-10	0	-9	0	0	0	0	0
85	-22	-12	-2	-12	-2	0	0	0	0
80	-24	-14	-4	-14	-4	0	0	0	0
75	-26	-16	-6	-17	-7	0	0	0	0
70	-28	-18	-8	-20	-10	0	0	0	0
65	-30	-20	-10	-23	-13	-3	-6	0	0
60	-32	-22	-12	-26	-16	-6	-12	-2	0
55	-34	-24	-14	-29	-19	-9	-18	-8	0
50	-36	-26	-16	-32	-22	-12	-24	-14	-4
45	-38	-28	-18	-35	-25	-15	-29	-19	-9
40	-40	-30	-20	-38	-28	-18	-34	-24	-14

1. **Obtain V1, VR and V2 for the actual weight using the 24K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (24K Derate)

Maximum Reverse Thrust

Weight Adjustment (1000 KG)

24K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	-0.4	-0.4	-0.4	-5.8	-5.8	-5.8	-11.0	-11.0	-11.0
90	-0.6	-0.6	-0.6	-5.8	-5.8	-5.8	-10.6	-10.6	-10.6
85	-0.9	-0.9	-0.9	-5.7	-5.7	-5.7	-10.2	-10.2	-10.2
80	-1.1	-1.1	-1.1	-5.7	-5.7	-5.7	-9.8	-9.8	-9.8
75	-1.3	-1.3	-1.3	-5.6	-5.6	-5.6	-9.3	-9.3	-9.3
70	-1.5	-1.5	-1.5	-5.4	-5.4	-5.4	-8.9	-8.9	-8.9
65	-1.5	-1.5	-1.5	-5.2	-5.2	-5.2	-8.3	-8.3	-8.3
60	-1.5	-1.5	-1.5	-5.0	-5.0	-5.0	-7.8	-7.8	-7.8
55	-1.5	-1.5	-1.5	-4.7	-4.7	-4.7	-7.2	-7.2	-7.2
50	-1.4	-1.4	-1.4	-4.3	-4.3	-4.3	-6.5	-6.5	-6.5
45	-1.3	-1.3	-1.3	-4.0	-4.0	-4.0	-5.9	-5.9	-5.9
40	-1.3	-1.3	-1.3	-3.6	-3.6	-3.6	-5.3	-5.3	-5.3

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1000	47.2								
1200	80.2	62.9	45.0	30.7					
1400		95.1	78.2	54.0	34.5				
1600				79.3	57.9	38.2	33.5		
1800					83.7	61.9	47.5	30.4	
2000						88.2	62.9	44.4	
2200							80.6	59.4	41.3
2400							101.0	76.4	55.9
2600								96.4	72.5
2800									91.8

1. **Enter Weight Adjustment table with reported braking action and 24K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust “Good” field length available by -20 m/+20 m for every 5°C above/below 4°C.
Adjust “Medium” field length available by -20 m/+20 m for every 5°C above/below 4°C.
Adjust “Poor” field length available by -35 m/+35 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (24K Derate)

Maximum Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-4	-2	0	-13	-10	-8	-23	-21	-18
85	-5	-3	0	-14	-11	-9	-24	-22	-19
80	-6	-3	-1	-15	-12	-10	-26	-23	-21
75	-7	-4	-2	-16	-13	-11	-27	-25	-22
70	-8	-5	-3	-17	-15	-12	-29	-27	-24
65	-9	-6	-4	-19	-17	-14	-32	-29	-27
60	-9	-7	-4	-21	-18	-16	-34	-31	-29
55	-10	-8	-5	-22	-20	-17	-36	-33	-31
50	-11	-9	-6	-23	-21	-18	-37	-35	-32
45	-12	-9	-7	-24	-22	-19	-39	-36	-34
40	-12	-10	-7	-25	-22	-20	-39	-37	-34

1. **Obtain V1, VR and V2 for the actual weight using the 24K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (24K Derate)

No Reverse Thrust

Weight Adjustments (1000 KG)

24K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	-1.0	-1.0	-1.0	-7.9	-7.9	-7.9	-14.4	-14.4	-14.4
90	-1.5	-1.5	-1.5	-8.1	-8.1	-8.1	-14.1	-14.1	-14.1
85	-2.0	-2.0	-2.0	-8.2	-8.2	-8.2	-13.8	-13.8	-13.8
80	-2.4	-2.4	-2.4	-8.4	-8.4	-8.4	-13.4	-13.4	-13.4
75	-2.8	-2.8	-2.8	-8.4	-8.4	-8.4	-12.9	-12.9	-12.9
70	-3.0	-3.0	-3.0	-8.2	-8.2	-8.2	-12.3	-12.3	-12.3
65	-3.1	-3.1	-3.1	-7.9	-7.9	-7.9	-11.5	-11.5	-11.5
60	-3.1	-3.1	-3.1	-7.5	-7.5	-7.5	-10.5	-10.5	-10.5
55	-3.0	-3.0	-3.0	-6.9	-6.9	-6.9	-9.4	-9.4	-9.4
50	-2.8	-2.8	-2.8	-6.3	-6.3	-6.3	-8.2	-8.2	-8.2
45	-2.4	-2.4	-2.4	-5.4	-5.4	-5.4	-6.8	-6.8	-6.8
40	-2.0	-2.0	-2.0	-4.5	-4.5	-4.5	-5.4	-5.4	-5.4

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1200	57.1								
1300	79.2	35.6							
1400	97.5	64.5							
1500		84.8	45.6						
1600		102.9	71.1						
1700			90.2						
1800				49.7					
1900				75.5					
2000				95.7	44.7				
2100					72.2				
2200					92.7	39.3			
2300						68.7			
2400						89.7			
2900							51.7		
3000							73.3		
3100							93.4		
3200								43.7	
3300								66.0	
3400								86.4	
3500									35.6
3600									58.4
3700									79.5
3800									99.4

1. **Enter Weight Adjustment table with reported braking action and 24K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust “Good” field length available by -30 m/+30 m for every 5°C above/below 4°C.
Adjust “Medium” field length available by -30 m/+30 m for every 5°C above/below 4°C.
Adjust “Poor” field length available by -45 m/+45 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (24K Derate)

No Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	-5	0	0	-14	-9	-4	-31	-26	-21
90	-6	-1	0	-16	-11	-6	-34	-29	-24
85	-7	-2	0	-18	-13	-8	-37	-32	-27
80	-8	-3	0	-20	-15	-10	-40	-35	-30
75	-9	-4	0	-23	-18	-13	-43	-38	-33
70	-11	-6	-1	-25	-20	-15	-47	-42	-37
65	-12	-7	-2	-28	-23	-18	-50	-45	-40
60	-14	-9	-4	-31	-26	-21	-54	-49	-44
55	-15	-10	-5	-33	-28	-23	-59	-54	-49
50	-17	-12	-7	-37	-32	-27	-63	-58	-53
45	-19	-14	-9	-40	-35	-30	-67	-62	-57
40	-21	-16	-11	-43	-38	-33	-72	-67	-62

1. **Obtain V1, VR and V2 for the actual weight using the 24K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Takeoff %N1 - (24K Derate)

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

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
60	90.3	90.8	91.2	91.2	91.1	91.1	91.0	91.1	91.2	91.0	91.2	91.3	91.4
55	91.0	91.6	92.0	92.0	92.0	91.9	91.9	91.9	92.0	91.9	91.7	91.3	90.8
50	91.8	92.4	92.8	92.8	92.8	92.7	92.7	92.7	92.7	92.6	92.6	92.2	91.8
45	92.6	93.2	93.6	93.6	93.6	93.6	93.5	93.5	93.5	93.4	93.3	93.1	92.8
40	93.4	94.0	94.4	94.4	94.4	94.3	94.3	94.2	94.2	94.1	94.1	94.0	93.8
35	94.2	94.8	95.2	95.2	95.2	95.1	95.1	95.0	95.0	94.9	94.8	94.8	94.7
30	93.8	95.0	96.1	96.0	96.0	96.0	95.9	95.8	95.8	95.7	95.7	95.6	95.6
25	93.1	94.3	95.4	95.9	96.4	96.7	96.7	96.6	96.6	96.5	96.4	96.4	96.3
20	92.3	93.5	94.6	95.1	95.7	96.3	96.9	97.6	97.5	97.5	97.4	97.3	97.2
15	91.6	92.7	93.8	94.3	94.9	95.5	96.1	96.8	97.5	98.2	98.6	98.6	98.5
10	90.8	92.0	93.0	93.6	94.1	94.7	95.3	96.0	96.7	97.5	98.2	99.1	100.0
5	90.0	91.2	92.2	92.8	93.3	93.9	94.5	95.2	95.9	96.7	97.4	98.4	99.3
0	89.2	90.4	91.4	92.0	92.5	93.1	93.7	94.4	95.1	95.9	96.7	97.6	98.5
-5	88.4	89.6	90.6	91.2	91.7	92.3	92.9	93.6	94.3	95.1	95.9	96.8	97.7
-10	87.6	88.8	89.8	90.4	90.9	91.5	92.1	92.8	93.5	94.3	95.1	96.1	97.0
-15	86.8	88.0	89.0	89.5	90.0	90.6	91.3	92.0	92.7	93.5	94.3	95.3	96.2
-20	86.0	87.1	88.2	88.7	89.2	89.8	90.5	91.2	91.9	92.6	93.5	94.5	95.4
-25	85.2	86.3	87.3	87.9	88.4	89.0	89.6	90.3	91.0	91.8	92.6	93.7	94.6
-30	84.4	85.5	86.5	87.0	87.5	88.1	88.8	89.5	90.2	91.0	91.8	92.9	93.8
-35	83.5	84.6	85.6	86.2	86.6	87.3	87.9	88.6	89.3	90.1	91.0	92.1	93.0
-40	82.7	83.8	84.8	85.3	85.8	86.4	87.0	87.8	88.5	89.3	90.1	91.2	92.2
-45	81.8	82.9	83.9	84.4	84.9	85.5	86.2	86.9	87.6	88.4	89.3	90.4	91.4
-50	81.0	82.0	83.0	83.5	84.0	84.6	85.3	86.0	86.7	87.5	88.4	89.5	90.5

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.9	1.0

Assumed Temperature Reduced Thrust (24K Derate)

Maximum Assumed Temperature (Table 1 of 3)

Based on 25% Takeoff Thrust Reduction

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
55	73	71	69	67								
50	73	71	69	67	65	63						
45	73	71	69	67	65	63	61	59	57			
40	73	71	69	67	65	63	61	59	57	55		
35	67	67	67	67	65	63	61	59	57	55	53	
30	64	61	62	61	61	61	61	59	57	55	53	51
25	64	61	59	57	56	56	57	57	57	55	53	51
20	64	61	59	57	56	54	53	53	53	53	52	51
15	64	61	59	57	56	54	53	52	50	49	48	47
10 & BELOW	64	61	59	57	56	54	53	52	50	48	45	43

Takeoff %N1 (Table 2 of 3)

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

ASSUMED TEMP (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
75	88.3	88.6	89.1	89.6	90.2	90.8	91.5	92.2	92.7	93.1	93.3	93.4
70	89.1	89.5	89.4	89.3	89.6	90.1	90.8	91.6	92.0	92.5	92.6	92.7
65	90.0	90.4	90.3	90.2	90.2	90.1	90.2	90.9	91.4	91.8	91.9	92.1
60	90.8	91.2	91.2	91.1	91.1	91.0	91.1	91.2	91.0	91.2	91.3	91.4
55	91.6	92.0	92.0	92.0	91.9	91.9	91.9	92.0	91.9	91.7	91.3	90.8
50	92.4	92.8	92.8	92.8	92.7	92.7	92.7	92.7	92.6	92.6	92.2	91.8
45	93.2	93.6	93.6	93.6	93.6	93.5	93.5	93.5	93.4	93.3	93.1	92.8
40	94.0	94.4	94.4	94.4	94.3	94.3	94.2	94.2	94.1	94.1	94.0	93.8
35	94.8	95.2	95.2	95.2	95.1	95.1	95.0	95.0	94.9	94.8	94.8	94.7
30	95.0	96.1	96.0	96.0	96.0	95.9	95.8	95.8	95.7	95.7	95.6	95.6
25	94.3	95.4	95.9	96.4	96.7	96.7	96.6	96.6	96.5	96.4	96.4	96.3
20	93.5	94.6	95.1	95.7	96.3	96.9	97.6	97.5	97.5	97.4	97.3	97.2
15	92.7	93.8	94.3	94.9	95.5	96.1	96.8	97.5	98.2	98.6	98.6	98.5
10	92.0	93.0	93.6	94.1	94.7	95.3	96.0	96.7	97.5	98.2	99.1	100.0
MINIMUM ASSUMED TEMP (°C)	32	30	28	26	24	22	20	18	16	15	12	10

With engine bleed for packs off, increase %N1 by 1.0

Assumed Temperature Reduced Thrust (24K Derate)

%N1 Adjustment for Temperature Difference (Table 3 of 3)

ASSUMED TEMP MINUS OAT (°C)	OUTSIDE AIR TEMPERATURE (°C)													
	-40	-20	0	5	10	15	20	25	30	35	40	45	50	55
110	12.1													
100	11.3	8.5												
90	11.7	8.9												
80	12.5	8.0	5.5											
70	11.3	8.4	5.9	5.6	4.0									
60	9.7	9.2	4.8	4.7	4.4	4.2	2.6							
50	7.8	7.9	5.3	3.5	3.3	3.6	3.0	2.7	1.2					
40		6.4	6.0	5.5	3.7	3.2	3.7	3.0	2.8	3.0	3.7			
30		4.6	4.6	4.6	4.5	4.3	4.2	4.0	4.1	4.0	3.9	3.8	3.7	
20			3.1	3.1	3.1	3.0	2.9	2.9	2.8	2.7	2.7	2.6	2.6	2.5
10			1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.3	1.3
0			0	0	0	0	0	0	0	0	0	0	0	0

1. **Determine Maximum Assumed Temperature allowed from Table 1.**
2. **Find Maximum %N1 from Table 2 using the desired assumed temperature (no greater than temperature from Table 1).**
3. **Use the difference between assumed temperature and OAT to determine the %N1 adjustment from Table 3.**
4. **Subtract %N1 adjustment from Maximum %N1 in Table 2.**

Takeoff Speeds - Dry Runway (22K Derate)

V1, VR, V2

WEIGHT (1000 KG)	FLAPS 1			FLAPS 5			FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
80	162	163	165	156	156	159									
76	158	158	162	152	152	156									
72	153	154	158	147	147	152	146	146	150	142	142	147			
68	148	149	155	142	143	149	141	141	147	138	138	144			
64	143	144	151	138	138	145	136	137	143	134	134	140	131	131	138
60	138	139	147	132	133	141	131	132	139	128	129	136	126	126	134
56	132	133	142	127	128	137	126	126	135	123	124	132	121	121	130
52	127	127	138	122	122	132	121	121	131	118	118	128	116	116	126
48	121	121	133	116	116	128	115	115	126	112	113	124	110	110	122
44	115	115	128	110	111	123	109	109	122	107	107	119	105	105	117
40	108	108	123	104	104	118	103	103	117	100	101	115	98	99	113

Check V1(MCG).

V1, VR, V2 Adjustments*

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

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
80	-3	-2	0	1	1	-1	-1	0	0	0	1	1	1
76	-3	-1	0	1	1	-1	-1	0	0	0	1	1	1
72	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
68	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
64	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
60	-1	-1	0	1	1	-1	-1	0	0	0	1	1	1
56	-1	0	0	1	1	-1	-1	0	0	0	1	1	1
52	-1	0	0	1	1	-1	-1	0	0	0	1	1	1
48	-1	0	0	0	1	-1	-1	0	0	0	1	1	1
44	0	0	0	0	1	-1	-1	0	0	0	1	1	1
40	0	0	0	0	1	-1	-1	0	0	0	1	1	1

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	87	85					
60	140	87	85	84	83			
50	122	89	87	84	83	81	79	77
40	104	94	91	88	85	82	79	77
30	86	96	96	93	89	86	82	79
20	68	97	96	94	93	90	86	82
-60	-76	98	98	96	94	91	89	87

Takeoff Speeds - Wet Runway (22K Derate)

V1, VR, V2

WEIGHT (1000 KG)	FLAPS 1			FLAPS 5			FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
80	157	163	165	150	156	159									
76	152	158	162	146	152	156									
72	147	154	158	141	147	152	141	146	150	138	142	147			
68	142	149	155	136	143	149	136	141	147	133	138	144			
64	136	144	151	131	138	145	130	137	143	127	134	140	126	131	138
60	131	139	147	125	133	141	125	132	139	122	129	136	120	126	134
56	125	133	142	120	128	137	119	126	135	116	124	132	115	121	130
52	119	127	138	114	122	132	113	121	131	111	118	128	109	116	126
48	113	121	133	108	116	128	108	115	126	105	113	124	103	110	122
44	107	115	128	102	111	123	102	109	122	99	107	119	98	105	117
40	100	108	123	96	104	118	95	103	117	93	101	115	92	99	113

Check V1(MCG).

V1, VR, V2 Adjustments*

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

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
80	-5	-3	0	3	5	-3	-2	-1	0	1	1	2	2
76	-5	-2	0	3	5	-3	-2	-1	0	1	1	2	2
72	-4	-2	0	2	5	-3	-2	-1	0	1	1	2	2
68	-4	-2	0	2	4	-3	-2	-1	0	1	1	2	3
64	-3	-2	0	2	4	-3	-2	-1	0	1	1	2	3
60	-3	-2	0	2	4	-3	-2	-1	0	1	1	2	3
56	-3	-1	0	2	3	-4	-2	-1	0	1	2	2	3
52	-3	-1	0	1	3	-4	-3	-1	0	1	2	2	3
48	-2	-1	0	1	2	-4	-3	-1	0	1	2	2	3
44	-2	-1	0	1	2	-4	-3	-1	0	1	2	3	3
40	-2	-1	0	1	2	-5	-3	-2	0	1	2	3	4

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	87	85					
60	140	87	85	84	83			
50	122	89	87	84	83	81	79	77
40	104	94	91	88	85	82	79	77
30	86	96	96	93	89	86	82	79
20	68	97	96	94	93	90	86	82
-60	-76	98	98	96	94	91	89	87

Maximum Allowable Clearway (22K Derate)

FIELD LENGTH (M)	DRY RUNWAY MAX ALLOWABLE CLEARWAY FOR V1 REDUCTION (M)
1200	150
1600	180
2000	210
2400	240
2800	270
3200	290

Clearway and Stopway V1 Adjustments (22K Derate)

CLEARWAY MINUS STOPWAY (M)	NORMAL V1 (KIAS)							
	DRY RUNWAY				WET RUNWAY			
	100	120	140	160	100	120	140	160
300	-4	-3	-3	-3				
200	-3	-3	-3	-2				
100	-2	-2	-2	-1				
0	0	0	0	0	0	0	0	0
-100	0	0	0	0	1	1	1	0
-200	0	0	0	0	4	3	2	0
-300	0	0	0	0	4	3	2	1

Use of clearway not allowed on wet runways.
V1 not to exceed VR.

Stab Trim Setting (22K Derate)

Flaps 1 and 5

WEIGHT (1000 KG)	C.G. (%MAC)									
	6	9	11	14	18	21	24	28	32	36
80	8 1/2	8 1/2	8 1/2	8	7 1/4	6 3/4	6 1/4	5 3/4	5	4 1/2
70	8 1/2	8 1/4	8	7 1/2	6 3/4	6 1/4	5 3/4	5 1/4	4 1/2	3 3/4
60	8 1/4	7 3/4	7 1/2	7	6 1/4	5 3/4	5 1/4	4 3/4	4	3 1/4
50	7 1/4	6 3/4	6 1/2	6	5 1/2	5	4 3/4	4	3 1/2	3
45	6 1/2	6 1/4	6	5 3/4	5	4 3/4	4 1/4	3 3/4	3 1/4	2 3/4
35	6 1/2	6 1/4	6	5 3/4	5	4 3/4	4 1/4	3 3/4	3 1/4	2 3/4

Flaps 10, 15 and 25

WEIGHT (1000 KG)	C.G. (%MAC)									
	6	8	9	10	16	26	27	31	34	36
80	8 1/2	8 1/2	8 1/2	8 1/2	7	5	4 3/4	4	3 1/4	3
70	8 1/2	8 1/4	8	8	6 1/2	4 1/2	4 1/4	3 1/2	3	2 3/4
60	7 3/4	7 1/4	7	7	5 3/4	4	3 3/4	3	2 3/4	2 3/4
50	6 1/2	6 1/4	6	5 3/4	4 3/4	3	3	2 3/4	2 3/4	2 3/4
45	6	5 3/4	5 1/2	5 1/2	4 1/4	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4
35	6	5 3/4	5 1/2	5 1/2	4 1/4	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4

ADVISORY INFORMATION

Slush/Standing Water Takeoff (22K Derate)

Maximum Reverse Thrust

Weight Adjustments (1000 KG)

22K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	-12.7	-15.2	-17.7	-16.3	-18.8	-21.3	-23.1	-25.5	-28.0
90	-11.7	-14.2	-16.7	-14.9	-17.4	-19.9	-20.9	-23.4	-25.9
85	-10.8	-13.3	-15.8	-13.5	-16.0	-18.5	-18.7	-21.2	-23.7
80	-9.8	-12.3	-14.8	-12.1	-14.6	-17.1	-16.6	-19.1	-21.6
75	-8.9	-11.4	-13.9	-10.8	-13.2	-15.7	-14.5	-17.0	-19.5
70	-8.0	-10.5	-13.0	-9.5	-12.0	-14.5	-12.6	-15.1	-17.6
65	-7.1	-9.6	-12.1	-8.3	-10.8	-13.3	-10.8	-13.3	-15.8
60	-6.3	-8.8	-11.3	-7.2	-9.7	-12.2	-9.1	-11.6	-14.1
55	-5.5	-8.0	-10.5	-6.1	-8.6	-11.1	-7.6	-10.1	-12.6
50	-4.7	-7.2	-9.7	-5.2	-7.7	-10.2	-6.2	-8.7	-11.2
45	-3.9	-6.4	-8.9	-4.3	-6.8	-9.3	-4.9	-7.4	-9.9
40	-3.2	-5.7	-8.2	-3.5	-5.9	-8.4	-3.7	-6.2	-8.7

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1200	36.3			39.3			44.3		
1400	57.8	38.1		60.6	41.0		65.5	46.0	
1600	81.2	59.7	39.8	83.4	62.5	42.7	92.4	67.4	47.7
1800	104.8	83.2	61.7		85.4	64.4		94.9	69.5
2000			85.2			87.3			97.4

1. **Enter Weight Adjustment table with slush/standing water depth and 22K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -20 m/+20 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (22K Derate)

Maximum Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-13	-8	-3	-8	-3	0	0	0	0
85	-13	-8	-3	-8	-3	0	0	0	0
80	-14	-9	-4	-7	-2	0	0	0	0
75	-14	-9	-4	-8	-3	0	0	0	0
70	-15	-10	-5	-10	-5	0	0	0	0
65	-17	-12	-7	-12	-7	-2	-1	0	0
60	-19	-14	-9	-14	-9	-4	-5	0	0
55	-20	-15	-10	-17	-12	-7	-9	-4	0
50	-21	-16	-11	-18	-13	-8	-12	-7	-2
45	-21	-16	-11	-19	-14	-9	-15	-10	-5
40	-21	-16	-11	-19	-14	-9	-16	-11	-6

1. **Obtain V1, VR and V2 for the actual weight using the 22K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (22K Derate)

No Reverse Thrust

Weight Adjustments (1000 KG)

22K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	-15.6	-17.8	-20.1	-19.5	-21.8	-24.0	-26.3	-28.6	-30.9
90	-14.4	-16.7	-18.9	-17.8	-20.1	-22.3	-23.9	-26.1	-28.4
85	-13.2	-15.5	-17.7	-16.1	-18.3	-20.6	-21.4	-23.6	-25.9
80	-12.0	-14.3	-16.5	-14.4	-16.6	-18.9	-18.9	-21.2	-23.4
75	-10.8	-13.1	-15.4	-12.8	-15.0	-17.3	-16.6	-18.8	-21.1
70	-9.7	-12.0	-14.3	-11.3	-13.5	-15.8	-14.4	-16.7	-18.9
65	-8.7	-11.0	-13.2	-9.9	-12.1	-14.4	-12.4	-14.7	-16.9
60	-7.7	-10.0	-12.2	-8.6	-10.9	-13.1	-10.6	-12.8	-15.1
55	-6.8	-9.0	-11.3	-7.4	-9.7	-12.0	-8.9	-11.2	-13.4
50	-5.9	-8.2	-10.4	-6.4	-8.7	-10.9	-7.4	-9.7	-12.0
45	-5.0	-7.3	-9.6	-5.5	-7.7	-10.0	-6.1	-8.4	-10.6
40	-4.2	-6.5	-8.8	-4.6	-6.8	-9.1	-4.9	-7.1	-9.4

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1400				31.5			44.2		
1600	50.9			58.2			69.4	42.6	
1800	80.4	49.0		85.5	56.3		95.9	67.5	41.0
2000		78.5	47.0		83.7	54.5		94.2	65.7
2200			76.7			81.9			92.4
2400			103.2						

1. **Enter Weight Adjustment table with slush/standing water depth and 22K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -35 m/+30 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for available field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (22K Derate)
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	-18	-13	-8	-11	-6	-1	0	0	0
90	-18	-13	-8	-11	-6	-1	0	0	0
85	-18	-13	-8	-11	-6	-1	0	0	0
80	-19	-14	-9	-10	-5	0	0	0	0
75	-19	-14	-9	-11	-6	-1	0	0	0
70	-21	-16	-11	-13	-8	-3	0	0	0
65	-23	-18	-13	-16	-11	-6	-1	0	0
60	-25	-20	-15	-19	-14	-9	-7	-2	0
55	-26	-21	-16	-22	-17	-12	-12	-7	-2
50	-27	-22	-17	-24	-19	-14	-16	-11	-6
45	-28	-23	-18	-26	-21	-16	-20	-15	-10
40	-27	-22	-17	-25	-20	-15	-22	-17	-12

1. **Obtain V1, VR and V2 for the actual weight using the 22K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (22K Derate)

Maximum Reverse Thrust

Weight Adjustment (1000 KG)

22K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	0.0	0.0	0.0	-5.4	-5.4	-5.4	-11.0	-11.0	-11.0
90	-0.3	-0.3	-0.3	-5.4	-5.4	-5.4	-10.5	-10.5	-10.5
85	-0.6	-0.6	-0.6	-5.4	-5.4	-5.4	-10.0	-10.0	-10.0
80	-0.8	-0.8	-0.8	-5.4	-5.4	-5.4	-9.5	-9.5	-9.5
75	-1.0	-1.0	-1.0	-5.2	-5.2	-5.2	-9.0	-9.0	-9.0
70	-1.1	-1.1	-1.1	-5.1	-5.1	-5.1	-8.5	-8.5	-8.5
65	-1.2	-1.2	-1.2	-4.8	-4.8	-4.8	-8.0	-8.0	-8.0
60	-1.3	-1.3	-1.3	-4.6	-4.6	-4.6	-7.5	-7.5	-7.5
55	-1.3	-1.3	-1.3	-4.4	-4.4	-4.4	-7.0	-7.0	-7.0
50	-1.3	-1.3	-1.3	-4.2	-4.2	-4.2	-6.5	-6.5	-6.5
45	-1.4	-1.4	-1.4	-4.0	-4.0	-4.0	-6.1	-6.1	-6.1
40	-1.4	-1.4	-1.4	-3.9	-3.9	-3.9	-5.6	-5.6	-5.6

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1000	53.3	32.6							
1200	85.3	66.1	45.9	36.5					
1400		97.2	78.5	60.3	40.2				
1600				86.1	64.4	43.9	37.8		
1800					90.3	68.5	52.4	33.7	
2000						94.6	68.9	47.9	
2200							87.6	63.8	43.6
2400								81.9	58.9
2600								101.3	76.3
2800									95.6

1. **Enter Weight Adjustment table with reported braking action and 22K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -20 m/+20 m for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -20 m/+20 m for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -30 m/+30 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (22K Derate)
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-4	-2	0	-12	-9	-7	-21	-18	-16
85	-5	-2	0	-12	-10	-7	-22	-20	-17
80	-5	-3	0	-13	-11	-8	-23	-21	-18
75	-6	-4	-1	-14	-12	-9	-25	-22	-20
70	-7	-4	-2	-16	-13	-11	-27	-24	-22
65	-8	-5	-3	-17	-15	-12	-29	-26	-24
60	-9	-6	-4	-19	-17	-14	-31	-29	-26
55	-10	-7	-5	-21	-18	-16	-33	-31	-28
50	-10	-8	-5	-22	-19	-17	-35	-33	-30
45	-11	-8	-6	-23	-20	-18	-37	-34	-32
40	-11	-8	-6	-23	-21	-18	-37	-35	-32

1. **Obtain V1, VR and V2 for the actual weight using the 22K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (22K Derate)

No Reverse Thrust

Weight Adjustments (1000 KG)

22K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	-1.0	-1.0	-1.0	-7.8	-7.8	-7.8	-14.2	-14.2	-14.2
90	-1.2	-1.2	-1.2	-7.6	-7.6	-7.6	-13.5	-13.5	-13.5
85	-1.4	-1.4	-1.4	-7.3	-7.3	-7.3	-12.8	-12.8	-12.8
80	-1.6	-1.6	-1.6	-7.1	-7.1	-7.1	-12.1	-12.1	-12.1
75	-1.7	-1.7	-1.7	-6.8	-6.8	-6.8	-11.4	-11.4	-11.4
70	-1.8	-1.8	-1.8	-6.5	-6.5	-6.5	-10.7	-10.7	-10.7
65	-1.9	-1.9	-1.9	-6.2	-6.2	-6.2	-10.0	-10.0	-10.0
60	-1.9	-1.9	-1.9	-5.9	-5.9	-5.9	-9.4	-9.4	-9.4
55	-1.9	-1.9	-1.9	-5.6	-5.6	-5.6	-8.8	-8.8	-8.8
50	-2.0	-2.0	-2.0	-5.4	-5.4	-5.4	-8.1	-8.1	-8.1
45	-2.0	-2.0	-2.0	-5.2	-5.2	-5.2	-7.5	-7.5	-7.5
40	-2.1	-2.1	-2.1	-5.0	-5.0	-5.0	-6.9	-6.9	-6.9

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1000	41.9								
1200	78.9	57.3	32.6						
1400		91.7	71.4						
1600			104.4	62.1	30.5				
1800				94.3	64.9	33.4			
2000					97.0	67.8			
2200						99.7	35.7		
2400							57.0		
2600							82.0	45.5	
2800								68.4	34.7
3000								94.8	55.9
3200									80.6

1. **Enter Weight Adjustment table with reported braking action and 22K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust "Good" field length available by -25 m/+20 m for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -25 m/+20 m for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -40 m/+35 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (22K Derate)
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	-5	-2	0	-14	-11	-9	-27	-25	-22
90	-5	-3	0	-15	-12	-10	-29	-26	-24
85	-6	-3	-1	-16	-13	-11	-30	-28	-25
80	-7	-4	-2	-17	-14	-12	-32	-29	-27
75	-7	-5	-2	-18	-16	-13	-34	-32	-29
70	-8	-6	-3	-20	-17	-15	-37	-34	-32
65	-10	-7	-5	-22	-20	-17	-40	-37	-35
60	-11	-8	-6	-24	-22	-19	-43	-40	-38
55	-12	-9	-7	-26	-24	-21	-45	-43	-40
50	-13	-10	-8	-28	-26	-23	-48	-45	-43
45	-14	-11	-9	-30	-27	-25	-49	-47	-44
40	-14	-11	-9	-31	-28	-26	-50	-48	-45

1. **Obtain V1, VR and V2 for the actual weight using the 22K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Takeoff %N1 (22K Derate)

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

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
60	87.7	88.3	88.7	88.8	88.9	89.1	89.2	89.2	89.1	88.6	88.3	88.7	89.2
55	88.5	89.1	89.5	89.7	89.8	89.9	90.0	90.0	90.0	89.5	89.0	88.8	88.6
50	89.3	89.8	90.4	90.5	90.6	90.7	90.9	90.8	90.8	90.4	89.9	89.7	89.6
45	90.2	90.7	91.2	91.3	91.4	91.5	91.7	91.6	91.6	91.2	90.8	90.7	90.5
40	91.1	91.6	92.1	92.2	92.3	92.4	92.5	92.4	92.4	92.1	91.7	91.6	91.5
35	91.9	92.5	93.0	93.1	93.2	93.2	93.3	93.3	93.2	92.9	92.5	92.5	92.4
30	91.5	92.6	93.8	93.9	94.0	94.0	94.1	94.0	93.9	93.7	93.4	93.3	93.2
25	90.8	91.9	93.1	93.7	94.4	94.8	94.9	94.8	94.8	94.4	94.0	94.0	94.0
20	90.0	91.1	92.3	93.0	93.6	94.3	95.0	95.6	95.6	95.3	94.9	94.8	94.7
15	89.3	90.4	91.6	92.2	92.8	93.6	94.3	94.8	95.3	95.9	96.1	95.9	95.5
10	88.5	89.6	90.8	91.4	92.1	92.8	93.5	94.0	94.5	95.1	95.7	96.4	97.1
5	87.8	88.9	90.0	90.7	91.3	92.0	92.7	93.2	93.7	94.3	94.9	95.6	96.3
0	87.0	88.1	89.2	89.9	90.5	91.2	91.9	92.4	92.9	93.5	94.1	94.8	95.5
-5	86.2	87.3	88.4	89.1	89.7	90.4	91.1	91.6	92.1	92.7	93.3	94.0	94.7
-10	85.4	86.5	87.6	88.3	88.9	89.6	90.3	90.8	91.3	91.9	92.5	93.2	93.9
-15	84.6	85.7	86.8	87.5	88.1	88.8	89.4	90.0	90.5	91.1	91.7	92.4	93.1
-20	83.8	84.9	86.0	86.6	87.3	87.9	88.6	89.1	89.7	90.3	90.8	91.6	92.3
-25	83.0	84.1	85.2	85.8	86.4	87.1	87.8	88.3	88.8	89.4	90.0	90.7	91.5
-30	82.2	83.3	84.4	85.0	85.6	86.3	86.9	87.4	88.0	88.6	89.2	89.9	90.6
-35	81.4	82.4	83.5	84.1	84.7	85.4	86.1	86.6	87.1	87.7	88.3	89.0	89.8
-40	80.6	81.6	82.7	83.3	83.9	84.5	85.2	85.7	86.2	86.8	87.4	88.2	88.9
-45	79.7	80.7	81.8	82.4	83.0	83.7	84.3	84.8	85.3	86.0	86.6	87.3	88.0
-50	78.9	79.9	80.9	81.5	82.1	82.8	83.4	83.9	84.5	85.1	85.7	86.4	87.2

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.9	0.9	0.9

Assumed Temperature Reduced Thrust (22K Derate)

Maximum Assumed Temperature (Table 1 of 3)

Based on 25% Takeoff Thrust Reduction

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
55	73	71	69	67								
50	73	71	69	67	65	63						
45	73	71	69	67	65	63	61	59	57			
40	72	71	69	67	65	63	61	59	57	55		
35	66	66	66	66	65	63	61	59	57	55	53	
30	63	61	61	61	61	61	61	59	57	55	53	51
25	63	61	59	57	56	56	56	56	56	55	53	51
20	63	61	59	57	55	53	51	51	51	50	50	50
15	63	61	59	57	55	53	51	50	47	45	45	45
10 & BELOW	63	61	59	57	55	53	51	50	47	45	43	41

Takeoff %N1 (Table 2 of 3)

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

ASSUMED TEMP (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
75	85.7	86.0	86.7	87.4	88.2	88.9	89.5	90.1	90.2	90.2	90.6	91.1
70	86.6	87.0	87.1	87.1	87.5	88.3	88.9	89.4	89.5	89.6	90.0	90.4
65	87.4	87.8	88.0	88.0	88.2	88.3	88.3	88.8	88.9	88.9	89.4	89.8
60	88.3	88.7	88.8	88.9	89.1	89.2	89.2	89.1	88.6	88.3	88.7	89.2
55	89.1	89.5	89.7	89.8	89.9	90.0	90.0	90.0	89.5	89.0	88.8	88.6
50	89.8	90.4	90.5	90.6	90.7	90.9	90.8	90.8	90.4	89.9	89.7	89.6
45	90.7	91.2	91.3	91.4	91.5	91.7	91.6	91.6	91.2	90.8	90.7	90.5
40	91.6	92.1	92.2	92.3	92.4	92.5	92.4	92.4	92.1	91.7	91.6	91.5
35	92.5	93.0	93.1	93.2	93.2	93.3	93.3	93.2	92.9	92.5	92.5	92.4
30	92.6	93.8	93.9	94.0	94.0	94.1	94.0	93.9	93.7	93.4	93.3	93.2
25	91.9	93.1	93.7	94.4	94.8	94.9	94.8	94.8	94.4	94.0	94.0	94.0
20	91.1	92.3	93.0	93.6	94.3	95.0	95.6	95.6	95.3	94.9	94.8	94.7
15	90.4	91.6	92.2	92.8	93.6	94.3	94.8	95.3	95.9	96.1	95.9	95.5
10	89.6	90.8	91.4	92.1	92.8	93.5	94.0	94.5	95.1	95.7	96.4	97.1
MINIMUM ASSUMED TEMP (°C)	32	30	28	26	24	22	20	18	16	15	12	10

With engine bleed for packs off, increase %N1 by 0.9.

Assumed Temperature Reduced Thrust (22K Derate)

%N1 Adjustment for Temperature Difference (Table 3 of 3)

ASSUMED TEMP MINUS OAT (°C)	OUTSIDE AIR TEMPERATURE (°C)													
	-40	-20	0	5	10	15	20	25	30	35	40	45	50	55
110	11.6													
100	10.3	7.9												
90	10.8	8.4												
80	12.2	7.1	5.0											
70	11.0	7.6	5.4	5.2	3.5									
60	9.6	9.0	4.1	4.0	3.9	3.8	2.1							
50	8.0	7.7	4.5	2.8	2.6	2.7	2.6	2.4	0.8					
40		6.2	5.9	4.7	3.0	2.6	2.7	2.8	2.6	2.5	2.9			
30		4.7	4.6	4.5	4.4	4.2	4.1	4.0	4.0	3.9	3.8	3.7	3.6	
20			3.1	3.0	3.0	3.0	2.9	2.8	2.7	2.7	2.6	2.6	2.5	2.4
10			1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.3	1.3	1.3
0			0	0	0	0	0	0	0	0	0	0	0	0

1. **Determine Maximum Assumed Temperature allowed from Table 1.**
2. **Find Maximum %N1 from Table 2 using the desired assumed temperature (no greater than temperature from Table 1).**
3. **Use the difference between assumed temperature and OAT to determine the %N1 adjustment from Table 3.**
4. **Subtract %N1 adjustment from Maximum %N1 in Table 2.**

Max Climb %N1

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

TAT (°C)	PRESSURE ALTITUDE (FT)/SPEED (KIAS/MACH)									
	0	5000	10000	15000	20000	25000	30000	35000	37000	41000
	280	280	280	280	280	280	280	.78	.78	.78
60	90.2	90.5	90.4	90.6	90.4	92.1	93.8	95.1	95.2	93.5
55	91.0	91.2	91.3	91.4	90.8	91.5	93.1	94.4	94.5	92.8
50	91.7	92.0	92.1	92.2	91.7	91.5	92.4	93.7	93.8	92.1
45	92.4	92.6	92.8	93.0	92.6	92.4	92.4	93.0	93.1	91.4
40	93.1	93.3	93.6	93.8	93.4	93.2	93.2	92.3	92.4	90.7
35	93.6	94.0	94.3	94.5	94.3	94.0	94.0	93.0	92.4	90.8
30	92.9	94.8	95.0	95.2	95.1	94.8	94.7	93.9	93.3	91.8
25	92.2	94.8	95.7	95.9	95.9	95.5	95.4	94.7	94.1	92.8
20	91.4	94.0	96.5	96.7	96.6	96.2	96.1	95.4	94.9	93.7
15	90.6	93.2	95.9	97.5	97.4	96.9	96.7	96.2	95.7	94.6
10	89.9	92.5	95.1	97.8	98.3	97.7	97.4	96.9	96.5	95.6
5	89.1	91.7	94.3	97.0	99.2	98.6	98.1	97.7	97.3	96.5
0	88.3	90.9	93.5	96.2	98.6	99.6	99.1	98.5	98.2	97.5
-5	87.6	90.1	92.7	95.4	97.8	99.6	100.0	99.2	99.0	98.4
-10	86.8	89.3	91.9	94.6	97.1	98.8	100.3	100.2	99.8	99.4
-15	86.0	88.5	91.0	93.8	96.3	98.0	99.6	101.1	100.8	100.4
-20	85.2	87.6	90.2	93.0	95.5	97.2	98.7	100.8	101.3	101.0
-25	84.3	86.8	89.4	92.2	94.7	96.4	97.9	100.0	100.5	100.1
-30	83.5	86.0	88.5	91.3	93.9	95.6	97.1	99.1	99.6	99.3
-35	82.7	85.1	87.7	90.5	93.1	94.8	96.3	98.3	98.8	98.4
-40	81.8	84.3	86.8	89.6	92.3	93.9	95.4	97.4	97.9	97.6

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)					
	0	10	20	30	35	41
ENGINE ANTI-ICE	-0.6	-0.8	-0.9	-0.9	-0.8	-0.8
ENGINE & WING ANTI-ICE*	-1.8	-2.1	-2.5	-2.7	-3.0	-3.0

***Dual bleed sources**

Go-around %N1

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

AIRPORT OAT		TAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
°C	°F		-2000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
57	134	60	95.0	96.2	96.8									
52	125	55	95.9	96.7	96.6	96.8	97.5							
47	116	50	96.6	97.6	97.8	97.8	97.7	97.5	98.2	98.8				
42	108	45	97.4	98.4	98.5	98.6	98.7	98.8	98.7	98.5	98.5	99.0		
37	99	40	98.0	99.1	99.2	99.3	99.4	99.5	99.6	99.5	99.1	98.9	98.8	99.1
32	90	35	98.1	99.9	100.0	100.1	100.1	100.3	100.3	100.2	99.9	99.6	99.6	99.5
27	81	30	97.3	99.8	100.4	100.7	100.7	100.7	100.7	100.7	100.6	100.4	100.4	100.3
22	72	25	96.6	99.1	99.7	100.2	100.6	100.9	100.9	100.9	100.9	100.9	100.9	100.8
17	63	20	95.8	98.3	98.9	99.5	99.8	100.2	100.5	100.9	101.0	101.1	101.0	101.0
12	54	15	95.0	97.5	98.1	98.7	99.1	99.4	99.8	100.1	100.5	100.9	101.3	101.2
7	45	10	94.2	96.8	97.4	98.0	98.3	98.7	99.0	99.4	99.8	100.2	100.5	100.9
2	36	5	93.4	96.0	96.6	97.2	97.6	97.9	98.3	98.7	99.0	99.4	99.8	100.2
-3	27	0	92.6	95.2	95.8	96.4	96.8	97.2	97.5	97.9	98.3	98.7	99.0	99.4
-8	18	-5	91.8	94.4	95.0	95.6	96.0	96.4	96.8	97.2	97.5	97.9	98.3	98.6
-13	9	-10	91.0	93.6	94.2	94.8	95.2	95.6	96.0	96.4	96.8	97.1	97.5	97.9
-17	1	-15	90.2	92.8	93.4	94.0	94.4	94.8	95.2	95.6	96.0	96.4	96.7	97.1
-22	-8	-20	89.3	92.0	92.6	93.2	93.6	94.0	94.4	94.8	95.2	95.6	95.9	96.3
-27	-17	-25	88.5	91.1	91.8	92.4	92.8	93.2	93.6	94.0	94.4	94.8	95.1	95.5
-32	-26	-30	87.6	90.3	90.9	91.6	92.0	92.4	92.8	93.3	93.6	94.0	94.3	94.7
-37	-35	-35	86.8	89.4	90.1	90.7	91.1	91.6	92.0	92.4	92.8	93.2	93.5	93.9
-42	-44	-40	85.9	88.6	89.2	89.9	90.3	90.7	91.2	91.6	92.0	92.4	92.7	93.0
-47	-53	-45	85.0	87.7	88.4	89.0	89.4	89.9	90.3	90.8	91.2	91.5	91.9	92.2
-52	-62	-50	84.1	86.8	87.5	88.2	88.6	89.0	89.5	90.0	90.3	90.7	91.0	91.4

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (FT)											
	-2000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.8	0.8	0.8	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9
A/C HIGH	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Climb (280/.76)

Flaps Up, Set Max Climb Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		40	50	60	70	80
40000	**PITCH ATT**	**4.0**	**4.0**	**4.0**		
	V/S (FT/MIN)	1700	1100	600		
30000	**PITCH ATT**	**4.0**	**4.0**	**3.5**	**4.0**	**4.0**
	V/S (FT/MIN)	2500	1900	1500	1100	800
20000	**PITCH ATT**	**7.0**	**6.5**	**6.0**	**6.0**	**6.0**
	V/S (FT/MIN)	4200	3300	2600	2100	1700
10000	**PITCH ATT**	**11.0**	**9.5**	**8.5**	**8.0**	**8.0**
	V/S (FT/MIN)	5600	4400	3600	3000	2500
SEA LEVEL	**PITCH ATT**	**14.5**	**12.5**	**11.0**	**10.0**	**9.5**
	V/S (FT/MIN)	6700	5300	4400	3700	3100

Cruise (.76/280)

Flaps Up, %N1 for Level Flight

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		40	50	60	70	80
40000	**PITCH ATT**	**2.0**	**2.5**	**3.5**		
	%N1	83	85	90		
35000	**PITCH ATT**	**1.0**	**2.0**	**2.5**	**3.0**	**3.5**
	%N1	81	83	84	87	90
30000	**PITCH ATT**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**
	%N1	81	82	83	84	86
25000	**PITCH ATT**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**
	%N1	77	78	79	81	82
20000	**PITCH ATT**	**1.0**	**1.5**	**2.0**	**2.5**	**3.5**
	%N1	74	74	75	77	78
15000	**PITCH ATT**	**1.0**	**1.5**	**2.0**	**3.0**	**3.5**
	%N1	70	71	72	73	74

Descent (.76/280)

Flaps Up, Set Idle Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		40	50	60	70	80
40000	**PITCH ATT**	**-1.5**	**-0.5**	**0.5**	**1.0**	**1.5**
	V/S (FT/MIN)	-2700	-2400	-2300	-2500	-2700
30000	**PITCH ATT**	**-3.5**	**-2.0**	**-1.0**	**0.5**	**0.5**
	V/S (FT/MIN)	-3100	-2600	-2300	-2100	-2000
20000	**PITCH ATT**	**-3.5**	**-2.0**	**-1.0**	**0.0**	**0.5**
	V/S (FT/MIN)	-2800	-2300	-2000	-1900	-1700
10000	**PITCH ATT**	**-3.5**	**-2.0**	**-1.0**	**0.0**	**0.5**
	V/S (FT/MIN	-2500	-2100	-1800	-1700	-1500
SEA LEVEL	**PITCH ATT**	**-3.5**	**-2.5**	**-1.0**	**0.5**	**0.5**
	V/S (FT/MIN)	-2300	-1900	-1700	-1500	-1400

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Holding (VREF40 + 70)

Flaps Up, %N1 for Level Flight

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		40	50	60	70	80
15000	**PITCH ATT**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
	%N1	56	62	66	70	73
	KIAS	178	193	212	229	246
10000	**PITCH ATT**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
	%N1	53	58	62	66	70
	KIAS	178	192	211	228	244
5000	**PITCH ATT**	**5.0**	**5.5**	**5.0**	**5.0**	**5.0**
	%N1	49	54	58	62	66
	KIAS	178	192	210	227	243

Terminal Area (5000 FT)

%N1 for Level Flight

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS UP (GEAR UP)	**PITCH ATT**	**5.0**	**5.5**	**5.5**	**6.0**	**6.5**
(VREF40 + 70)	%N1	48	54	58	62	65
FLAPS 1 (GEAR UP)	**PITCH ATT**	**5.0**	**5.0**	**5.5**	**6.0**	**6.0**
(VREF40 + 50)	%N1	51	56	60	65	68
FLAPS 5 (GEAR UP)	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.5**	**6.5**
(VREF40 + 30)	%N1	51	56	61	65	69
FLAPS 15 (GEAR DOWN)	**PITCH ATT**	**5.5**	**6.0**	**6.0**	**6.0**	**6.5**
(VREF40 + 20)	%N1	60	66	71	75	79

Final Approach (1500 FT)

Gear Down, %N1 for 3° Glideslope

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS 15	**PITCH ATT**	**2.0**	**2.5**	**2.5**	**2.5**	**2.5**
(VREF15 + 10)	%N1	43	47	51	55	58
FLAPS 30	**PITCH ATT**	**0.5**	**1.0**	**1.0**	**1.0**	**1.0**
(VREF30 + 10)	%N1	47	52	57	60	64
FLAPS 40	**PITCH ATT**	**-0.5**	**0.0**	**0.0**	**0.0**	**0.0**
(VREF40 + 10)	%N1	53	58	63	67	70

Go-Around

Flaps 15, Gear Up, Set Go-Around Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		40	50	60	70	80
10000	**PITCH ATT**	**16.0**	**12.0**	**9.5**	**8.0**	**7.0**
	V/S (FT/MIN)	4200	3200	2600	2000	1600
	KIAS	151	168	183	197	209
5000	**PITCH ATT**	**20.0**	**15.0**	**12.0**	**10.0**	**8.5**
	V/S (FT/MIN)	4900	3900	3100	2600	2100
	KIAS	151	168	183	196	208
SEA LEVEL	**PITCH ATT**	**24.0**	**18.0**	**14.5**	**12.0**	**10.0**
	V/S (FT/MIN)	5600	4500	3700	3100	2500
	KIAS	151	167	182	196	208

Intentionally
Blank

Performance Inflight — Chapter PI

All Engine — Section 51

Long Range Cruise Maximum Operating Altitude

Max Cruise Thrust

ISA + 10°C and Below

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
85	32300	-10	34300*	34300*	33800	32200	30800
80	33600	-13	35800*	35800*	35100	33500	32100
75	35000	-16	37100*	37100*	36400	34900	33500
70	36400	-18	38400*	38400*	37900	36300	35000
65	38000	-18	39800*	39800*	39400	37800	36500
60	39600	-18	41000	41000	41000	39500	38200
55	41000	-18	41000	41000	41000	41000	40000
50	41000	-18	41000	41000	41000	41000	41000
45	41000	-18	41000	41000	41000	41000	41000
40	41000	-18	41000	41000	41000	41000	41000

ISA + 15°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
85	32300	-4	33000*	33000*	33000*	32200	30800
80	33600	-7	34700*	34700*	34700*	33500	32100
75	35000	-10	36200*	36200*	36200*	34900	33500
70	36400	-12	37600*	37600*	37600*	36300	35000
65	38000	-12	38900*	38900*	38900*	37800	36500
60	39600	-12	40400*	40400*	40400*	39500	38200
55	41000	-12	41000	41000	41000	41000	40000
50	41000	-12	41000	41000	41000	41000	41000
45	41000	-12	41000	41000	41000	41000	41000
40	41000	-12	41000	41000	41000	41000	41000

ISA + 20°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
85	32300	2	29400*	29400*	29400*	29400*	29400*
80	33600	-1	32200*	32200*	32200*	32200*	32100
75	35000	-4	34700*	34700*	34700*	34700*	33500
70	36400	-7	36200*	36200*	36200*	36200*	35000
65	38000	-7	37700*	37700*	37700*	37700*	36500
60	39600	-7	39100*	39100*	39100*	39100*	38200
55	41000	-7	40500*	40500*	40500*	40500*	40000
50	41000	-7	41000	41000	41000	41000	41000
45	41000	-7	41000	41000	41000	41000	41000
40	41000	-7	41000	41000	41000	41000	41000

***Denotes altitude thrust limited in level flight, 100 fpm residual rate of climb.**

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)								
		25	27	29	31	33	35	37	39	41
85	%N1	85.0	86.4	87.6	88.8	90.3				
	MACH	.735	.759	.776	.788	.792				
	KIAS	308	306	300	292	281				
	FF/ENG	1539	1536	1527	1510	1500				
80	%N1	83.7	85.1	86.4	87.6	88.8	91.1			
	MACH	.715	.743	.765	.780	.790	.790			
	KIAS	299	299	296	289	281	268			
	FF/ENG	1447	1451	1446	1432	1414	1426			
75	%N1	82.1	83.7	85.0	86.4	87.6	88.9	92.6		
	MACH	.692	.723	.750	.770	.784	.792	.788		
	KIAS	289	290	289	285	278	269	255		
	FF/ENG	1348	1362	1363	1353	1338	1321	1366		
70	%N1	80.3	82.0	83.6	85.0	86.3	87.5	89.5		
	MACH	.668	.699	.730	.755	.774	.787	.792		
	KIAS	278	280	281	279	274	267	257		
	FF/ENG	1250	1264	1275	1272	1259	1244	1244		
65	%N1	78.6	80.2	81.8	83.4	84.8	86.1	87.7	90.6	
	MACH	.645	.673	.705	.735	.760	.777	.789	.791	
	KIAS	268	269	271	271	269	263	256	245	
	FF/ENG	1155	1166	1180	1186	1180	1166	1162	1179	
60	%N1	77.0	78.3	79.9	81.6	83.1	84.5	86.2	88.2	91.6
	MACH	.627	.647	.676	.709	.739	.763	.779	.790	.790
	KIAS	260	258	259	261	261	258	252	245	233
	FF/ENG	1076	1070	1082	1093	1096	1088	1086	1085	1111
55	%N1	75.4	76.5	77.8	79.4	81.2	82.7	84.5	86.6	88.7
	MACH	.611	.627	.647	.677	.711	.741	.765	.781	.791
	KIAS	253	249	247	248	250	250	247	241	234
	FF/ENG	1007	990	985	995	1003	1005	1006	1008	1008
50	%N1	73.7	74.8	75.9	77.2	78.9	80.6	82.5	84.8	86.8
	MACH	.595	.610	.626	.646	.676	.710	.741	.765	.781
	KIAS	246	242	238	236	237	239	239	236	230
	FF/ENG	944	921	906	899	906	914	921	928	930
45	%N1	71.5	72.9	74.0	75.2	76.4	78.1	80.2	82.6	84.8
	MACH	.569	.591	.607	.624	.643	.673	.707	.739	.763
	KIAS	235	234	231	227	224	225	227	227	224
	FF/ENG	868	857	838	823	825	828	839	852	859
40	%N1	68.8	70.5	71.9	73.1	74.2	75.4	77.3	79.9	82.3
	MACH	.538	.561	.584	.602	.619	.637	.665	.699	.732
	KIAS	222	222	222	219	215	212	212	214	214
	FF/ENG	801	796	787	769	751	739	742	757	771

Shaded area approximates optimum altitude.

Long Range Cruise Enroute Fuel and Time - Low Altitudes

Ground to Air Miles Conversions

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
295	270	248	230	214	200	190	181	173	165	158
444	406	373	345	321	300	285	272	259	248	238
594	543	498	461	429	400	380	362	346	331	318
744	680	623	576	536	500	476	453	432	414	397
894	817	749	692	643	600	571	544	519	496	476
1045	954	874	808	751	700	666	634	605	579	556
1197	1092	1000	924	858	800	761	725	692	662	635
1349	1230	1126	1039	966	900	856	816	778	745	714
1502	1369	1252	1155	1073	1000	951	906	865	827	793
1655	1508	1379	1272	1181	1100	1046	996	951	909	872
1809	1647	1505	1388	1288	1200	1141	1086	1037	992	951
1963	1787	1632	1505	1396	1300	1236	1177	1123	1074	1030
2118	1927	1760	1621	1504	1400	1331	1268	1210	1157	1109
2274	2068	1888	1738	1612	1500	1426	1358	1296	1239	1188
2430	2209	2015	1856	1720	1600	1521	1448	1381	1321	1267
2587	2350	2143	1972	1828	1700	1616	1538	1467	1403	1346
2744	2492	2271	2090	1936	1800	1711	1628	1553	1486	1425
2902	2634	2400	2207	2044	1900	1805	1719	1639	1568	1504
3060	2777	2529	2325	2153	2000	1900	1809	1725	1650	1582

Reference Fuel And Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		20		24		28	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	1.4	0:42	1.3	0:40	1.1	0:38	0.9	0:37	0.9	0:36
300	2.2	1:02	2.0	0:59	1.7	0:54	1.5	0:53	1.4	0:51
400	3.0	1:22	2.7	1:17	2.3	1:11	2.1	1:09	1.9	1:07
500	3.7	1:42	3.4	1:36	3.0	1:28	2.7	1:25	2.5	1:22
600	4.5	2:02	4.1	1:55	3.6	1:45	3.2	1:42	3.0	1:38
700	5.2	2:22	4.8	2:14	4.2	2:02	3.8	1:58	3.5	1:54
800	6.0	2:43	5.5	2:33	4.8	2:19	4.4	2:14	4.1	2:09
900	6.7	3:03	6.2	2:52	5.5	2:37	4.9	2:31	4.6	2:25
1000	7.5	3:24	6.9	3:11	6.1	2:54	5.5	2:47	5.1	2:41
1100	8.2	3:45	7.6	3:31	6.7	3:11	6.1	3:04	5.7	2:57
1200	8.9	4:06	8.2	3:50	7.3	3:29	6.6	3:20	6.2	3:12
1300	9.7	4:27	8.9	4:10	7.9	3:47	7.2	3:37	6.7	3:28
1400	10.4	4:48	9.6	4:30	8.5	4:04	7.7	3:53	7.2	3:44
1500	11.1	5:10	10.3	4:50	9.1	4:22	8.3	4:10	7.7	4:01
1600	11.8	5:31	10.9	5:10	9.7	4:40	8.8	4:27	8.2	4:17
1700	12.5	5:53	11.6	5:30	10.3	4:58	9.4	4:43	8.7	4:33
1800	13.2	6:15	12.2	5:50	10.9	5:16	9.9	5:00	9.2	4:49
1900	13.9	6:37	12.9	6:11	11.5	5:34	10.4	5:17	9.7	5:05
2000	14.6	6:59	13.6	6:31	12.1	5:53	11.0	5:34	10.2	5:22

Long Range Cruise Enroute Fuel and Time - Low Altitudes

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	40	50	60	70	80
1	-0.1	0.0	0.0	0.1	0.1
2	-0.2	-0.1	0.0	0.1	0.3
3	-0.4	-0.2	0.0	0.2	0.5
4	-0.5	-0.2	0.0	0.3	0.6
5	-0.6	-0.3	0.0	0.4	0.8
6	-0.7	-0.4	0.0	0.5	1.0
7	-0.9	-0.4	0.0	0.6	1.2
8	-1.0	-0.5	0.0	0.7	1.4
9	-1.1	-0.6	0.0	0.8	1.6
10	-1.2	-0.6	0.0	0.9	1.8
11	-1.3	-0.7	0.0	1.0	1.9
12	-1.5	-0.8	0.0	1.1	2.1
13	-1.6	-0.9	0.0	1.2	2.3
14	-1.7	-0.9	0.0	1.3	2.5
15	-1.8	-1.0	0.0	1.4	2.7

Long Range Cruise Enroute Fuel and Time - High Altitudes

Ground to Air Miles Conversions

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
540	505	474	446	422	400	382	366	351	337	324
808	757	710	669	633	600	574	549	527	506	488
1078	1009	947	892	844	800	765	733	703	676	651
1348	1262	1184	1116	1055	1000	956	916	879	845	814
1619	1515	1421	1339	1266	1200	1148	1099	1055	1014	977
1890	1768	1658	1562	1477	1400	1339	1283	1231	1183	1140
2162	2023	1897	1786	1689	1600	1531	1466	1406	1352	1302
2435	2277	2135	2011	1900	1800	1722	1649	1582	1521	1465
2708	2532	2374	2235	2112	2000	1913	1832	1757	1689	1627
2982	2788	2612	2459	2324	2200	2104	2015	1933	1858	1789
3256	3044	2851	2684	2535	2400	2295	2198	2109	2026	1951
3532	3300	3091	2909	2747	2600	2486	2381	2283	2194	2113
3808	3557	3331	3133	2959	2800	2677	2563	2458	2362	2274
4085	3815	3571	3359	3171	3000	2868	2746	2633	2529	2435
4362	4072	3811	3584	3383	3200	3059	2928	2807	2697	2596
4639	4330	4051	3809	3595	3400	3250	3111	2982	2864	2757
4917	4588	4292	4035	3807	3600	3441	3293	3156	3031	2917
5196	4847	4533	4260	4019	3800	3631	3474	3330	3197	3077
5476	5107	4775	4487	4231	4000	3821	3656	3503	3364	3237
5757	5368	5017	4713	4444	4200	4012	3837	3677	3530	3396
6040	5629	5260	4939	4656	4400	4202	4019	3850	3695	3556
6322	5891	5503	5166	4869	4600	4392	4200	4023	3861	3714
6606	6153	5746	5393	5082	4800	4583	4381	4196	4026	3873
6892	6417	5990	5621	5295	5000	4773	4562	4368	4191	4031

Long Range Cruise Enroute Fuel and Time - High Altitudes

Reference Fuel And Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	29		31		33		35		37	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
400	1.9	1:06	1.8	1:04	1.8	1:02	1.7	1:01	1.7	1:01
600	3.0	1:37	2.9	1:34	2.8	1:31	2.7	1:29	2.6	1:28
800	4.0	2:07	3.9	2:03	3.8	1:59	3.6	1:57	3.5	1:55
1000	5.1	2:38	4.9	2:33	4.7	2:28	4.6	2:24	4.5	2:22
1200	6.1	3:10	5.9	3:03	5.7	2:57	5.5	2:53	5.4	2:49
1400	7.1	3:41	6.9	3:34	6.7	3:26	6.5	3:21	6.3	3:17
1600	8.1	4:13	7.9	4:05	7.6	3:56	7.4	3:49	7.2	3:44
1800	9.1	4:45	8.8	4:36	8.6	4:26	8.3	4:18	8.1	4:12
2000	10.1	5:17	9.8	5:07	9.5	4:56	9.2	4:47	9.0	4:40
2200	11.1	5:50	10.8	5:39	10.4	5:26	10.1	5:16	9.9	5:08
2400	12.0	6:22	11.7	6:11	11.4	5:57	11.0	5:45	10.8	5:36
2600	13.0	6:55	12.6	6:43	12.3	6:28	11.9	6:15	11.6	6:04
2800	13.9	7:28	13.6	7:15	13.2	6:59	12.8	6:45	12.5	6:33
3000	14.9	8:01	14.5	7:47	14.1	7:31	13.7	7:15	13.3	7:02
3200	15.8	8:35	15.4	8:20	14.9	8:03	14.5	7:46	14.1	7:31
3400	16.8	9:09	16.3	8:53	15.8	8:35	15.4	8:16	15.0	8:00
3600	17.7	9:42	17.2	9:26	16.7	9:07	16.2	8:48	15.8	8:30
3800	18.6	10:17	18.1	10:00	17.6	9:40	17.1	9:19	16.6	9:00
4000	19.5	10:51	19.0	10:33	18.4	10:12	17.9	9:51	17.4	9:30
4200	20.4	11:25	19.8	11:07	19.3	10:45	18.7	10:23	18.2	10:01
4400	21.3	12:00	20.7	11:41	20.1	11:19	19.5	10:55	19.0	10:31
4600	22.2	12:36	21.6	12:15	21.0	11:52	20.4	11:28	19.8	11:03
4800	23.1	13:11	22.4	12:49	21.8	12:26	21.2	12:01	20.6	11:34
5000	24.0	13:47	23.3	13:24	22.6	12:59	22.0	12:33	21.4	12:06

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	40	50	60	70	80
2	-0.3	-0.2	0.0	0.2	0.7
4	-0.5	-0.3	0.0	0.4	1.3
6	-0.8	-0.5	0.0	0.6	1.8
8	-1.1	-0.6	0.0	0.9	2.3
10	-1.4	-0.8	0.0	1.1	2.7
12	-1.7	-0.9	0.0	1.3	3.2
14	-2.0	-1.0	0.0	1.5	3.6
16	-2.4	-1.2	0.0	1.7	4.0
18	-2.7	-1.4	0.0	1.9	4.4
20	-3.0	-1.5	0.0	2.0	4.8
22	-3.4	-1.7	0.0	2.2	5.1
24	-3.8	-1.8	0.0	2.4	5.4
26	-4.1	-2.0	0.0	2.6	5.7
28	-4.5	-2.2	0.0	2.7	6.0
30	-4.9	-2.4	0.0	2.9	6.3

Long Range Cruise Wind-Altitude Trade

PRESSURE ALTITUDE (1000 FT)	CRUISE WEIGHT (1000 KG)									
	85	80	75	70	65	60	55	50	45	40
41					30	7	0	4	16	33
39				22	4	0	4	15	30	45
37		37	14	2	0	5	15	28	43	56
35	23	7	0	0	6	16	28	41	54	64
33	2	0	2	8	18	29	41	53	62	68
31	0	4	11	21	31	42	52	61	67	70
29	7	15	24	34	43	53	61	67	70	70
27	19	27	36	45	54	61	66	70	70	68
25	31	40	48	55	62	67	70	70	69	64

The above wind factor tables are for calculation of wind required to maintain present range capability at new pressure altitude, i.e., break-even wind.

Method:

1. **Read wind factors for present and new altitudes from table.**
2. **Determine difference (new altitude wind factor minus present altitude wind factor); This difference may be negative or positive.**
3. **Break-even wind at new altitude is present altitude wind plus difference from step 2.**

Descent

.78/280/250

PRESSURE ALTITUDE (FT)	TIME (MIN)	FUEL (KG)	DISTANCE (NM)			
			LANDING WEIGHT (1000 KG)			
			40	50	60	70
41000	27	340	102	119	133	142
39000	26	340	97	114	127	136
37000	25	330	92	108	121	130
35000	24	330	88	103	116	125
33000	24	320	84	99	111	120
31000	23	320	80	94	105	113
29000	22	310	75	88	98	106
27000	21	300	70	82	92	99
25000	20	300	66	77	86	92
23000	19	290	61	71	79	85
21000	18	280	57	66	73	78
19000	17	270	52	61	67	72
17000	15	250	48	55	61	65
15000	14	240	44	50	55	58
10000	11	200	30	34	37	39
5000	7	150	18	19	20	21
1500	4	110	9	9	9	9

Allowances for a straight-in approach are included.

Holding

Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)								
		1500	5000	10000	15000	20000	25000	30000	35000	41000
85	%N1	64.3	67.0	70.7	74.7	78.9	83.0	87.0		
	KIAS	250	251	252	253	255	257	260		
	FF/ENG	1500	1470	1460	1450	1430	1430	1460		
80	%N1	62.6	65.5	69.1	73.2	77.3	81.6	85.5		
	KIAS	242	243	244	245	247	249	252		
	FF/ENG	1420	1390	1380	1370	1340	1340	1360		
75	%N1	60.9	63.9	67.5	71.6	75.6	80.0	83.9	88.2	
	KIAS	235	236	236	238	239	241	243	247	
	FF/ENG	1340	1310	1300	1290	1260	1250	1270	1300	
70	%N1	59.2	62.0	65.9	69.8	73.9	78.3	82.3	86.5	
	KIAS	227	227	228	229	231	232	235	238	
	FF/ENG	1260	1240	1220	1200	1180	1160	1180	1200	
65	%N1	57.4	60.0	64.2	67.8	72.1	76.4	80.5	84.7	
	KIAS	219	219	220	221	222	224	226	228	
	FF/ENG	1180	1160	1140	1120	1100	1080	1090	1110	
60	%N1	55.6	58.1	62.1	65.9	70.1	74.3	78.6	82.7	
	KIAS	210	210	211	212	213	214	216	219	
	FF/ENG	1110	1080	1060	1040	1020	990	1010	1020	
55	%N1	53.6	56.1	59.8	64.0	67.9	72.2	76.5	80.7	87.9
	KIAS	200	201	202	203	204	205	207	209	212
	FF/ENG	1030	1000	980	960	940	920	920	930	980
50	%N1	51.4	53.9	57.5	61.7	65.5	69.9	74.0	78.4	85.5
	KIAS	192	192	192	193	194	195	196	198	201
	FF/ENG	950	920	900	880	860	860	850	850	890
45	%N1	49.1	51.5	55.1	58.9	63.1	67.2	71.4	75.9	82.9
	KIAS	185	185	185	185	185	185	186	187	190
	FF/ENG	880	850	840	820	800	780	770	770	800
40	%N1	46.6	48.9	52.5	56.1	60.4	64.2	68.6	73.0	80.1
	KIAS	178	178	178	178	178	178	178	178	178
	FF/ENG	820	790	760	740	720	710	700	690	710

This table includes 5% additional fuel for holding in a racetrack pattern.

Intentionally
Blank

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF15	ONE REV	NO REV

Dry Runway

BRAKING CONFIGURATION	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	ONE REV	NO REV
MAX MANUAL	1010	70/-60	25/30	-35/125	15/-10	25/-25	35	25	50
AUTOBRAKE MAX	1300	65/-75	30/40	-45/155	0/0	30/-30	60	0	5
AUTOBRAKE 3	1870	105/-120	50/65	-80/260	0/0	55/-55	100	0	0
AUTOBRAKE 2	2385	155/-170	75/95	-105/360	30/-45	70/-70	100	70	70
AUTOBRAKE 1	2640	185/-200	90/115	-125/425	70/-85	80/-80	95	240	335

Good Reported Braking Action

BRAKING CONFIGURATION	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	ONE REV	NO REV
MAX MANUAL	1395	80/-85	40/50	-60/210	35/-30	35/-35	50	75	175
AUTOBRAKE MAX	1485	85/-90	40/55	-65/215	30/-25	35/-40	55	85	190
AUTOBRAKE 3	1870	105/-120	50/65	-80/265	5/0	55/-55	100	5	15
AUTOBRAKE 2	2385	155/-170	75/95	-105/360	30/-45	70/-70	100	70	70
AUTOBRAKE 1	2640	185/-200	90/115	-125/425	70/-85	80/-80	95	240	335

Medium Reported Braking Action

BRAKING CONFIGURATION	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	ONE REV	NO REV
MAX MANUAL	1930	125/-130	60/80	-95/345	90/-70	55/-55	65	215	520
AUTOBRAKE MAX	1965	130/-135	60/85	-100/350	85/-65	55/-55	75	215	520
AUTOBRAKE 3	2065	130/-140	60/85	-100/360	65/-45	60/-60	100	150	450
AUTOBRAKE 2	2440	160/-175	75/100	-115/405	65/-65	70/-75	100	115	250
AUTOBRAKE 1	2655	185/-200	90/120	-130/440	90/-90	80/-80	95	255	395

Poor Reported Braking Action

BRAKING CONFIGURATION	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	ONE REV	NO REV
MAX MANUAL	2545	180/-185	85/120	-145/550	215/-140	70/-75	80	465	1245
AUTOBRAKE MAX	2545	185/-185	90/120	-145/550	220/-145	70/-75	80	465	1245
AUTOBRAKE 3	2560	185/-185	90/120	-145/550	210/-130	70/-75	95	465	1255
AUTOBRAKE 2	2730	190/-200	90/125	-155/565	200/-130	75/-80	100	375	1090
AUTOBRAKE 1	2855	205/-215	100/135	-160/585	205/-145	80/-85	95	440	1080

Reference distance is based on sea level, standard day, no wind or slope, VREF15 approach speed, two-engine detent No. 2 reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 60 m.
For autobrake and manual speedbrakes, increase reference landing distance by 55 m.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF30	ONE REV	NO REV

Dry Runway

MAX MANUAL	960	55/-55	20/30	-35/120	10/-10	20/-20	35	20	40
AUTOBRAKE MAX	1215	60/-65	30/35	-45/150	0/0	30/-30	55	0	5
AUTOBRAKE 3	1725	95/-110	45/60	-75/250	0/0	50/-50	95	0	0
AUTOBRAKE 2	2190	140/-150	65/90	-100/345	30/-40	65/-65	95	60	60
AUTOBRAKE 1	2415	165/-180	80/105	-120/405	65/-75	70/-70	85	195	290

Good Reported Braking Action

MAX MANUAL	1330	75/-80	35/45	-60/205	35/-30	35/-35	50	70	155
AUTOBRAKE MAX	1415	80/-85	40/50	-60/210	30/-25	35/-35	60	75	170
AUTOBRAKE 3	1725	95/-110	45/60	-75/250	5/0	50/-50	95	5	15
AUTOBRAKE 2	2190	140/-150	65/90	-100/345	30/-40	65/-65	95	60	60
AUTOBRAKE 1	2415	165/-180	80/105	-120/405	65/-75	70/-70	85	195	290

Medium Reported Braking Action

MAX MANUAL	1815	115/-120	55/75	-95/335	85/-65	50/-50	65	190	450
AUTOBRAKE MAX	1850	120/-125	55/75	-95/340	80/-60	50/-50	75	190	455
AUTOBRAKE 3	1925	120/-125	55/75	-95/345	65/-45	55/-55	95	140	410
AUTOBRAKE 2	2245	140/-155	70/90	-110/390	65/-60	65/-65	95	105	225
AUTOBRAKE 1	2430	165/-180	80/105	-120/420	85/-80	70/-75	85	210	350

Poor Reported Braking Action

MAX MANUAL	2365	165/-170	80/110	-140/530	205/-135	65/-70	75	400	1045
AUTOBRAKE MAX	2370	165/-170	80/110	-140/530	205/-135	65/-70	80	400	1050
AUTOBRAKE 3	2385	170/-170	80/110	-140/535	200/-125	65/-70	85	400	1055
AUTOBRAKE 2	2525	175/-180	85/115	-145/550	190/-125	70/-75	90	335	925
AUTOBRAKE 1	2630	185/-190	85/120	-150/565	195/-135	75/-80	85	380	930

Reference distance is based on sea level, standard day, no wind or slope, VREF30 approach speed, two-engine detent No. 2 reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 60 m.
For autobrake and manual speedbrakes, increase reference landing distance by 55 m.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 40

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF40	ONE REV	NO REV

Dry Runway

MAX MANUAL	915	55/-50	20/25	-35/115	10/-10	20/-20	35	15	35
AUTOBRAKE MAX	1135	55/-60	25/35	-40/140	0/0	25/-25	55	0	0
AUTOBRAKE 3	1590	85/-100	40/55	-70/235	0/0	45/-45	90	0	0
AUTOBRAKE 2	2030	125/-140	60/80	-95/330	20/-35	60/-60	95	35	35
AUTOBRAKE 1	2260	150/-165	75/95	-115/390	55/-65	65/-65	85	155	220

Good Reported Braking Action

MAX MANUAL	1270	70/-75	35/45	-55/200	35/-30	30/-30	50	65	140
AUTOBRAKE MAX	1350	75/-80	35/45	-60/205	30/-25	35/-35	60	70	150
AUTOBRAKE 3	1600	85/-100	40/55	-70/240	10/-5	45/-45	95	5	15
AUTOBRAKE 2	2030	125/-140	60/80	-95/330	20/-35	60/-60	95	35	35
AUTOBRAKE 1	2260	150/-165	75/95	-115/390	55/-65	65/-65	85	155	220

Medium Reported Braking Action

MAX MANUAL	1730	105/-115	50/70	-90/330	85/-65	45/-45	65	170	405
AUTOBRAKE MAX	1750	110/-120	55/70	-90/335	75/-60	45/-50	75	170	405
AUTOBRAKE 3	1800	110/-120	55/70	-95/340	70/-45	50/-50	90	150	390
AUTOBRAKE 2	2090	130/-145	60/85	-105/375	55/-55	60/-60	95	75	190
AUTOBRAKE 1	2275	150/-165	75/95	-115/405	80/-75	65/-65	85	170	275

Poor Reported Braking Action

MAX MANUAL	2245	155/-160	75/100	-140/520	200/-130	60/-65	75	360	930
AUTOBRAKE MAX	2250	155/-160	75/105	-140/520	200/-130	60/-65	75	360	930
AUTOBRAKE 3	2260	155/-165	75/105	-140/525	195/-125	60/-65	85	360	935
AUTOBRAKE 2	2370	160/-165	75/105	-140/535	185/-120	65/-70	90	290	830
AUTOBRAKE 1	2470	170/-180	80/110	-145/550	190/-130	70/-75	85	335	815

Reference distance is based on sea level, standard day, no wind or slope, VREF40 approach speed, two-engine detent No. 2 reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 55 m.
For autobrake and manual speedbrakes, increase reference landing distance by 45 m.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Airspeed Unreliable (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1075	80/-65	25/35	-40/130	15/-10	25/-25	N/A	30	60
AUTOBRAKE MAX	1435	70/-80	35/45	-50/165	5/-5	35/-35	N/A	0	5
AUTOBRAKE 2	2550	165/-180	85/110	-110/370	50/-55	75/-75	N/A	165	180

Good Reported Braking Action

MAX MANUAL	1475	80/-85	40/55	-60/215	35/-30	40/-40	N/A	90	205
AUTOBRAKE MAX	1600	85/-95	45/60	-65/225	30/-25	40/-40	N/A	100	230
AUTOBRAKE 2	2550	165/-180	85/110	-110/370	55/-55	75/-75	N/A	165	180

Medium Reported Braking Action

MAX MANUAL	2025	130/-135	65/85	-100/350	90/-70	55/-55	N/A	240	595
AUTOBRAKE MAX	2080	130/-140	65/90	-100/355	85/-65	55/-60	N/A	245	605
AUTOBRAKE 3	2255	135/-145	70/90	-105/370	60/-45	65/-65	N/A	145	460

Poor Reported Braking Action

MAX MANUAL	2635	185/-190	90/125	-145/550	210/-140	75/-80	N/A	505	1385
AUTOBRAKE MAX	2635	185/-190	90/125	-145/550	210/-135	75/-80	N/A	500	1380
AUTOBRAKE 3	2685	185/-190	90/125	-150/555	195/-125	75/-80	N/A	485	1375

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Airspeed Unreliable (Flaps 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1025	60/-60	25/30	-35/125	15/-10	25/-25	N/A	25	55
AUTOBRAKE MAX	1335	60/-70	30/40	-45/155	5/-5	30/-35	N/A	0	5
AUTOBRAKE 2	2345	150/-160	75/95	-105/355	45/-50	70/-70	N/A	140	160

Good Reported Braking Action

MAX MANUAL	1415	75/-80	40/50	-60/210	35/-30	35/-35	N/A	80	185
AUTOBRAKE MAX	1525	80/-90	40/55	-65/220	30/-30	40/-40	N/A	90	205
AUTOBRAKE 2	2345	150/-160	75/95	-105/355	45/-50	70/-70	N/A	140	160

Medium Reported Braking Action

MAX MANUAL	1915	120/-125	60/80	-95/340	85/-70	50/-55	N/A	215	520
AUTOBRAKE MAX	1965	120/-130	60/80	-95/345	80/-65	55/-55	N/A	215	530
AUTOBRAKE 3	2100	120/-135	60/85	-100/360	60/-50	60/-60	N/A	135	420

Poor Reported Braking Action

MAX MANUAL	2460	170/-170	85/115	-140/535	200/-130	65/-70	N/A	435	1165
AUTOBRAKE MAX	2470	170/-175	85/115	-140/535	200/-125	70/-75	N/A	430	1160
AUTOBRAKE 3	2510	170/-175	85/115	-145/540	190/-125	70/-75	N/A	425	1165

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Airspeed Unreliable (Flaps 40)

VREF40

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	985	55/-55	20/30	-35/120	15/-10	20/-20	N/A	20	45
AUTOBRAKE MAX	1245	55/-65	30/35	-45/150	5/0	30/-30	N/A	0	0
AUTOBRAKE 2	2195	135/-150	70/90	-100/340	40/-45	65/-65	N/A	105	110

Good Reported Braking Action

MAX MANUAL	1360	70/-80	35/50	-60/205	35/-30	35/-35	N/A	75	170
AUTOBRAKE MAX	1455	75/-85	40/50	-60/215	30/-25	35/-35	N/A	85	185
AUTOBRAKE 2	2195	135/-150	70/90	-100/340	40/-45	65/-65	N/A	105	110

Medium Reported Braking Action

MAX MANUAL	1830	110/-120	55/75	-95/335	85/-65	50/-50	N/A	195	465
AUTOBRAKE MAX	1870	115/-125	60/80	-95/340	80/-60	50/-50	N/A	195	475
AUTOBRAKE 3	1965	115/-125	60/80	-100/350	60/-50	55/-55	N/A	135	405

Poor Reported Braking Action

MAX MANUAL	2345	160/-165	80/110	-140/525	195/-130	65/-70	N/A	395	1035
AUTOBRAKE MAX	2355	160/-165	80/110	-140/525	195/-125	65/-70	N/A	390	1035
AUTOBRAKE 3	2380	160/-165	80/110	-140/530	190/-125	65/-70	N/A	395	1045

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

All Flaps Up Landing

VREF40 + 55

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1330	185/-85	50/105	-45/205	20/-15	35/-35	45	45	95
AUTOBRAKE MAX	1855	85/-90	45/70	-60/195	5/-5	50/-50	75	5	20
AUTOBRAKE 2	3360	195/-225	115/150	-130/430	75/-85	105/-105	100	280	330

Good Reported Braking Action

MAX MANUAL	1755	85/-95	50/65	-65/230	40/-35	45/-50	45	110	255
AUTOBRAKE MAX	2000	90/-100	55/75	-75/245	30/-25	55/-55	70	85	225
AUTOBRAKE 2	3360	195/-225	115/150	-130/430	75/-85	105/-105	100	280	330

Medium Reported Braking Action

MAX MANUAL	2495	145/-155	80/110	-110/385	105/-85	70/-75	65	315	775
AUTOBRAKE MAX	2580	150/-160	85/115	-110/390	100/-80	75/-75	75	325	800
AUTOBRAKE 3	2950	145/-170	90/120	-120/420	65/-60	90/-90	110	165	510

Poor Reported Braking Action

MAX MANUAL	3320	220/-225	120/165	-165/605	250/-170	95/-100	80	690	1915
AUTOBRAKE MAX	3325	215/-225	120/165	-165/605	245/-160	100/-100	90	685	1905
AUTOBRAKE 3	3445	210/-225	120/165	-170/615	220/-150	100/-105	110	600	1840

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

ANTISKID INOPERATIVE (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1795	105/-110	50/65	-80/290	55/-45	45/-45	60	145	345
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	2015	125/-130	60/80	-100/350	85/-65	50/-55	70	215	530
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2585	180/-180	85/120	-145/545	200/-135	70/-75	80	460	1280
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	3450	260/-260	120/175	-245/1005	625/-305	85/-105	95	1100	3915
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
ANTISKID INOPERATIVE (Flaps 30)
VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1695	95/-105	45/60	-80/280	55/-45	40/-45	60	125	300
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1895	115/-120	55/75	-95/340	80/-65	50/-50	65	185	455
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2415	165/-165	80/105	-140/530	190/-125	65/-70	80	395	1075
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	3205	235/-235	110/155	-235/980	590/-285	75/-100	90	945	3215
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

ANTISKID INOPERATIVE (Flaps 40)

VREF40

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1615	90/-100	45/60	-80/275	55/-45	40/-40	60	115	265
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1805	105/-115	50/70	-95/335	80/-60	45/-45	65	170	405
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2290	150/-155	70/100	-140/520	185/-120	60/-65	80	355	950
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	3040	220/-225	100/145	-230/960	575/-275	70/-95	85	860	2860
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Jammed or Restricted Flight Controls (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1005	70/-60	25/30	-35/125	10/-10	20/-25	35	25	50
AUTOBRAKE MAX	1310	65/-75	30/40	-45/155	5/-5	30/-30	65	0	5
AUTOBRAKE 2	2360	155/-170	75/100	-105/355	35/-50	70/-70	95	100	100

Good Reported Braking Action

MAX MANUAL	1380	75/-80	35/50	-60/205	35/-30	35/-35	50	80	185
AUTOBRAKE MAX	1485	85/-90	40/55	-60/215	30/-25	35/-35	55	90	205
AUTOBRAKE 2	2360	155/-170	75/100	-105/355	35/-50	70/-70	95	100	100

Medium Reported Braking Action

MAX MANUAL	1900	125/-130	60/80	-95/340	85/-65	50/-55	65	225	550
AUTOBRAKE MAX	1935	125/-130	60/80	-95/345	80/-65	50/-55	75	225	555
AUTOBRAKE 3	2055	125/-135	60/85	-100/355	60/-40	55/-60	100	145	465

Poor Reported Braking Action

MAX MANUAL	2480	180/-180	85/120	-145/540	205/-135	70/-75	75	475	1310
AUTOBRAKE MAX	2480	180/-180	85/120	-145/540	205/-135	70/-75	80	475	1305
AUTOBRAKE 3	2500	180/-180	85/120	-145/540	200/-120	70/-75	95	475	1310

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

LEADING EDGE FLAPS TRANSIT (Flaps 15)

VREF15 + 15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1130	80/-70	25/35	-40/135	15/-15	25/-25	35	30	70
AUTOBRAKE MAX	1500	70/-80	35/45	-50/170	5/-5	40/-40	65	0	5
AUTOBRAKE 2	2725	175/-190	90/115	-115/385	50/-60	85/-85	100	155	160

Good Reported Braking Action

MAX MANUAL	1570	85/-95	45/60	-65/220	40/-35	40/-40	50	105	240
AUTOBRAKE MAX	1690	90/-100	45/60	-65/230	35/-30	45/-45	60	115	260
AUTOBRAKE 2	2730	175/-190	90/115	-115/385	50/-60	85/-85	100	160	160

Medium Reported Braking Action

MAX MANUAL	2170	140/-145	70/95	-100/365	95/-75	60/-60	70	275	695
AUTOBRAKE MAX	2210	140/-150	70/95	-105/365	90/-70	60/-65	75	280	700
AUTOBRAKE 3	2375	140/-150	75/100	-110/380	65/-45	70/-70	110	175	570

Poor Reported Braking Action

MAX MANUAL	2825	200/-205	100/140	-155/570	225/-150	80/-85	80	580	1620
AUTOBRAKE MAX	2825	200/-205	100/140	-155/570	230/-155	80/-85	85	575	1615
AUTOBRAKE 3	2855	200/-200	100/140	-155/570	215/-130	80/-85	100	565	1615

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

LOSS OF SYSTEM A (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

BRAKING CONFIGURATION	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	ONE REV	NO REV
MAX MANUAL	1120	70/-65	25/35	-40/135	15/-15	25/-25	45	35	60
AUTOBRAKE MAX	1300	65/-75	30/40	-45/155	0/0	30/-30	60	0	10
AUTOBRAKE 2	2465	150/-175	75/95	-110/365	0/-10	75/-75	140	0	0

Good Reported Braking Action

BRAKING CONFIGURATION	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	ONE REV	NO REV
MAX MANUAL	1620	95/-100	45/60	-70/235	50/-40	40/-45	70	135	275
AUTOBRAKE MAX	1630	95/-105	45/65	-70/235	40/-35	45/-45	75	135	275
AUTOBRAKE 2	2465	150/-175	75/95	-110/365	0/-10	75/-75	140	0	0

Medium Reported Braking Action

BRAKING CONFIGURATION	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	ONE REV	NO REV
MAX MANUAL	2235	150/-155	75/100	-110/380	115/-90	60/-65	90	350	840
AUTOBRAKE MAX	2220	150/-155	75/100	-105/380	120/-95	60/-65	90	345	830
AUTOBRAKE 3	2220	150/-155	75/100	-105/380	120/-85	60/-65	90	345	830

Poor Reported Braking Action

BRAKING CONFIGURATION	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	ONE REV	NO REV
MAX MANUAL	2905	215/-215	105/145	-160/590	265/-175	80/-85	105	710	2025
AUTOBRAKE MAX	2900	215/-215	105/150	-160/590	265/-180	80/-85	105	710	2025
AUTOBRAKE 3	2900	215/-215	105/150	-160/590	265/-180	80/-85	105	710	2025

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

LOSS OF SYSTEM A (Flaps 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1060	65/-55	25/35	-40/130	15/-15	25/-25	45	30	50
AUTOBRAKE MAX	1215	60/-65	30/35	-45/145	0/0	30/-30	55	10	15
AUTOBRAKE 2	2260	135/-155	65/85	-105/350	0/-10	70/-70	135	0	0

Good Reported Braking Action

MAX MANUAL	1535	85/-95	45/60	-65/225	45/-40	40/-40	70	120	240
AUTOBRAKE MAX	1550	90/-95	45/60	-65/230	40/-35	40/-40	75	120	240
AUTOBRAKE 2	2260	135/-155	65/85	-105/350	0/-10	70/-70	135	0	0

Medium Reported Braking Action

MAX MANUAL	2090	135/-140	65/90	-105/370	110/-85	55/-60	85	305	710
AUTOBRAKE MAX	2085	135/-140	70/90	-105/370	115/-90	55/-60	90	300	705
AUTOBRAKE 3	2085	135/-140	70/90	-105/370	115/-80	55/-60	90	300	705

Poor Reported Braking Action

MAX MANUAL	2695	195/-195	95/130	-155/570	250/-165	75/-80	100	605	1650
AUTOBRAKE MAX	2695	195/-195	95/135	-155/570	250/-165	75/-80	100	605	1650
AUTOBRAKE 3	2695	195/-195	95/135	-155/570	250/-165	75/-80	100	605	1650

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
LOSS OF SYSTEM A (Flaps 40)
VREF40

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1015	60/-55	25/30	-35/125	15/-15	25/-25	50	30	45
AUTOBRAKE MAX	1140	55/-60	25/35	-40/140	5/0	25/-25	55	10	20
AUTOBRAKE 2	2075	125/-140	60/80	-100/335	0/-5	60/-60	130	0	0

Good Reported Braking Action

MAX MANUAL	1460	80/-90	40/55	-65/225	45/-40	35/-40	70	105	210
AUTOBRAKE MAX	1470	85/-90	40/55	-65/225	40/-35	40/-40	75	105	210
AUTOBRAKE 2	2075	125/-140	60/80	-100/335	0/-5	60/-60	130	0	0

Medium Reported Braking Action

MAX MANUAL	1970	125/-135	60/85	-100/360	105/-85	55/-55	85	265	615
AUTOBRAKE MAX	1970	125/-135	60/85	-100/360	110/-85	55/-55	85	265	615
AUTOBRAKE 3	1970	125/-135	60/85	-100/360	110/-80	55/-55	90	265	615

Poor Reported Braking Action

MAX MANUAL	2525	180/-185	85/120	-150/560	240/-155	70/-75	95	525	1400
AUTOBRAKE MAX	2530	180/-185	90/125	-150/560	245/-160	70/-75	95	530	1405
AUTOBRAKE 3	2530	180/-185	90/125	-150/560	245/-160	70/-75	95	530	1405

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

LOSS OF SYSTEM A AND SYSTEM B (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1570	80/-90	40/50	-60/195	35/-35	40/-40	75	-10	65
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	2290	135/-145	65/90	-100/335	100/-80	60/-60	105	95	440
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	3035	200/-210	100/140	-150/525	215/-160	80/-85	120	365	1415
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	3770	275/-275	135/190	-210/785	475/-270	100/-110	130	815	3380
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
LOSS OF SYSTEM B (Flaps 15)
VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1140	55/-60	25/35	-45/145	20/-15	25/-25	40	40	70
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1630	95/-100	45/65	-75/255	50/-45	45/-45	60	140	285
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2215	150/-155	70/100	-115/410	125/-95	60/-65	75	340	815
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	2835	210/-210	100/140	-170/640	295/-180	75/-85	90	665	1870
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

MANUAL REVERSION (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1570	80/-90	40/50	-60/195	35/-35	40/-40	75	-10	65
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	2290	135/-145	65/90	-100/335	100/-80	60/-60	105	95	440
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	3035	200/-210	100/140	-150/525	215/-160	80/-85	120	365	1415
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	3770	275/-275	135/190	-210/785	475/-270	100/-110	130	815	3380
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

One Engine Inoperative Landing (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1020	75/-65	25/30	-35/130	15/-10	25/-25	35	0	25
AUTOBRAKE MAX	1300	70/-75	30/40	-45/155	0/0	30/-30	60	0	0
AUTOBRAKE 2	2450	150/-170	75/95	-110/365	10/-25	75/-75	120	0	0

Good Reported Braking Action

MAX MANUAL	1440	80/-85	40/50	-65/215	40/-35	40/-40	50	0	100
AUTOBRAKE MAX	1545	85/-95	40/55	-65/225	35/-30	40/-40	60	0	110
AUTOBRAKE 2	2450	150/-170	75/95	-110/365	10/-25	75/-75	120	0	0

Medium Reported Braking Action

MAX MANUAL	2075	135/-140	65/85	-105/370	110/-85	60/-60	70	0	310
AUTOBRAKE MAX	2115	135/-145	65/85	-105/375	105/-80	60/-60	80	0	315
AUTOBRAKE 3	2165	135/-150	65/85	-105/380	90/-65	60/-65	100	0	295

Poor Reported Braking Action

MAX MANUAL	2850	200/-210	95/130	-165/605	290/-185	85/-85	90	0	765
AUTOBRAKE MAX	2850	200/-210	95/130	-165/605	290/-185	85/-85	95	0	765
AUTOBRAKE 3	2875	205/-210	95/130	-165/610	280/-180	85/-85	100	0	775

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

One Engine Inoperative Landing (Flaps 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	970	60/-55	20/30	-35/125	15/-10	20/-20	35	0	25
AUTOBRAKE MAX	1215	60/-65	30/35	-45/150	0/0	30/-30	55	0	0
AUTOBRAKE 2	2240	135/-150	65/85	-105/350	10/-25	65/-65	110	0	0

Good Reported Braking Action

MAX MANUAL	1370	75/-80	35/50	-60/210	35/-30	35/-35	50	0	90
AUTOBRAKE MAX	1465	80/-90	40/50	-65/220	35/-30	35/-40	60	0	100
AUTOBRAKE 2	2240	135/-150	65/85	-105/350	10/-25	65/-65	110	0	0

Medium Reported Braking Action

MAX MANUAL	1940	120/-130	60/80	-100/360	105/-80	55/-55	70	0	265
AUTOBRAKE MAX	1975	125/-135	60/80	-100/365	95/-75	55/-55	80	0	270
AUTOBRAKE 3	2015	125/-135	60/80	-105/365	90/-65	55/-60	90	0	260

Poor Reported Braking Action

MAX MANUAL	2625	180/-190	85/115	-155/585	265/-170	75/-80	85	0	635
AUTOBRAKE MAX	2625	180/-190	85/115	-155/585	270/-165	75/-80	90	0	635
AUTOBRAKE 3	2655	185/-190	90/120	-160/585	260/-170	75/-80	90	0	640

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Stabilizer Trim Inoperative (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1005	70/-60	25/30	-35/125	10/-10	20/-25	35	25	50
AUTOBRAKE MAX	1310	65/-75	30/40	-45/155	5/-5	30/-30	65	0	5
AUTOBRAKE 2	2360	155/-170	75/100	-105/355	35/-50	70/-70	95	100	100

Good Reported Braking Action

MAX MANUAL	1380	75/-80	35/50	-60/205	35/-30	35/-35	50	80	185
AUTOBRAKE MAX	1485	85/-90	40/55	-60/215	30/-25	35/-35	55	90	205
AUTOBRAKE 2	2360	155/-170	75/100	-105/355	35/-50	70/-70	95	100	100

Medium Reported Braking Action

MAX MANUAL	1900	125/-130	60/80	-95/340	85/-65	50/-55	65	225	550
AUTOBRAKE MAX	1935	125/-130	60/80	-95/345	80/-65	50/-55	75	225	555
AUTOBRAKE 3	2055	125/-135	60/85	-100/355	60/-40	55/-60	100	145	465

Poor Reported Braking Action

MAX MANUAL	2480	180/-180	85/120	-145/540	205/-135	70/-75	75	475	1310
AUTOBRAKE MAX	2480	180/-180	85/120	-145/540	205/-135	70/-75	80	475	1305
AUTOBRAKE 3	2500	180/-180	85/120	-145/540	200/-120	70/-75	95	475	1310

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Asymmetry (1 ≤ Flap Lever <15)

VREF40 + 30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1110	90/-65	25/40	-40/135	15/-15	25/-25	35	30	60
AUTOBRAKE MAX	1510	70/-75	35/45	-50/170	5/-5	40/-40	65	0	5
AUTOBRAKE 2	2730	165/-185	90/115	-115/385	55/-60	85/-85	100	165	175

Good Reported Braking Action

MAX MANUAL	1525	80/-85	40/55	-60/215	35/-30	40/-40	45	90	210
AUTOBRAKE MAX	1665	80/-90	45/60	-65/225	30/-25	45/-45	65	95	225
AUTOBRAKE 2	2735	160/-185	90/115	-115/385	55/-65	85/-85	95	165	175

Medium Reported Braking Action

MAX MANUAL	2125	125/-135	70/90	-100/360	90/-75	60/-60	65	255	625
AUTOBRAKE MAX	2180	130/-140	70/95	-100/360	85/-70	60/-60	75	260	640
AUTOBRAKE 3	2385	125/-140	70/95	-110/380	60/-45	70/-70	110	150	470

Poor Reported Braking Action

MAX MANUAL	2795	190/-195	100/135	-150/565	220/-150	80/-85	80	545	1510
AUTOBRAKE MAX	2790	185/-195	100/135	-150/565	220/-145	80/-85	85	540	1500
AUTOBRAKE 3	2845	185/-190	100/135	-155/570	205/-130	80/-85	105	525	1495

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Asymmetry (Flap Lever 15 or 25)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1005	70/-60	25/30	-35/125	10/-10	20/-25	35	25	50
AUTOBRAKE MAX	1310	65/-75	30/40	-45/155	5/-5	30/-30	65	0	5
AUTOBRAKE 2	2360	155/-170	75/100	-105/355	35/-50	70/-70	95	100	100

Good Reported Braking Action

MAX MANUAL	1380	75/-80	35/50	-60/205	35/-30	35/-35	50	80	185
AUTOBRAKE MAX	1485	85/-90	40/55	-60/215	30/-25	35/-35	55	90	205
AUTOBRAKE 2	2360	155/-170	75/100	-105/355	35/-50	70/-70	95	100	100

Medium Reported Braking Action

MAX MANUAL	1900	125/-130	60/80	-95/340	85/-65	50/-55	65	225	550
AUTOBRAKE MAX	1935	125/-130	60/80	-95/345	80/-65	50/-55	75	225	555
AUTOBRAKE 3	2055	125/-135	60/85	-100/355	60/-40	55/-60	100	145	465

Poor Reported Braking Action

MAX MANUAL	2480	180/-180	85/120	-145/540	205/-135	70/-75	75	475	1310
AUTOBRAKE MAX	2480	180/-180	85/120	-145/540	205/-135	70/-75	80	475	1305
AUTOBRAKE 3	2500	180/-180	85/120	-145/540	200/-120	70/-75	95	475	1310

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Asymmetry (Flap Lever 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	960	55/-55	20/30	-35/120	10/-10	20/-20	35	20	45
AUTOBRAKE MAX	1215	60/-65	30/35	-45/150	5/0	30/-30	60	0	5
AUTOBRAKE 2	2165	140/-150	65/90	-100/340	30/-45	65/-65	90	85	85

Good Reported Braking Action

MAX MANUAL	1315	70/-75	35/45	-60/200	30/-30	35/-35	50	75	165
AUTOBRAKE MAX	1410	75/-85	35/50	-60/210	30/-25	35/-35	60	80	185
AUTOBRAKE 2	2165	140/-150	65/90	-100/340	35/-45	65/-65	90	85	85

Medium Reported Braking Action

MAX MANUAL	1790	115/-120	55/75	-90/330	80/-65	50/-50	65	195	480
AUTOBRAKE MAX	1820	115/-120	55/75	-95/335	75/-60	50/-50	70	200	480
AUTOBRAKE 3	1910	115/-125	55/75	-95/345	60/-40	50/-55	95	140	425

Poor Reported Braking Action

MAX MANUAL	2315	160/-165	80/105	-140/525	195/-125	60/-65	75	410	1100
AUTOBRAKE MAX	2320	165/-165	80/110	-140/525	195/-130	65/-70	75	410	1100
AUTOBRAKE 3	2335	165/-165	80/110	-140/525	190/-115	65/-70	90	410	1110

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Disagree (1 ≤ Indicated Flaps <15)

VREF40 + 30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	1110	90/-65	25/40	-40/135	15/-15	25/-25	35	30	60
AUTOBRAKE MAX	1510	70/-75	35/45	-50/170	5/-5	40/-40	65	0	5
AUTOBRAKE 2	2730	165/-185	90/115	-115/385	55/-60	85/-85	100	165	175
Good Reported Braking Action									
MAX MANUAL	1525	80/-85	40/55	-60/215	35/-30	40/-40	45	90	210
AUTOBRAKE MAX	1665	80/-90	45/60	-65/225	30/-25	45/-45	65	95	225
AUTOBRAKE 2	2735	160/-185	90/115	-115/385	55/-65	85/-85	95	165	175
Medium Reported Braking Action									
MAX MANUAL	2125	125/-135	70/90	-100/360	90/-75	60/-60	65	255	625
AUTOBRAKE MAX	2180	130/-140	70/95	-100/360	85/-70	60/-60	75	260	640
AUTOBRAKE 3	2385	125/-140	70/95	-110/380	60/-45	70/-70	110	150	470
Poor Reported Braking Action									
MAX MANUAL	2795	190/-195	100/135	-150/565	220/-150	80/-85	80	545	1510
AUTOBRAKE MAX	2790	185/-195	100/135	-150/565	220/-145	80/-85	85	540	1500
AUTOBRAKE 3	2845	185/-190	100/135	-155/570	205/-130	80/-85	105	525	1495

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Disagree (15 ≤ Indicated Flaps <30)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1005	70/-60	25/30	-35/125	10/-10	20/-25	35	25	50
AUTOBRAKE MAX	1310	65/-75	30/40	-45/155	5/-5	30/-30	65	0	5
AUTOBRAKE 2	2360	155/-170	75/100	-105/355	35/-50	70/-70	95	100	100

Good Reported Braking Action

MAX MANUAL	1380	75/-80	35/50	-60/205	35/-30	35/-35	50	80	185
AUTOBRAKE MAX	1485	85/-90	40/55	-60/215	30/-25	35/-35	55	90	205
AUTOBRAKE 2	2360	155/-170	75/100	-105/355	35/-50	70/-70	95	100	100

Medium Reported Braking Action

MAX MANUAL	1900	125/-130	60/80	-95/340	85/-65	50/-55	65	225	550
AUTOBRAKE MAX	1935	125/-130	60/80	-95/345	80/-65	50/-55	75	225	555
AUTOBRAKE 3	2055	125/-135	60/85	-100/355	60/-40	55/-60	100	145	465

Poor Reported Braking Action

MAX MANUAL	2480	180/-180	85/120	-145/540	205/-135	70/-75	75	475	1310
AUTOBRAKE MAX	2480	180/-180	85/120	-145/540	205/-135	70/-75	80	475	1305
AUTOBRAKE 3	2500	180/-180	85/120	-145/540	200/-120	70/-75	95	475	1310

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Disagree (30 ≤ Indicated Flaps <40)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	960	55/-55	20/30	-35/120	10/-10	20/-20	35	20	45
AUTOBRAKE MAX	1215	60/-65	30/35	-45/150	5/0	30/-30	60	0	5
AUTOBRAKE 2	2165	140/-150	65/90	-100/340	30/-45	65/-65	90	85	85

Good Reported Braking Action

MAX MANUAL	1315	70/-75	35/45	-60/200	30/-30	35/-35	50	75	165
AUTOBRAKE MAX	1410	75/-85	35/50	-60/210	30/-25	35/-35	60	80	185
AUTOBRAKE 2	2165	140/-150	65/90	-100/340	35/-45	65/-65	90	85	85

Medium Reported Braking Action

MAX MANUAL	1790	115/-120	55/75	-90/330	80/-65	50/-50	65	195	480
AUTOBRAKE MAX	1820	115/-120	55/75	-95/335	75/-60	50/-50	70	200	480
AUTOBRAKE 3	1910	115/-125	55/75	-95/345	60/-40	50/-55	95	140	425

Poor Reported Braking Action

MAX MANUAL	2315	160/-165	80/105	-140/525	195/-125	60/-65	75	410	1100
AUTOBRAKE MAX	2320	165/-165	80/110	-140/525	195/-130	65/-70	75	410	1100
AUTOBRAKE 3	2335	165/-165	80/110	-140/525	190/-115	65/-70	90	410	1110

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flaps Up Landing

VREF40 + 40

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1185	110/-70	30/70	-40/140	15/-15	30/-30	45	30	70
AUTOBRAKE MAX	1645	75/-80	40/55	-55/180	5/-5	40/-45	70	5	10
AUTOBRAKE 2	2970	175/-195	100/130	-120/400	65/-70	90/-90	95	205	235

Good Reported Braking Action

MAX MANUAL	1600	80/-90	45/60	-65/220	35/-30	40/-45	45	90	205
AUTOBRAKE MAX	1795	85/-95	50/65	-70/235	25/-25	45/-50	65	80	200
AUTOBRAKE 2	2970	175/-195	100/130	-120/400	65/-70	90/-90	95	205	235

Medium Reported Braking Action

MAX MANUAL	2255	135/-140	70/95	-105/365	95/-75	65/-65	65	260	625
AUTOBRAKE MAX	2330	135/-145	75/100	-105/370	90/-75	65/-65	70	265	645
AUTOBRAKE 3	2605	135/-155	80/105	-115/395	60/-55	75/-80	105	145	435

Poor Reported Braking Action

MAX MANUAL	2990	200/-205	105/145	-155/580	230/-155	85/-90	80	565	1530
AUTOBRAKE MAX	2995	195/-205	105/145	-155/580	230/-150	85/-90	90	560	1520
AUTOBRAKE 3	3080	190/-205	105/145	-160/585	210/-140	90/-95	100	520	1495

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Recommended Brake Cooling Schedule

Reference Brake Energy Per Brake (Millions of Foot Pounds)

		WIND CORRECTED BRAKES ON SPEED (KIAS)*																	
		80			100			120			140			160			180		
WEIGHT (1000 KG)	OAT (°C)	PRESSURE ALTITUDE (1000 FT)																	
		0	5	10	0	5	10	0	5	10	0	5	10	0	5	10	0	5	10
80	0	15.1	17.0	19.3	22.4	25.3	28.9	30.9	35.0	40.2	40.4	45.9	53.0	50.8	57.9	67.3	60.8	69.6	81.2
	10	15.6	17.6	20.0	23.1	26.1	29.8	31.9	36.2	41.5	41.8	47.5	54.8	52.5	59.9	69.5	62.8	71.9	83.9
	15	15.8	17.8	20.2	23.5	26.5	30.3	32.4	36.7	42.1	42.4	48.2	55.6	53.3	60.7	70.5	63.7	72.9	85.1
	20	16.0	18.1	20.5	23.8	26.9	30.7	32.8	37.2	42.7	42.9	48.8	56.3	54.0	61.5	71.4	64.6	73.9	86.2
	30	16.4	18.5	21.1	24.4	27.6	31.5	33.7	38.2	43.8	44.0	50.0	57.7	55.3	63.1	73.2	66.2	75.7	88.4
	40	16.6	18.7	21.3	24.7	27.9	31.9	34.1	38.7	44.4	44.7	50.9	58.8	56.3	64.3	74.8	67.5	77.4	90.5
	50	16.6	18.7	21.3	24.8	28.0	32.1	34.3	39.0	44.9	45.2	51.5	59.7	57.1	65.4	76.3	68.7	79.0	92.9
70	0	13.7	15.4	17.5	20.2	22.8	26.0	27.7	31.3	35.9	36.1	41.0	47.2	45.3	51.6	59.7	54.9	62.7	72.9
	10	14.2	15.9	18.1	20.8	23.5	26.8	28.6	32.4	37.1	37.3	42.3	48.7	46.8	53.3	61.6	56.7	64.8	75.4
	15	14.4	16.2	18.4	21.1	23.9	27.2	29.0	32.8	37.6	37.8	43.0	49.4	47.5	54.0	62.5	57.5	65.7	76.4
	20	14.6	16.4	18.6	21.4	24.2	27.6	29.4	33.3	38.1	38.4	43.5	50.1	48.1	54.8	63.4	58.3	66.5	77.4
	30	14.9	16.8	19.1	22.0	24.8	28.3	30.2	34.1	39.1	39.3	44.6	51.4	49.3	56.1	64.9	59.8	68.2	79.4
	40	15.1	17.0	19.3	22.2	25.1	28.6	30.5	34.6	39.6	39.9	45.3	52.2	50.1	57.1	66.2	60.9	69.6	81.2
	50	15.1	17.0	19.3	22.3	25.2	28.8	30.7	34.8	40.0	40.2	45.8	52.9	50.7	58.0	67.4	61.8	70.9	83.0
60	0	12.3	13.9	15.7	18.0	20.3	23.1	24.4	27.6	31.6	31.7	35.9	41.2	39.6	45.0	51.8	48.1	54.8	63.5
	10	12.7	14.3	16.3	18.5	20.9	23.8	25.2	28.5	32.6	32.7	37.1	42.6	40.9	46.5	53.6	49.7	56.6	65.6
	15	12.9	14.6	16.5	18.8	21.2	24.2	25.6	29.0	33.1	33.2	37.6	43.2	41.5	47.1	54.4	50.4	57.4	66.5
	20	13.1	14.8	16.7	19.1	21.5	24.5	26.0	29.4	33.5	33.6	38.1	43.8	42.0	47.8	55.1	51.1	58.2	67.4
	30	13.4	15.1	17.2	19.6	22.1	25.1	26.6	30.1	34.4	34.5	39.1	44.9	43.1	49.0	56.5	52.3	59.6	69.1
	40	13.6	15.3	17.3	19.8	22.3	25.4	26.9	30.5	34.9	35.0	39.7	45.6	43.8	49.8	57.5	53.2	60.7	70.5
	50	13.5	15.3	17.3	19.8	22.4	25.5	27.0	30.6	35.1	35.2	40.0	46.0	44.2	50.4	58.3	53.9	61.7	71.9
50	0	11.0	12.3	14.0	15.7	17.7	20.2	21.2	23.9	27.3	27.2	30.8	35.3	33.8	38.3	44.1	40.9	46.4	53.6
	10	11.3	12.7	14.4	16.3	18.3	20.8	21.9	24.7	28.2	28.1	31.8	36.5	34.9	39.6	45.5	42.2	48.0	55.4
	15	11.5	12.9	14.7	16.5	18.6	21.1	22.2	25.1	28.6	28.6	32.3	37.0	35.4	40.2	46.2	42.8	48.7	56.2
	20	11.6	13.1	14.9	16.7	18.9	21.4	22.5	25.4	29.0	28.9	32.8	37.5	35.9	40.7	46.8	43.4	49.3	56.9
	30	11.9	13.4	15.2	17.2	19.3	22.0	23.1	26.1	29.7	29.7	33.6	38.4	36.8	41.8	48.0	44.5	50.6	58.4
	40	12.1	13.6	15.4	17.3	19.5	22.2	23.4	26.4	30.1	30.1	34.0	39.0	37.4	42.4	48.8	45.2	51.4	59.4
	50	12.0	13.6	15.4	17.3	19.6	22.3	23.4	26.5	30.3	30.2	34.2	39.3	37.6	42.8	49.3	45.7	52.1	60.3
40	0	9.6	10.8	12.3	13.5	15.2	17.3	17.9	20.2	23.0	22.8	25.8	29.4	28.1	31.8	36.4	33.7	38.2	43.9
	10	10.0	11.2	12.7	14.0	15.8	17.9	18.5	20.9	23.8	23.6	26.6	30.4	29.0	32.8	37.6	34.8	39.5	45.4
	15	10.1	11.4	12.9	14.2	16.0	18.1	18.8	21.2	24.1	23.9	27.0	30.8	29.4	33.3	38.2	35.3	40.0	46.0
	20	10.2	11.5	13.1	14.4	16.2	18.4	19.1	21.5	24.5	24.2	27.4	31.3	29.8	33.8	38.7	35.8	40.6	46.6
	30	10.5	11.8	13.4	14.8	16.6	18.9	19.6	22.1	25.1	24.9	28.1	32.1	30.6	34.6	39.7	36.7	41.6	47.8
	40	10.6	11.9	13.5	14.9	16.8	19.1	19.8	22.3	25.4	25.2	28.4	32.5	31.0	35.1	40.2	37.2	42.2	48.6
	50	10.6	11.9	13.5	14.9	16.8	19.1	19.8	22.3	25.5	25.2	28.6	32.7	31.1	35.3	40.6	37.5	42.6	49.1

***To correct for wind, enter table with the brakes on speed minus one half the headwind or plus 1.5 times the tailwind. If ground speed is used for brakes on speed, ignore wind and enter table with sea level, 15°C.**

ADVISORY INFORMATION

Recommended Brake Cooling Schedule
Adjusted Brake Energy Per Brake (Millions of Foot Pounds)
No Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)								
EVENT		10	20	30	40	50	60	70	80	90
RTO MAX MAN		10	20	30	40	50	60	70	80	90
LANDING	MAX MAN	7.8	16.3	25.3	34.7	44.7	55.0	65.7	76.6	87.9
	MAX AUTO	7.5	15.4	23.6	32.4	41.8	51.8	62.5	74.1	86.5
	AUTOBRAKE 3	7.3	14.7	22.3	30.2	38.6	47.6	57.4	68.1	80.0
	AUTOBRAKE 2	7.0	13.8	20.5	27.4	34.8	42.7	51.5	61.3	72.4
	AUTOBRAKE 1	6.7	13.1	19.2	25.3	31.8	38.8	46.6	55.4	65.5

Two Engine Detent Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)								
EVENT		10	20	30	40	50	60	70	80	90
RTO MAX MAN		10	20	30	40	50	60	70	80	90
LANDING	MAX MAN	7.0	14.6	22.8	31.4	40.5	49.9	59.7	69.8	80.0
	MAX AUTO	5.8	12.3	19.5	27.2	35.6	44.5	53.9	63.7	74.1
	AUTOBRAKE 3	4.3	9.2	14.7	20.7	27.2	34.4	42.0	50.2	59.0
	AUTOBRAKE 2	2.5	5.6	9.1	13.1	17.8	23.0	28.8	35.2	42.3
	AUTOBRAKE 1	1.8	3.8	6.1	8.8	11.9	15.5	19.6	24.4	29.8

Cooling Time (Minutes) - Category C Steel Brakes

(Note: A placard showing carbon brakes configuration will be put at the Center Forward Panel upon modification.)

	EVENT ADJUSTED BRAKE ENERGY (MILLIONS OF FOOT POUNDS)								
	16 & BELOW	17	20	23	25	28	32	33 TO 48	49 & ABOVE
	BRAKE TEMPERATURE MONITOR SYSTEM INDICATION ON CDS								
	UP TO 2.4	2.6	3.1	3.5	3.9	4.4	4.9	5.0 TO 7.5	7.5 & ABOVE
INFLIGHT GEAR DOWN	NO SPECIAL PROCEDURE REQUIRED	1	2	3	4	5	6	CAUTION	FUSE PLUG MELT ZONE
GROUND		10	20	30	40	50	60		

Cooling Time (Minutes) - Category N Carbon Brakes

	EVENT ADJUSTED BRAKE ENERGY (MILLIONS OF FOOT POUNDS)								
	16 & BELOW	17	19	20.9	23.5	26.9	29.4	30 TO 41	41 & ABOVE
	BRAKE TEMPERATURE MONITOR SYSTEM INDICATION ON CDS								
	UP TO 2.5	2.6	3	3.3	3.8	4.5	4.9	5.0 TO 7.1	7.1 & ABOVE
INFLIGHT GEAR DOWN	NO SPECIAL PROCEDURE REQUIRED	1	4	5	6	7	7.6	CAUTION	FUSE PLUG MELT ZONE
GROUND		6.7	16.0	24.1	34.2	45.9	53.3		

Observe maximum quick turnaround limit.
Table shows energy per brake added by a single stop with all brakes operating. Energy is assumed to be equally distributed among the operating brakes. Total energy is the sum of residual energy plus energy added.
Add 1.0 million foot pounds per brake for each taxi mile.

When in caution zone, wheel fuse plugs may melt. Delay takeoff and inspect after one hour. If overheat occurs after takeoff, extend gear soon for at least 7 minutes.

When in fuse plug melt zone, clear runway immediately. Unless required, do not set parking brake. Do not approach gear or attempt to taxi for one hour. Tire, wheel and brake replacement may be required. If overheat occurs after takeoff, extend gear soon for at least 12 minutes.

Brake temperature monitor system (BTMS) indication on CDS systems page may be used 10 to 15 minutes after airplane has come to a complete stop or inflight with gear retracted to determine recommended cooling schedule.

ENGINE INOP

Initial Max Continuous %N1

Based on .79M, A/C high and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT)								
	25	27	29	31	33	35	37	39	41
20	96.8	96.6	96.3	96.1	95.9	95.4	95.0	94.7	93.9
15	97.4	97.2	96.9	96.8	96.6	96.2	95.7	95.5	94.8
10	98.0	97.8	97.5	97.4	97.4	96.9	96.5	96.3	95.7
5	98.3	98.6	98.3	98.1	98.1	97.7	97.3	97.1	96.6
0	97.5	98.7	99.2	99.0	98.9	98.5	98.2	98.0	97.5
-5	96.7	98.0	99.1	99.8	99.7	99.3	98.9	98.7	98.4
-10	96.0	97.2	98.4	99.6	100.5	100.2	99.8	99.6	99.4
-15	95.2	96.4	97.6	98.8	100.1	101.0	100.8	100.6	100.3
-20	94.4	95.6	96.8	98.0	99.3	100.5	101.1	100.8	100.6
-25	93.6	94.9	96.0	97.2	98.5	99.7	100.2	100.0	99.8
-30	92.8	94.1	95.2	96.4	97.7	98.8	99.4	99.2	99.0
-35	92.0	93.2	94.4	95.6	96.8	98.0	98.5	98.3	98.1
-40	91.2	92.4	93.5	94.7	96.0	97.1	97.6	97.4	97.2

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)								
	25	27	29	31	33	35	37	39	41
ENGINE ANTI-ICE	-1.2	-1.1	-1.0	-0.9	-0.8	-0.8	-0.8	-0.8	-0.8
ENGINE & WING ANTI-ICE	-4.2	-4.4	-4.5	-4.7	-5.0	-4.8	-4.8	-4.8	-4.8

Max Continuous %N1

37000 FT to 29000 FT Pressure Altitudes

37000 FT PRESS ALT		TAT (°C)											
KIAS	M	-55	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0
160	.51	96.6	97.6	98.5	99.4	100.2	99.6	98.8	97.6	96.3	94.7	93.2	91.8
200	.63	96.0	96.9	97.8	98.7	99.6	100.4	100.1	99.3	98.4	97.5	96.3	95.2
240	.74	95.1	96.0	96.8	97.7	98.6	99.4	100.3	100.7	100.0	99.2	98.4	97.5
280	.86	94.3	95.2	96.1	97.0	97.8	98.7	99.5	100.4	101.2	100.9	100.0	99.1

35000 FT PRESS ALT		TAT (°C)											
KIAS	M	-55	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0
160	.49	96.5	97.4	98.3	99.2	100.1	99.8	99.0	98.0	96.8	95.4	94.0	92.7
200	.60	96.1	97.0	97.9	98.8	99.7	100.6	100.5	99.6	98.6	97.6	96.5	95.4
240	.71	95.0	95.9	96.8	97.7	98.6	99.4	100.3	100.8	100.2	99.5	98.6	97.7
280	.82	93.8	94.6	95.5	96.4	97.3	98.1	98.9	99.8	100.6	100.3	99.5	98.8

33000 FT PRESS ALT		TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
160	.47	97.4	98.3	99.2	100.0	100.8	100.0	99.1	97.9	96.7	95.3	93.9	92.6
200	.58	97.0	97.9	98.8	99.7	100.6	101.4	100.6	99.6	98.6	97.5	96.3	95.1
240	.68	95.9	96.8	97.7	98.5	99.4	100.2	101.1	100.9	100.2	99.4	98.4	97.4
280	.79	94.3	95.1	96.0	96.8	97.7	98.5	99.3	100.2	100.5	99.7	98.9	98.1
320	.89	93.6	94.5	95.4	96.2	97.1	97.9	98.7	99.5	100.3	101.1	100.7	99.8

31000 FT PRESS ALT		TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
160	.45	97.3	98.2	99.1	100.0	100.9	101.1	100.2	99.2	98.0	96.6	95.2	93.9
200	.55	97.1	98.0	98.9	99.7	100.6	101.5	101.6	100.7	99.7	98.6	97.4	96.2
240	.66	95.6	96.5	97.4	98.3	99.1	100.0	100.8	101.3	100.5	99.8	98.8	97.8
280	.76	93.8	94.7	95.5	96.4	97.2	98.0	98.8	99.7	100.5	99.8	98.9	98.0
320	.85	92.4	93.2	94.1	94.9	95.7	96.5	97.4	98.2	98.9	99.7	99.9	99.1

29000 FT PRESS ALT		TAT (°C)											
KIAS	M	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
160	.43	98.1	99.0	99.9	100.8	101.6	101.2	100.2	99.1	97.9	96.4	95.1	93.8
200	.53	97.5	98.4	99.3	100.2	101.0	101.9	101.3	100.4	99.3	98.2	96.9	95.8
240	.63	96.3	97.1	98.0	98.9	99.7	100.5	101.4	101.1	100.2	99.2	98.3	97.2
280	.73	94.2	95.0	95.9	96.7	97.5	98.3	99.1	99.9	100.1	99.1	98.2	97.5
320	.82	92.1	92.9	93.7	94.5	95.3	96.1	96.9	97.7	98.5	99.2	98.5	97.6
360	.91	92.1	92.9	93.7	94.5	95.3	96.1	96.9	97.7	98.5	99.2	100.0	100.1

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)				
	29	31	33	35	37
ENGINE ANTI-ICE ON	-0.9	-0.9	-0.8	-0.8	-0.8
ENGINE & WING ANTI-ICE ON	-4.1	-4.3	-4.5	-4.7	-4.7

ENGINE INOP

Max Continuous %N1
27000 FT to 20000 FT Pressure Altitudes

27000 FT PRESS ALT		TAT (°C)											
KIAS	M	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
160	.41	98.0	98.8	99.7	100.6	101.4	102.2	101.2	100.2	99.0	97.8	96.4	95.1
200	.51	96.9	97.8	98.7	99.6	100.4	101.2	101.8	100.8	99.9	98.8	97.6	96.4
240	.60	95.6	96.5	97.4	98.2	99.1	99.9	100.7	101.3	100.4	99.4	98.5	97.5
280	.70	93.6	94.4	95.3	96.1	96.9	97.7	98.5	99.3	100.1	99.4	98.4	97.6
320	.79	91.6	92.4	93.2	94.0	94.8	95.6	96.4	97.2	98.0	98.7	98.6	97.8
360	.88	91.0	91.8	92.6	93.4	94.2	95.0	95.8	96.6	97.3	98.1	98.8	99.4

25000 FT PRESS ALT		TAT (°C)											
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
160	.39	98.8	99.7	100.5	101.4	102.2	102.4	101.4	100.3	99.1	97.7	96.5	95.2
200	.49	97.5	98.3	99.2	100.0	100.9	101.7	101.5	100.6	99.5	98.4	97.3	96.2
240	.58	95.7	96.5	97.4	98.2	99.0	99.9	100.7	100.5	99.5	98.6	97.6	96.7
280	.67	93.9	94.7	95.5	96.3	97.1	97.9	98.7	99.5	99.5	98.6	97.6	96.9
320	.76	91.7	92.6	93.4	94.2	95.0	95.8	96.5	97.3	98.0	98.6	97.8	97.2
360	.85	90.4	91.2	92.1	92.9	93.7	94.5	95.3	96.1	96.9	97.6	98.4	98.2

24000 FT PRESS ALT		TAT (°C)											
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
160	.38	98.6	99.5	100.4	101.2	102.1	102.9	101.9	100.8	99.6	98.4	97.1	95.8
200	.48	97.5	98.4	99.2	100.1	100.9	101.8	102.2	101.1	100.1	99.0	97.8	96.7
240	.57	95.9	96.8	97.6	98.5	99.3	100.1	100.9	101.2	100.2	99.2	98.2	97.3
280	.66	94.2	95.1	95.9	96.7	97.5	98.3	99.1	99.9	100.4	99.4	98.3	97.5
320	.75	92.1	93.0	93.8	94.6	95.4	96.2	96.9	97.7	98.5	99.2	98.6	97.8
360	.83	90.6	91.4	92.2	93.1	93.9	94.7	95.5	96.2	97.0	97.8	98.5	98.6

22000 FT PRESS ALT		TAT (°C)											
KIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
160	.37	99.1	100.0	100.9	101.7	102.5	102.8	101.8	100.7	99.5	98.2	97.0	95.8
200	.46	98.4	99.3	100.1	101.0	101.8	102.6	102.3	101.2	100.0	98.9	97.8	96.8
240	.55	97.2	98.1	98.9	99.7	100.5	101.3	102.1	101.6	100.5	99.4	98.5	97.5
280	.63	95.7	96.5	97.4	98.2	99.0	99.8	100.6	101.3	101.0	99.8	98.9	98.1
320	.72	93.9	94.7	95.5	96.3	97.1	97.9	98.6	99.4	100.1	100.2	99.3	98.6
360	.80	92.2	93.0	93.8	94.6	95.4	96.1	96.9	97.7	98.4	99.2	99.7	99.1

20000 FT PRESS ALT		TAT (°C)											
KIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
160	.35	98.7	99.5	100.4	101.2	102.0	102.8	102.5	101.5	100.4	99.2	98.0	96.8
200	.44	98.3	99.2	100.0	100.9	101.7	102.5	103.3	102.3	101.1	100.0	98.9	97.8
240	.53	97.5	98.4	99.2	100.0	100.8	101.7	102.5	103.1	101.8	100.5	99.5	98.6
280	.61	96.2	97.0	97.8	98.7	99.5	100.3	101.1	101.8	102.5	101.3	100.1	99.3
320	.69	94.7	95.5	96.3	97.1	97.9	98.7	99.5	100.2	101.0	101.7	100.9	99.9
360	.77	93.0	93.8	94.6	95.4	96.2	97.0	97.7	98.5	99.2	100.0	100.7	100.4

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)				
	20	22	24	25	27
ENGINE ANTI-ICE ON	-0.9	-0.9	-1.0	-1.0	-1.0
ENGINE & WING ANTI-ICE ON	-3.6	-3.8	-3.8	-3.9	-4.0

Max Continuous %N1
18000 FT to 12000 FT Pressure Altitudes

18000 FT PRESS ALT		TAT (°C)											
KIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
160	.34	98.5	99.3	100.2	101.0	101.8	102.6	101.6	100.3	99.2	98.1	97.0	95.9
200	.42	98.7	99.6	100.4	101.2	102.0	102.8	103.1	101.7	100.4	99.3	98.3	97.3
240	.51	97.8	98.7	99.5	100.3	101.1	101.9	102.7	102.5	101.1	99.9	99.0	98.1
280	.59	96.3	97.1	97.9	98.7	99.5	100.3	101.0	101.8	101.6	100.5	99.6	98.8
320	.67	94.8	95.6	96.4	97.2	97.9	98.7	99.5	100.2	101.0	100.9	100.0	99.2
360	.75	93.0	93.8	94.6	95.3	96.1	96.9	97.6	98.4	99.1	99.9	100.2	99.6

16000 FT PRESS ALT		TAT (°C)											
KIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
160	.33	97.1	98.0	98.8	99.6	100.4	101.2	101.6	100.3	99.1	98.1	97.1	96.1
200	.41	98.0	98.8	99.6	100.4	101.2	102.0	102.8	102.5	101.3	100.2	99.3	98.3
240	.49	97.1	97.9	98.7	99.5	100.3	101.1	101.9	102.7	101.8	100.5	99.6	98.7
280	.57	95.6	96.4	97.2	98.0	98.8	99.6	100.3	101.1	101.8	100.9	99.8	99.0
320	.64	94.0	94.8	95.6	96.4	97.2	97.9	98.7	99.4	100.2	100.9	100.2	99.4
360	.72	92.1	92.9	93.7	94.5	95.3	96.1	96.9	97.7	98.4	99.2	99.9	99.6

14000 FT PRESS ALT		TAT (°C)											
KIAS	M	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
160	.31	96.6	97.4	98.2	99.0	99.8	100.6	100.4	99.1	98.0	97.1	96.2	95.3
200	.39	97.1	97.9	98.7	99.5	100.3	101.1	101.8	101.5	101.0	100.1	99.3	98.4
240	.47	96.6	97.4	98.2	99.0	99.8	100.6	101.3	101.8	101.1	100.3	99.5	98.7
280	.54	95.5	96.3	97.1	97.8	98.6	99.4	100.1	100.9	101.0	100.1	99.2	98.5
320	.62	94.1	94.9	95.7	96.5	97.2	98.0	98.7	99.5	100.2	100.3	99.5	98.8
360	.69	92.2	93.1	93.9	94.7	95.5	96.3	97.0	97.8	98.6	99.3	99.6	99.0

12000 FT PRESS ALT		TAT (°C)											
KIAS	M	-20	-15	-10	-5	0	5	10	15	20	25	30	35
160	.30	96.3	97.0	97.8	98.6	99.4	100.1	99.3	98.1	97.1	96.3	95.4	94.5
200	.38	97.1	97.9	98.7	99.5	100.3	101.0	101.5	100.8	99.8	99.0	98.2	97.3
240	.45	96.5	97.3	98.0	98.8	99.6	100.3	101.1	101.0	100.1	99.4	98.6	97.9
280	.52	95.5	96.3	97.0	97.8	98.6	99.3	100.0	100.8	100.3	99.4	98.6	98.0
320	.60	94.0	94.8	95.6	96.4	97.2	97.9	98.7	99.4	100.2	99.7	98.9	98.2
360	.67	92.3	93.2	94.0	94.8	95.6	96.4	97.1	97.9	98.7	99.4	99.1	98.5

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)			
	12	14	16	18
ENGINE ANTI-ICE ON	-0.9	-0.9	-0.9	-0.9
ENGINE & WING ANTI-ICE ON	-3.2	-3.4	-3.4	-3.5

ENGINE INOP

Max Continuous %N1
10000 FT to 1000 FT Pressure Altitudes

10000 FT PRESS ALT		TAT (°C)											
KIAS	M	-20	-15	-10	-5	0	5	10	15	20	25	30	35
160	.29	95.2	96.0	96.8	97.6	98.3	99.1	99.8	98.6	97.4	96.6	95.8	94.9
200	.36	96.0	96.7	97.5	98.3	99.0	99.8	100.5	100.5	99.4	98.5	97.8	97.0
240	.43	95.6	96.4	97.2	97.9	98.7	99.4	100.2	100.9	100.1	99.2	98.4	97.7
280	.51	94.5	95.3	96.1	96.9	97.6	98.4	99.1	99.9	100.4	99.5	98.7	98.0
320	.58	93.0	93.9	94.7	95.5	96.2	97.0	97.8	98.6	99.3	99.7	99.0	98.2
360	.65	91.6	92.4	93.2	94.0	94.8	95.6	96.4	97.2	98.0	98.7	99.1	98.5
5000 FT PRESS ALT		TAT (°C)											
KIAS	M	-10	-5	0	5	10	15	20	25	30	35	40	45
160	.26	94.9	95.7	96.4	97.2	98.0	98.8	99.2	98.3	97.4	96.6	95.9	95.1
200	.33	94.7	95.5	96.3	97.1	97.8	98.6	99.4	98.9	98.0	97.3	96.6	95.8
240	.40	94.0	94.8	95.6	96.4	97.2	97.9	98.7	99.5	98.7	97.9	97.2	96.5
280	.46	93.3	94.1	94.9	95.7	96.5	97.3	98.1	98.8	98.9	98.2	97.5	96.8
320	.53	92.5	93.3	94.1	94.9	95.7	96.5	97.2	98.0	98.7	98.4	97.7	97.1
360	.59	91.5	92.3	93.1	93.9	94.7	95.5	96.2	97.0	97.8	98.5	98.0	97.3
3000 FT PRESS ALT		TAT (°C)											
KIAS	M	-5	0	5	10	15	20	25	30	35	40	45	50
160	.26	94.8	95.6	96.4	97.2	98.0	98.7	98.8	97.9	97.1	96.4	95.6	94.8
200	.32	94.5	95.3	96.1	96.9	97.6	98.4	99.2	98.3	97.5	96.8	96.1	95.3
240	.38	94.1	94.9	95.6	96.4	97.2	98.0	98.7	98.8	98.0	97.2	96.6	95.9
280	.45	93.2	94.0	94.8	95.6	96.4	97.2	97.9	98.7	98.3	97.5	96.9	96.2
320	.51	92.5	93.3	94.1	94.9	95.7	96.4	97.2	98.0	98.5	97.8	97.1	96.5
360	.57	91.6	92.4	93.2	94.0	94.7	95.5	96.3	97.1	97.8	98.1	97.4	96.8
1000 FT PRESS ALT		TAT (°C)											
KIAS	M	-5	0	5	10	15	20	25	30	35	40	45	50
160	.25	93.9	94.7	95.4	96.2	97.0	97.8	98.5	98.2	97.4	96.7	96.0	95.2
200	.31	93.5	94.3	95.1	95.9	96.7	97.4	98.2	98.5	97.8	97.0	96.3	95.6
240	.37	93.0	93.8	94.6	95.4	96.1	96.9	97.7	98.4	98.1	97.3	96.6	95.9
280	.43	92.3	93.2	93.9	94.7	95.5	96.3	97.1	97.8	98.3	97.6	96.9	96.2
320	.49	91.6	92.4	93.2	94.0	94.8	95.6	96.3	97.1	97.9	97.9	97.2	96.5
360	.55	90.7	91.5	92.3	93.1	93.9	94.7	95.4	96.2	96.9	97.7	97.3	96.6

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)			
	1	3	5	10
ENGINE ANTI-ICE ON	-0.6	-0.8	-0.8	-0.8
ENGINE & WING ANTI-ICE ON	-2.9	-3.0	-2.7	-3.2

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

WEIGHT (1000 KG)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFTDOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
85	82	271	18500	17300	15900
80	77	263	20200	19000	17700
75	72	255	21600	20600	19400
70	67	247	23100	22200	21100
65	62	238	24700	23800	22800
60	57	229	26800	25800	24700
55	53	219	29100	28100	27000
50	48	209	31200	30400	29400
45	43	199	33300	32600	31700
40	38	187	35600	34900	34000

Includes APU fuel burn.

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown/LRC Cruise Range Capability

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
138	128	120	112	106	100	95	90	86	82	78
275	256	239	225	212	200	190	180	172	164	157
413	384	359	337	317	300	284	270	258	246	235
551	512	479	449	423	400	379	360	344	328	314
689	640	598	562	529	500	474	451	429	410	392
826	768	718	674	635	600	569	541	515	492	471
964	896	838	786	741	700	664	631	601	574	549
1102	1025	957	898	846	800	758	721	687	656	628
1240	1153	1077	1011	952	900	853	811	773	738	706
1377	1281	1197	1123	1058	1000	948	901	859	820	785
1515	1409	1317	1235	1164	1100	1043	991	945	902	863
1653	1537	1436	1348	1270	1200	1138	1081	1030	984	942
1792	1666	1556	1460	1375	1300	1232	1171	1116	1066	1020
1930	1794	1676	1573	1481	1400	1327	1261	1202	1148	1098
2068	1922	1796	1685	1587	1500	1422	1351	1288	1230	1177
2207	2051	1916	1798	1693	1600	1517	1441	1373	1312	1255
2345	2180	2036	1910	1799	1700	1611	1531	1459	1393	1333
2484	2309	2156	2023	1905	1800	1706	1621	1545	1475	1411

Driftdown/Cruise Fuel and Time

AIR DIST (NM)	FUEL REQUIRED (1000 KG)										TIME (HR:MIN)
	WEIGHT AT START OF DRIFTDOWN (1000 KG)										
	40	45	50	55	60	65	70	75	80	85	
100	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0:16
200	0.8	0.8	0.9	0.9	1.0	1.0	1.1	1.1	1.2	1.3	0:33
300	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	0:49
400	1.6	1.8	1.9	2.0	2.2	2.3	2.5	2.6	2.8	2.9	1:06
500	2.0	2.2	2.4	2.6	2.8	3.0	3.2	3.3	3.5	3.7	1:22
600	2.4	2.7	2.9	3.1	3.3	3.6	3.8	4.0	4.3	4.5	1:39
700	2.8	3.1	3.4	3.6	3.9	4.2	4.5	4.7	5.0	5.3	1:55
800	3.2	3.6	3.9	4.2	4.5	4.8	5.1	5.4	5.7	6.1	2:11
900	3.6	4.0	4.3	4.7	5.0	5.4	5.7	6.1	6.4	6.8	2:28
1000	4.0	4.4	4.8	5.2	5.6	6.0	6.4	6.7	7.1	7.6	2:44
1100	4.4	4.8	5.3	5.7	6.1	6.6	7.0	7.4	7.9	8.3	3:01
1200	4.8	5.3	5.7	6.2	6.7	7.1	7.6	8.1	8.6	9.0	3:17
1300	5.2	5.7	6.2	6.7	7.2	7.7	8.2	8.7	9.2	9.8	3:34
1400	5.5	6.1	6.6	7.2	7.7	8.3	8.8	9.4	9.9	10.5	3:51
1500	5.9	6.5	7.1	7.7	8.3	8.9	9.4	10.0	10.6	11.2	4:07
1600	6.3	6.9	7.5	8.2	8.8	9.4	10.0	10.7	11.3	12.0	4:24
1700	6.6	7.3	8.0	8.6	9.3	10.0	10.6	11.3	12.0	12.7	4:41
1800	7.0	7.7	8.4	9.1	9.8	10.5	11.2	11.9	12.6	13.4	4:57

Includes APU fuel burn.
Driftdown at optimum driftdown speed and cruise at long range cruise speed.

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Altitude Capability

100 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
85	15200	12600	9900
80	17200	15300	12500
75	19200	17400	15000
70	20900	19700	17300
65	22500	21300	19800
60	24100	23000	21600
55	26300	24800	23500
50	29000	27700	25800
45	31400	30500	29200
40	33800	33000	31800

With engine anti-ice on, decrease altitude capability by 1200 ft.
With engine and wing anti-ice on, decrease altitude capability by 5500 ft.

ENGINE INOP

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)									
		10	15	17	19	21	23	25	27	29	31
85	%N1	91.8	95.5	97.9							
	MACH	.561	.600	.616							
	KIAS	311	303	300							
	FF/ENG	3067	3033	3052							
80	%N1	90.1	94.0	95.9	98.5						
	MACH	.545	.590	.603	.621						
	KIAS	302	299	294	291						
	FF/ENG	2875	2870	2846	2886						
75	%N1	88.4	92.5	94.0	96.1						
	MACH	.528	.579	.593	.607						
	KIAS	293	293	288	284						
	FF/ENG	2684	2709	2674	2662						
70	%N1	86.5	90.7	92.3	94.0	96.2					
	MACH	.510	.562	.582	.595	.610					
	KIAS	282	284	283	278	274					
	FF/ENG	2494	2518	2520	2481	2487					
65	%N1	84.5	88.7	90.4	92.2	93.9	96.4				
	MACH	.491	.542	.563	.584	.596	.612				
	KIAS	271	274	274	273	268	265				
	FF/ENG	2306	2327	2330	2330	2295	2317				
60	%N1	82.3	86.5	88.3	90.0	91.9	93.7	96.4			
	MACH	.471	.521	.543	.564	.585	.597	.614			
	KIAS	261	263	263	263	263	258	254			
	FF/ENG	2124	2137	2139	2140	2143	2114	2146			
55	%N1	80.2	84.2	85.9	87.7	89.5	91.4	93.3	96.2		
	MACH	.453	.498	.520	.541	.563	.585	.597	.614		
	KIAS	250	251	252	252	253	252	247	244		
	FF/ENG	1954	1948	1950	1950	1953	1958	1938	1971		
50	%N1	77.8	81.6	83.4	85.2	87.0	88.7	90.7	92.7	95.7	
	MACH	.434	.475	.495	.516	.538	.561	.583	.596	.613	
	KIAS	240	239	239	240	241	241	241	236	233	
	FF/ENG	1791	1764	1762	1762	1764	1767	1777	1765	1793	
45	%N1	75.5	79.1	80.6	82.3	84.1	85.9	87.7	89.7	91.8	94.8
	MACH	.415	.452	.469	.489	.511	.533	.556	.578	.593	.610
	KIAS	229	227	227	227	228	229	229	229	225	222
	FF/ENG	1636	1594	1582	1575	1577	1580	1586	1600	1593	1613
40	%N1	73.0	76.2	77.8	79.4	81.0	82.8	84.6	86.4	88.3	90.7
	MACH	.395	.429	.445	.462	.480	.502	.525	.548	.571	.589
	KIAS	218	215	215	214	214	215	216	216	216	214
	FF/ENG	1485	1434	1416	1402	1392	1394	1400	1410	1421	1424

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Diversion Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
298	272	249	230	214	200	190	180	172	164	158
600	547	501	462	429	400	379	361	344	328	315
903	823	753	694	644	600	570	542	517	494	473
1209	1100	1005	926	859	800	759	721	687	657	630
1516	1379	1259	1159	1075	1000	949	902	859	820	786
1825	1659	1513	1393	1290	1200	1139	1082	1031	984	943
2137	1940	1768	1626	1506	1400	1328	1262	1202	1147	1099
2450	2222	2024	1860	1722	1600	1518	1442	1373	1311	1256
2766	2507	2281	2095	1938	1800	1707	1622	1544	1474	1412
3083	2792	2539	2331	2155	2000	1896	1801	1715	1637	1568

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		18		22		26	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	1.4	0:43	1.2	0:41	1.1	0:39	1.0	0:38	0.9	0:37
400	2.8	1:23	2.6	1:19	2.4	1:14	2.2	1:11	2.1	1:09
600	4.3	2:04	3.9	1:57	3.6	1:50	3.4	1:45	3.2	1:42
800	5.7	2:46	5.2	2:36	4.9	2:26	4.5	2:19	4.4	2:14
1000	7.1	3:28	6.6	3:15	6.1	3:03	5.7	2:53	5.5	2:47
1200	8.5	4:10	7.9	3:55	7.3	3:40	6.8	3:28	6.6	3:21
1400	9.8	4:53	9.1	4:36	8.5	4:18	8.0	4:02	7.7	3:54
1600	11.2	5:36	10.4	5:16	9.7	4:55	9.1	4:38	8.7	4:28
1800	12.5	6:20	11.7	5:58	10.9	5:34	10.2	5:13	9.8	5:02
2000	13.9	7:05	12.9	6:39	12.0	6:13	11.3	5:49	10.8	5:36

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)								
	40	45	50	55	60	65	70	75	80
1	-0.1	-0.1	-0.1	0.0	0.0	0.1	0.1	0.2	0.3
2	-0.3	-0.2	-0.1	-0.1	0.0	0.2	0.3	0.6	0.8
3	-0.4	-0.3	-0.2	-0.1	0.0	0.3	0.5	0.9	1.2
4	-0.6	-0.4	-0.3	-0.1	0.0	0.3	0.7	1.2	1.6
5	-0.7	-0.5	-0.4	-0.2	0.0	0.4	0.9	1.4	2.0
6	-0.8	-0.6	-0.4	-0.2	0.0	0.5	1.1	1.7	2.4
7	-1.0	-0.8	-0.5	-0.3	0.0	0.6	1.2	2.0	2.8
8	-1.1	-0.9	-0.6	-0.3	0.0	0.6	1.4	2.2	3.2
9	-1.3	-1.0	-0.7	-0.3	0.0	0.7	1.5	2.4	3.5
10	-1.4	-1.1	-0.7	-0.4	0.0	0.7	1.6	2.6	3.8
11	-1.6	-1.2	-0.8	-0.4	0.0	0.8	1.7	2.8	4.1
12	-1.7	-1.3	-0.9	-0.4	0.0	0.8	1.9	3.0	4.4
13	-1.9	-1.4	-0.9	-0.5	0.0	0.9	2.0	3.2	4.7
14	-2.0	-1.5	-1.0	-0.5	0.0	0.9	2.0	3.4	4.9

Includes APU fuel burn.

ENGINE INOP

MAX CONTINUOUS THRUST

Holding

Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)							
		1500	5000	10000	15000	20000	25000	30000	35000
85	%N1	81.1	84.1	88.3	92.8				
	KIAS	250	251	252	253				
	FF/ENG	2740	2730	2750	2800				
80	%N1	79.5	82.4	86.5	91.0	98.3			
	KIAS	242	243	244	245	247			
	FF/ENG	2580	2570	2570	2610	2740			
75	%N1	77.8	80.5	84.7	89.1	95.0			
	KIAS	235	236	236	238	239			
	FF/ENG	2420	2400	2400	2420	2490			
70	%N1	76.0	78.6	82.8	87.1	92.1			
	KIAS	227	227	228	229	231			
	FF/ENG	2260	2240	2230	2250	2270			
65	%N1	74.0	76.7	80.8	85.0	89.7	97.7		
	KIAS	219	219	220	221	222	224		
	FF/ENG	2100	2090	2070	2070	2080	2230		
60	%N1	71.7	74.6	78.5	82.8	87.4	93.7		
	KIAS	210	210	211	212	213	214		
	FF/ENG	1950	1930	1910	1910	1910	1970		
55	%N1	69.4	72.3	76.3	80.5	84.9	90.0		
	KIAS	200	201	202	203	204	205		
	FF/ENG	1800	1770	1750	1740	1730	1760		
50	%N1	66.9	69.7	73.8	77.8	82.3	87.0	94.9	
	KIAS	192	192	192	193	194	195	196	
	FF/ENG	1650	1620	1600	1580	1570	1570	1680	
45	%N1	64.2	66.9	70.9	75.0	79.4	84.0	89.6	
	KIAS	185	185	185	185	185	185	186	
	FF/ENG	1500	1470	1440	1420	1400	1400	1450	
40	%N1	61.1	64.0	67.8	72.0	76.2	80.7	85.4	94.0
	KIAS	178	178	178	178	178	178	178	178
	FF/ENG	1350	1330	1300	1270	1250	1240	1260	1360

This table includes 5% additional fuel for holding in a racetrack pattern.

ENGINE INOP

ADVISORY INFORMATION

Gear Down Landing Rate of Climb Available

Flaps 15

TAT (°C)	RATE OF CLIMB (FT/MIN)					
	PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
52	-80	-140				
50	-50	-110	-220			
48	-20	-90	-190			
46	10	-60	-160	-270		
44	40	-30	-140	-250		
42	70	0	-110	-220	-340	
40	100	30	-80	-190	-310	
38	120	60	-50	-160	-290	-430
36	140	90	-30	-140	-260	-400
34	140	120	0	-120	-240	-380
32	140	130	20	-100	-220	-360
30	140	130	40	-80	-210	-340
20	150	140	60	-50	-160	-280
10	170	150	60	-50	-160	-280
0	170	160	70	-50	-160	-280
-20	190	170	80	-40	-160	-280
-40	200	180	80	-40	-170	-290

Rate of climb capability shown is valid for 60000 kg, gear down at VREF15+5.
Decrease rate of climb 130 ft/min per 5000 kg greater than 60000 kg.
Increase rate of climb 160 ft/min per 5000 kg less than 60000 kg.

Flaps 30

TAT (°C)	RATE OF CLIMB (FT/MIN)					
	PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
52	-260	-320				
50	-230	-300	-400			
48	-200	-270	-380			
46	-180	-250	-350	-460		
44	-150	-220	-330	-430		
42	-120	-190	-300	-410	-530	
40	-100	-170	-280	-390	-500	
38	-70	-140	-250	-360	-480	-620
36	-60	-110	-220	-340	-460	-600
34	-50	-80	-200	-320	-440	-570
32	-50	-70	-180	-300	-420	-550
30	-50	-60	-160	-280	-410	-540
20	-40	-60	-150	-260	-370	-490
10	-40	-50	-140	-260	-370	-480
0	-30	-50	-140	-260	-370	-490
-20	-30	-40	-140	-260	-380	-500
-40	-20	-40	-140	-270	-400	-520

Rate of climb capability shown is valid for 60000 kg, gear down at VREF30+5.
Decrease rate of climb 130 ft/min per 5000 kg greater than 60000 kg.
Increase rate of climb 160 ft/min per 5000 kg less than 60000 kg.

ALTERNATE MODE EEC

Alternate Mode EEC Limit Weight

PERFORMANCE LIMIT	NORMAL MODE PERFORMANCE LIMIT WEIGHT (1000 KG)										
	44	48	52	56	60	64	68	72	76	80	84
FIELD	41.8	45.6	49.5	53.3	57.0	60.8	64.2	68.4	72.2	75.9	79.8
CLIMB	41.1	44.9	48.6	52.4	56.1	60.0	63.6	67.3	71.1	74.3	78.6
OBSTACLE	41.3	45.1	48.8	52.6	56.3	60.1	63.7	67.4	71.1	74.7	78.6

Alternate Mode EEC Takeoff Speed Adjustment

TAKEOFF SPEEDS	TAKEOFF SPEED ADJUSTMENT (KTS)
DRY V1	+1
WET V1	+2
VR	+1
V2	0

Alternate Mode EEC Max Takeoff %N1

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

AIRPORT OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
60	92.6	93.2	93.6	93.7	93.8	93.9	94.0	94.1	94.0	93.7	93.6	93.5	93.5
55	93.2	93.8	94.3	94.4	94.5	94.6	94.7	94.9	94.7	94.4	94.1	93.5	92.8
50	93.8	94.4	94.9	95.1	95.2	95.4	95.5	95.6	95.5	95.2	94.9	94.4	93.9
45	94.6	95.2	95.6	95.8	95.9	96.1	96.2	96.3	96.2	95.9	95.6	95.3	94.9
40	95.2	95.9	96.4	96.5	96.6	96.7	96.8	97.0	96.9	96.6	96.3	96.2	95.9
35	95.8	96.5	97.2	97.3	97.4	97.5	97.6	97.7	97.6	97.3	97.0	96.9	96.8
30	95.4	96.6	98.1	98.1	98.2	98.2	98.3	98.3	98.2	98.1	97.8	97.7	97.7
25	94.6	95.9	97.3	97.9	98.5	98.6	98.5	98.5	98.5	98.5	98.4	98.4	98.5
20	93.8	95.1	96.6	97.1	97.7	98.0	98.3	98.6	98.6	98.7	98.6	98.6	98.6
15	93.0	94.3	95.8	96.4	97.0	97.3	97.6	97.9	98.3	98.7	98.9	98.9	98.9
10	92.3	93.6	95.0	95.6	96.2	96.5	96.8	97.2	97.5	97.9	98.3	98.8	99.3
5	91.5	92.8	94.2	94.8	95.4	95.8	96.1	96.4	96.8	97.2	97.6	98.1	98.5
0	90.7	92.0	93.4	94.1	94.7	95.0	95.3	95.7	96.0	96.4	96.8	97.3	97.8
-5	89.8	91.2	92.6	93.3	93.9	94.2	94.5	94.9	95.3	95.7	96.1	96.5	97.0
-10	89.0	90.4	91.8	92.5	93.1	93.4	93.8	94.1	94.5	94.9	95.3	95.8	96.2
-15	88.2	89.5	91.0	91.7	92.3	92.6	93.0	93.4	93.7	94.1	94.5	95.0	95.4
-20	87.4	88.7	90.2	90.8	91.5	91.8	92.2	92.6	93.0	93.4	93.7	94.2	94.6
-25	86.5	87.9	89.4	90.0	90.7	91.0	91.4	91.8	92.2	92.6	93.0	93.4	93.8
-30	85.7	87.0	88.5	89.2	89.8	90.2	90.6	91.0	91.4	91.8	92.1	92.6	93.0
-35	84.8	86.2	87.7	88.3	89.0	89.4	89.7	90.2	90.6	90.9	91.3	91.8	92.2
-40	83.9	85.3	86.8	87.5	88.1	88.5	88.9	89.3	89.7	90.1	90.5	90.9	91.4
-45	83.1	84.4	86.0	86.6	87.3	87.7	88.1	88.5	88.9	89.3	89.7	90.1	90.5
-50	82.2	83.5	85.1	85.7	86.4	86.8	87.2	87.7	88.1	88.4	88.8	89.3	89.7

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.8	0.8	0.9	0.9	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Intentionally
Blank

GEAR DOWN

Long Range Cruise Altitude Capability

Max Cruise Thrust, 100 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
85	15600	12500	9400
80	18400	15500	12600
75	21100	18500	15700
70	23600	21400	18600
65	26100	24400	21800
60	28600	27100	25300
55	30800	29600	28100
50	32900	31900	30700
45	35100	34100	33000
40	37500	36500	35400

GEAR DOWN

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)								
		10	21	23	25	27	29	31	33	35
85	%N1	85.9								
	MACH	.482								
	KIAS	267								
	FF/ENG	2421								
80	%N1	84.2								
	MACH	.468								
	KIAS	259								
	FF/ENG	2271								
75	%N1	82.5	91.7							
	MACH	.454	.554							
	KIAS	251	248							
	FF/ENG	2123	2101							
70	%N1	80.6	89.8	91.7						
	MACH	.440	.541	.557						
	KIAS	243	242	240						
	FF/ENG	1977	1960	1950						
65	%N1	78.6	87.9	89.5	91.6	94.5				
	MACH	.425	.524	.543	.560	.578				
	KIAS	235	234	233	231	229				
	FF/ENG	1835	1812	1806	1805	1836				
60	%N1	76.5	85.6	87.4	89.1	91.3	94.5			
	MACH	.409	.504	.525	.544	.562	.580			
	KIAS	226	225	225	224	222	220			
	FF/ENG	1696	1661	1661	1658	1664	1696			
55	%N1	74.4	83.3	85.0	86.8	88.5	90.9	94.1		
	MACH	.393	.484	.504	.525	.545	.562	.581		
	KIAS	217	216	216	216	215	213	211		
	FF/ENG	1559	1515	1512	1515	1517	1523	1555		
50	%N1	71.9	80.7	82.5	84.2	86.0	87.8	90.2	93.5	
	MACH	.376	.463	.482	.502	.523	.544	.561	.580	
	KIAS	207	206	206	206	206	205	203	201	
	FF/ENG	1424	1371	1367	1368	1374	1377	1381	1411	
45	%N1	69.1	78.0	79.7	81.4	83.1	85.0	86.8	89.1	92.5
	MACH	.358	.441	.458	.477	.498	.520	.541	.559	.578
	KIAS	197	196	196	196	196	196	195	193	191
	FF/ENG	1294	1231	1224	1224	1230	1235	1237	1239	1265
40	%N1	66.2	74.9	76.6	78.3	80.0	81.8	83.6	85.5	87.7
	MACH	.340	.417	.434	.452	.471	.491	.513	.535	.554
	KIAS	187	185	185	185	185	185	185	185	183
	FF/ENG	1170	1098	1085	1083	1089	1092	1094	1096	1097

GEAR DOWN

Long Range Cruise Enroute Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
324	290	260	236	217	200	188	178	168	160	153
654	583	523	474	435	400	377	357	338	321	307
989	880	787	713	653	600	566	535	507	483	461
1329	1181	1054	953	871	800	754	713	676	643	614
1674	1484	1322	1194	1090	1000	943	891	844	803	766
2024	1791	1593	1436	1310	1200	1131	1069	1013	962	918
2381	2103	1865	1680	1530	1400	1320	1247	1181	1122	1070
2743	2417	2140	1924	1751	1600	1508	1424	1348	1280	1221
3113	2737	2418	2171	1972	1800	1695	1600	1514	1438	1371

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		20		24		28	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	2.4	0:49	2.2	0:47	1.9	0:44	1.7	0:42	1.6	0:41
400	4.9	1:36	4.5	1:31	4.0	1:25	3.7	1:20	3.5	1:17
600	7.4	2:25	6.8	2:17	6.1	2:06	5.7	1:59	5.4	1:54
800	9.8	3:14	9.1	3:03	8.1	2:48	7.6	2:38	7.2	2:31
1000	12.1	4:04	11.3	3:50	10.1	3:30	9.5	3:18	9.0	3:08
1200	14.4	4:56	13.5	4:39	12.1	4:14	11.3	3:58	10.7	3:46
1400	16.7	5:49	15.6	5:28	14.0	4:58	13.1	4:40	12.4	4:24
1600	18.9	6:43	17.7	6:18	15.9	5:44	14.9	5:22	14.1	5:03
1800	21.1	7:38	19.7	7:10	17.7	6:30	16.6	6:05	15.7	5:43

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	40	50	60	70	80
2	-0.3	-0.2	0.0	0.3	0.7
4	-0.7	-0.3	0.0	0.6	1.3
6	-1.0	-0.5	0.0	0.9	2.0
8	-1.3	-0.7	0.0	1.2	2.6
10	-1.7	-0.8	0.0	1.4	3.2
12	-2.0	-1.0	0.0	1.6	3.7
14	-2.4	-1.2	0.0	1.8	4.2
16	-2.7	-1.3	0.0	2.0	4.6
18	-3.0	-1.5	0.0	2.2	5.0
20	-3.4	-1.7	0.0	2.4	5.3
22	-3.7	-1.8	0.0	2.5	5.6

GEAR DOWN

Descent

VREF40 + 70 KIAS

PRESSURE ALTITUDE (FT)	TIME (MIN)	FUEL (KG)	DISTANCE (NM)
41000	21	280	91
39000	20	270	86
37000	19	270	81
35000	19	260	77
33000	18	260	72
31000	17	250	68
29000	17	250	64
27000	16	240	60
25000	15	230	56
23000	14	230	52
21000	13	220	48
19000	13	210	44
17000	12	200	40
15000	11	190	36
10000	8	170	26
5000	6	140	16
1500	4	110	9

Allowances for a straight-in approach are included.

GEAR DOWN

Holding

Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)							
		1500	5000	10000	15000	20000	25000	30000	35000
85	%N1	75.8	78.5	82.7	87.0	92.0			
	KIAS	230	230	230	230	230			
	FF/ENG	2240	2230	2220	2240	2260			
80	%N1	74.2	77.0	81.1	85.4	90.0			
	KIAS	225	225	225	225	225			
	FF/ENG	2120	2110	2100	2100	2110			
75	%N1	72.5	75.4	79.4	83.7	88.3	94.8		
	KIAS	220	220	220	220	220	220		
	FF/ENG	2000	1990	1970	1970	1970	2050		
70	%N1	70.8	73.7	77.6	81.9	86.4	91.8		
	KIAS	216	216	216	216	216	216		
	FF/ENG	1890	1870	1850	1840	1840	1870		
65	%N1	69.0	71.9	75.9	80.1	84.5	89.3		
	KIAS	211	211	211	211	211	211		
	FF/ENG	1770	1750	1730	1720	1710	1730		
60	%N1	67.1	69.8	74.0	78.0	82.5	87.1	94.3	
	KIAS	204	204	204	204	204	204	204	
	FF/ENG	1660	1630	1610	1600	1580	1590	1670	
55	%N1	65.1	67.8	71.9	75.9	80.3	84.8	90.4	
	KIAS	198	198	198	198	198	198	198	
	FF/ENG	1540	1520	1490	1480	1460	1460	1500	
50	%N1	62.8	65.6	69.6	73.7	78.0	82.4	87.1	
	KIAS	192	192	192	192	192	192	192	
	FF/ENG	1430	1400	1380	1360	1330	1330	1350	
45	%N1	60.3	63.3	67.1	71.4	75.5	79.9	84.5	91.5
	KIAS	185	185	185	185	185	185	185	185
	FF/ENG	1310	1290	1270	1250	1220	1210	1220	1270
40	%N1	57.9	60.6	64.6	68.7	72.9	77.3	81.7	86.8
	KIAS	178	178	178	178	178	178	178	178
	FF/ENG	1200	1180	1160	1130	1110	1090	1100	1110

This table includes 5% additional fuel for holding in a racetrack pattern.

Intentionally
Blank

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

WEIGHT (1000 KG)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFTDOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
85	80	227	1700		
80	76	223	4000	2300	200
75	71	218	6300	4900	2800
70	66	213	8600	7300	5300
65	62	208	10900	9800	8000
60	57	202	13200	12300	10900
55	52	196	15600	14800	13900
50	47	190	18100	17300	16500
45	43	183	20600	19800	18900
40	38	176	23100	22300	21400

Includes APU fuel burn.

Long Range Cruise Altitude Capability

100 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
75	1500		
70	4500	2500	
65	7500	5900	3400
60	10600	9200	6900
55	13300	12300	10600
50	16200	15400	14500
45	19300	18300	17500
40	22200	21400	20500

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)									
		5	7	9	11	13	15	17	19	21	23
70	%N1	94.8									
	MACH	.389									
	KIAS	235									
	FF/ENG	3774									
65	%N1	92.6	94.3	96.9							
	MACH	.376	.389	.402							
	KIAS	228	227	226							
	FF/ENG	3477	3485	3527							
60	%N1	90.2	91.9	93.7	96.3						
	MACH	.364	.375	.388	.402						
	KIAS	220	219	218	218						
	FF/ENG	3192	3191	3198	3240						
55	%N1	87.8	89.3	91.0	92.8	95.4					
	MACH	.351	.362	.374	.387	.400					
	KIAS	212	211	210	209	209					
	FF/ENG	2924	2909	2906	2913	2951					
50	%N1	85.3	86.7	88.2	89.9	91.7	94.2	98.2			
	MACH	.338	.348	.359	.371	.384	.398	.412			
	KIAS	204	203	202	201	200	199	198			
	FF/ENG	2672	2647	2630	2626	2633	2657	2737			
45	%N1	82.7	84.0	85.4	86.9	88.6	90.4	92.7	96.6		
	MACH	.325	.334	.344	.355	.367	.380	.393	.408		
	KIAS	196	195	193	192	191	190	189	189		
	FF/ENG	2432	2400	2374	2356	2351	2352	2359	2417		
40	%N1	79.8	81.1	82.5	83.9	85.4	87.0	88.8	90.8	94.1	98.4
	MACH	.311	.320	.329	.339	.349	.361	.374	.387	.402	.418
	KIAS	188	186	184	183	182	181	180	179	179	178
	FF/ENG	2206	2166	2133	2107	2088	2076	2069	2065	2101	2201

GEAR DOWN
ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Diversion Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
172	151	134	120	109	100	93	88	83	78	75
352	308	270	242	219	200	187	175	165	156	148
533	465	408	364	330	300	280	262	246	232	220
716	623	545	486	440	400	373	349	328	309	293
900	783	684	609	551	500	466	436	409	385	365
1086	943	823	733	661	600	559	523	490	462	438
1273	1105	964	856	772	700	652	610	572	538	510
1462	1267	1103	980	883	800	745	696	652	614	581
1653	1431	1245	1104	994	900	838	782	733	690	653
1845	1595	1386	1228	1105	1000	931	868	813	765	724

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)					
	6		10		14	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
100	1.3	0:27	1.1	0:26	1.0	0:26
200	2.6	0:53	2.4	0:50	2.3	0:48
300	3.9	1:18	3.7	1:15	3.6	1:11
400	5.2	1:44	4.9	1:39	4.8	1:35
500	6.5	2:10	6.1	2:04	6.0	1:58
600	7.8	2:37	7.3	2:29	7.1	2:22
700	9.1	3:03	8.5	2:55	8.3	2:46
800	10.3	3:30	9.7	3:20	9.4	3:10
900	11.6	3:58	10.9	3:46	10.5	3:35
1000	12.8	4:25	12.0	4:12	11.6	3:59

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	40	50	60	70	80
1	-0.2	-0.1	0.0	0.1	0.3
2	-0.3	-0.2	0.0	0.3	0.6
3	-0.5	-0.3	0.0	0.5	1.0
4	-0.6	-0.3	0.0	0.7	1.3
5	-0.8	-0.4	0.0	0.9	1.7
6	-1.0	-0.5	0.0	1.0	2.0
7	-1.1	-0.6	0.0	1.2	2.4
8	-1.3	-0.7	0.0	1.4	2.7
9	-1.5	-0.7	0.0	1.6	3.1
10	-1.6	-0.8	0.0	1.8	3.5
11	-1.8	-0.9	0.0	1.9	3.8
12	-1.9	-1.0	0.0	2.1	4.2
13	-2.1	-1.1	0.0	2.3	4.5
14	-2.3	-1.1	0.0	2.5	4.9

Includes APU fuel burn.

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Holding

Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)			
		1500	5000	10000	15000
80	%N1	93.4			
	KIAS	225			
	FF/ENG	4140			
75	%N1	91.4	94.7		
	KIAS	220	220		
	FF/ENG	3870	3910		
70	%N1	89.4	92.6		
	KIAS	216	216		
	FF/ENG	3610	3640		
65	%N1	87.4	90.5	95.9	
	KIAS	211	211	211	
	FF/ENG	3360	3380	3460	
60	%N1	85.2	88.2	92.9	
	KIAS	204	204	204	
	FF/ENG	3110	3110	3150	
55	%N1	82.9	85.9	90.4	97.2
	KIAS	198	198	198	198
	FF/ENG	2860	2860	2880	3010
50	%N1	80.4	83.4	87.7	92.8
	KIAS	192	192	192	192
	FF/ENG	2630	2620	2620	2670
45	%N1	77.8	80.7	85.0	89.6
	KIAS	185	185	185	185
	FF/ENG	2400	2380	2380	2400
40	%N1	75.1	77.8	82.1	86.5
	KIAS	178	178	178	178
	FF/ENG	2180	2160	2140	2140

This table includes 5% additional fuel for holding in a racetrack pattern.

Introduction

This chapter contains information to supplement performance data from the Flight Management Computer (FMC). In addition, sufficient inflight data is provided to complete a flight with the FMC inoperative. In the event of conflict between data presented in this chapter and that contained in the approved Airplane Flight Manual, the Flight Manual shall always take precedence.

General

Takeoff Speeds

The speeds presented in the Takeoff Speeds table as well as FMC computed takeoff speeds can be used for all performance conditions except where adjustments must be made to V1 for clearway, stopway, anti-skid inoperative, thrust reversers inoperative, improved climb, contaminated runway situations or brake energy limits. 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 will not help this condition as the minimum control speeds are determined at the actual temperature and therefore are not reduced.

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

V1(MCG)

Regulations prohibit scheduling takeoff with a V1 less than minimum V1 for control on the ground, V1(MCG). It is therefore necessary to compare the adjusted V1 to V1(MCG). The V1(MCG) presented in this manual is conservative for all weight and bleed configurations.

To find V1(MCG) enter the V1(MCG) table with the airport pressure altitude and actual OAT. If the adjusted V1 is less than V1(MCG), set V1 equal to V1(MCG). If the adjusted VR is less than V1(MCG), set VR equal to V1(MCG), and determine a new V2 by adding the difference between the normal VR and V1(MCG) to the normal V2. No takeoff weight adjustment is necessary provided that the actual field length exceeds the minimum field length shown in the Field and Climb Limit Weight table in chapter Performance Dispatch.

Clearway and Stopway V1 Adjustments

Maximum allowable clearway limits are provided for guidance when more precise data is not available. Use of clearway is not allowed on wet runways.

Takeoff speed adjustments are to be applied to V1 speed when using takeoff weights based on the use of clearway and stopway.

Adjust V1 speed by the amount shown in the table. The adjusted V1 speed must not exceed VR. If the adjusted V1 speed is greater than VR, reduce V1 to equal VR.

Stab Trim

To find takeoff stabilizer trim setting, enter Stab Trim Setting table with anticipated brake release weight and center of gravity (C.G. % MAC) and read required stabilizer trim units.

VREF

This table contains flaps 40, 30 and 15 reference speeds for a given weight.

With autothrottles disengaged an approach speed wind correction (max 20 knots) of 1/2 steady headwind component + gust increment above steady wind is recommended. Do not apply a wind correction for tailwinds. The maximum command speed should not exceed landing flap placard speed minus 5 knots.

Flap Maneuver Speeds

This table provides flap maneuver speeds for various flap settings. During flap retraction, selection of the next flap position is initiated when reaching the maneuver speed for the existing flap position. During flap retraction, at least adequate maneuver capability or 30° of bank (15° of bank and 15° overshoot) to stick shaker is provided at the flap retraction speed. Full maneuver capability or at least 40° of bank (25° of bank and 15° overshoot) is provided when the airplane has accelerated to the recommended maneuver speed for the selected flap position.

During flap extension, selection of the flaps to the next flap position should be made when approaching, and before decelerating below, the maneuver speed for the existing flap position. The flap extension speed schedule varies with airplane weight and provides full maneuver capability or at least 40° of bank (25° of bank and 15° overshoot) to stick shaker at all weights.

Slush/Standing Water Takeoff

Experience has shown that aircraft performance may deteriorate significantly on runways covered with snow, slush, standing water or ice. Therefore, reductions in field/obstacle limited takeoff weight and revised takeoff speeds are necessary. The tables are intended for guidance in accordance with advisory material and assume an engine failure at the critical point during the takeoff.

The entire runway is assumed to be completely covered by a contaminant of uniform thickness and density. Therefore this information is conservative when operating under typical cold weather conditions where patches of slush exist and some degree of sanding is common. Takeoffs in slush depths greater than 13 mm (0.5 inches) are not recommended because of possible airplane damage as a result of slush impingement on the airplane structure. The use of assumed temperature for reduced thrust is not allowed on contaminated runways. Interpolation for slush/standing water depths between the values shown is permitted.

Takeoff weight determination:

1. Enter the Weight Adjustment table with the dry field/obstacle limit weight to obtain the weight reduction for the slush/standing water depth and airport pressure altitude.
2. Adjust field length available for temperature by amount shown beneath V1(MCG) limit weight table.
3. Enter the V1(MCG) Limit Weight table with the adjusted field length and pressure altitude to obtain the slush/standing water limit weight with respect to minimum field length required for V1(MCG) speed.

4. The maximum allowable takeoff weight in slush/standing water is the lesser of the limit weights found in steps 1 and 3.

Takeoff speed determination:

1. Determine takeoff speeds V1, VR and V2 for actual brake release weight using the Dry Runway Takeoff Speeds table for the appropriate flap setting and thrust rating.
2. If V1(MCG) limited, set V1=V1(MCG). If not limited by V1(MCG) considerations, enter the V1 Adjustment table with actual brake release weight to determine the V1 reduction to apply to V1 speed. If the adjusted V1 is less than V1(MCG), set V1=V1(MCG).

Slippery Runway Takeoff

Airplane braking action is reported as good, medium or poor, depending on existing runway conditions. If braking action is reported as good, conditions should not be expected to be as good as on clean, dry runways. The value "good" is comparative and is intended to mean that airplanes should not experience braking or directional control difficulties when stopping. The performance level used to calculate the "good" data is consistent with wet runway testing done on early Boeing jets. The performance level used to calculate the "poor" data reflects a runway covered with wet ice. Performance is based on a 15 ft screen height at the end of the runway. The tables provided are used in the same manner as the Slush/Standing Water tables.

Anti-Skid Inoperative

When operating with anti-skid inoperative, the field limit weight and V1 must be reduced to account for the effect on accelerate-stop performance. Anti-skid inoperative is only allowed on a dry runway. A simplified method which conservatively accounts for the effects of anti-skid inoperative is to reduce the normal dry field/obstacle limited weight by 8500 kg and the V1 associated with the reduced weight by the amount shown in the table below.

ANTI-SKID INOPERATIVE V1 ADJUSTMENTS

FIELD LENGTH (M)	V1 ADJUSTMENT (KIAS)
2000	-19
2500	-16
3000	-14
3500	-12
4000	-11

If the resulting V1 is less than V1(MCG), takeoff is permitted with V1 set equal to V1(MCG) provided the dry accelerate-stop distance adjusted for wind and slope exceeds approximately 1800 m.

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

Thrust Reverser Inoperative

When dispatching on a wet runway with both thrust reversers operative, an operative anti-skid system, and all brakes operating, regulations allow deceleration credit for one thrust reverser in the engine failure case and two thrust reversers in the all engine stop case.

When dispatching on a wet runway with one thrust reverser inoperative, the field/obstacle limited weight and V1 must be reduced to account for the effect on accelerate-stop performance. A simplified method, which conservatively accounts for this, is to reduce the normal wet runway/field/obstacle limited weight by 1050 kg and the V1 associated with the reduced weight by 2 knots.

If the resulting V1 is less than minimum V1, takeoff is permitted with V1 set equal to V1(MCG) provided the accelerate-stop distance available adjusted for wind and slope exceeds approximately 1200 m.

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

Takeoff %N1

To find Max Takeoff %N1 based on normal engine bleed for air conditioning packs on, enter Takeoff %N1 Table with airport pressure altitude and airport OAT and read %N1. Apply %N1 adjustments as provided when applicable.

Assumed Temperature Reduced Thrust

Regulations permit the use of up to 25% takeoff thrust reduction for operation with assumed temperature reduced thrust. Use of assumed temperature reduced thrust is not allowed with anti-skid inoperative or on runways contaminated with standing water, ice, slush, or snow. Use of assumed temperature reduced thrust is not recommended if potential windshear conditions exist.

To find the maximum allowable assumed temperature enter the Maximum Assumed Temperature table with airport pressure altitude and OAT. Compare this temperature to that at which the airplane is performance limited as determined from available takeoff performance data. Next, enter the Maximum Takeoff %N1 table with airport pressure altitude and the lower of the two temperatures previously determined, to obtain a maximum takeoff %N1. Do not use an assumed temperature less than the minimum assumed temperature shown. Enter the %N1 Adjustment table with OAT and the difference between the assumed and actual OAT to obtain a %N1 adjustment. Subtract the %N1 adjustment from the maximum takeoff %N1 found previously to determine the assumed temperature reduced thrust %N1.

Apply %N1 adjustments as provided when applicable.

Max Climb %N1

This table shows Max Climb %N1 for a 280/.78 climb speed schedule, normal engine bleed for packs on or off and anti-ice off. Enter the table with airport pressure altitude and TAT and read %N1. %N1 adjustments are shown for anti-ice operation.

Go-around %N1

To find Max Go-around %N1 based on normal engine bleed for packs on (AUTO) and anti-ice on or off, enter the Go-around %N1 table with airport pressure altitude and reported OAT or TAT and read %N1. For packs OFF or HIGH operation, apply the %N1 adjustment shown below the table.

Flight with Unreliable Airspeed / Turbulent Air Penetration

Pitch attitude and average %N1 information is provided for use in all phases of flight in the event of unreliable airspeed/Mach indications resulting from blocking or freezing of the pitot system. Loss of radome or turbulent air may also cause unreliable airspeed/Mach indications. The cruise table in this section may also be used for turbulent air penetration.

Pitch attitude is shown in bold type for emphasis since altitude and/or vertical speed indications may also be unreliable.

All Engines

Long Range Cruise Maximum Operating Altitude

These tables provide the maximum operating altitude in the same manner as the FMC. Maximum altitudes are shown for a given cruise weight and maneuver capability. This table considers both thrust and buffet limits, providing the more limiting of the two. Any data that is thrust limited is denoted by an asterisk and represents only a thrust limited condition in level flight with 100 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 15° may cause the airplane to lose speed and/or altitude. The altitudes shown in the table are limited to the maximum certified altitude of 41000 ft.

Long Range Cruise Control

These tables provide target %N1, Long Range Cruise Mach number, IAS and standard day fuel flow per engine for the airplane weight and pressure altitude. As indicated by the shaded area, at optimum altitude .79M approximates the Long Range Cruise Mach schedule.

Long Range Cruise Enroute Fuel and Time

Long Range Cruise Enroute Fuel and Time tables are provided to determine remaining time and fuel required to destination. The data is based on Long Range Cruise and .78/280/250 descent. Tables are presented for low altitudes and high altitudes.

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

APU Operation During Flight

For APU operation during flight, increase fuel flow according to the table in the Engine Inoperative text section.

Long Range Cruise Wind-Altitude Trade

Wind is a factor which may justify operations considerably below optimum altitude. For example, a favorable wind component may have an effect on ground speed which more than compensates for the loss in air range.

Using this table, it is possible to determine the break-even wind (advantage necessary or disadvantage that can be tolerated) to maintain the same range at another altitude and long range cruise speed. The tables make no allowance for climb or descent time, fuel or distance, and are based on comparing ground fuel mileage.

Descent

Time, fuel, and distance for descent are shown for a .78/280/250 descent speed schedule. Enter the table with top of descent pressure altitude and read distance, time and fuel. Data is based on flight idle thrust descent in zero wind. Allowances are included for a straight-in approach with gear down and landing flaps at the outer marker.

Holding

Target %N1, indicated airspeed and fuel flow per engine information is tabulated for holding with flaps up based on the FMC optimum holding speed schedule. This is the higher of the maximum endurance speed and the maneuvering speed. Small variations in airspeed will not appreciably affect the overall endurance time. Enter the table with weight and pressure altitude to read %N1, IAS and fuel flow per engine.

Advisory Information

Normal Configuration Landing Distance

The normal configuration distance tables are provided as advisory information to help determine the actual landing distance performance of the airplane for different runway surface conditions and brake configurations.

Flaps 15, 30, and 40 landing distances and adjustments are provided for dry runways as well as runways with good, medium, and poor reported braking action, which are commonly referred to as slippery runway conditions.

If the surface is affected by water, snow or ice, and the braking action is reported as "good", conditions should not be expected to be as good as on clean, dry runways. The value "good" is comparative and is intended to mean that airplanes should not experience braking or directional control difficulties when landing. The performance level used to calculate the "good" data is consistent with wet runway testing done on early Boeing jets. The performance level used to calculate "poor" data reflects runways covered with wet ice.

Dry runway landing performance is shown for max manual braking configuration and autobrake settings max, 3, 2, and 1. The autobrake performance may be used to assist in the selection of the most desirable autobrake setting for a given field length. Selection of an autobrake setting results in a constant rate of deceleration. Maximum effort manual braking should achieve shorter landing distance than the max autobrake setting. The reference landing distance is a reference distance from 50 ft above the threshold to stop based on a reference landing weight and normal approach speed for the selected landing flap at sea level, zero wind, zero slope, and two engine detent reverse thrust. Subsequent columns provide adjustments for off-reference landing weight, altitude, wind, slope, temperature, speed, and reverse thrust. Each adjustment is independently added to the reference landing distance.

Non-normal Configuration Landing Distance

Advisory information is provided to support non-normal configurations that affect the landing performance of the airplane. Landing distances and adjustments are provided for dry runways and runways with good, medium, and poor reported braking action.

Enter the table with the applicable non-normal configuration and read the normal approach speed. The reference landing distance is a reference distance from 50 ft above the threshold to stop based on a reference landing weight and speed at sea level, zero wind, and zero slope. Subsequent columns provide adjustments for off-reference landing weight, altitude, wind, slope, and speed conditions. Each adjustment is independently added to the reference landing distance. Landing distance includes the effect of reverse thrust.

Recommended Brake Cooling Schedule

Advisory information is provided to assist in avoiding the problems associated with hot brakes. For normal operation, most landings are at weights below the AFM quick turnaround limit weight.

Use of the recommended cooling schedule will help avoid brake overheat and fuse plug problems that could result from repeated landings at short time intervals or a rejected takeoff.

Enter the Recommended Brake Cooling Schedule table with the airplane weight and brakes on speed, adjusted for wind at the appropriate temperature and altitude condition. Instructions for applying wind adjustments are included below the table. Linear interpolation may be used to obtain intermediate values. The resulting number is the reference brake energy per brake in millions of foot-pounds, and represents the amount of energy absorbed by each brake during a rejected takeoff. Notes providing adjustments for wind are included below the table.

To determine the energy per brake absorbed during landing, enter the appropriate Adjusted Brake Energy Per Brake table (No Reverse Thrust or 2 Engine Reverse) with the reference brake energy per brake and the type of braking used during landing (Max Manual, Max Auto, or Autobrake). The resulting number is the adjusted brake energy per brake and represents the energy absorbed in each brake during the landing.

The recommended cooling time is found in the appropriate (steel or carbon brakes) final table by entering with the adjusted brake energy per brake. Times are provided for ground cooling and inflight gear down cooling.

Brake Temperature Monitor System (BTMS) indications are also shown. If brake cooling is determined from the BTMS, use the hottest brake indication 10 to 15 minutes after the airplane has come to a complete stop, or inflight with gear retracted to determine recommended cooling schedule.

Engine Inoperative

Initial Max Continuous %N1

The Initial Max Continuous %N1 setting for use following an engine failure is shown. The table is based on the typical all engine cruise speed of .79M to provide a target %N1 setting at the start of driftdown. Once driftdown is established, the Max Continuous %N1 table should be used to determine %N1 for the given conditions.

Max Continuous %N1

Power setting is based on one engine operating with one A/C pack operating and all anti-ice bleeds off. Enter the table with pressure altitude, TAT, and IAS or Mach to read %N1.

It is desirable to maintain engine thrust level within the limits of the Max Cruise thrust rating. However, where thrust level in excess of Max Cruise rating is required, such as for meeting terrain clearance, ATC altitude assignments, or to attain maximum range capability, it is permissible to use the thrust needed up to the Max Continuous thrust rating. The Max Continuous thrust rating is intended primarily for emergency use at the discretion of the pilot and is the maximum thrust that may be used continuously.

Driftdown Speed/Level Off Altitude

The table shows optimum driftdown speed as a function of cruise weight at start of driftdown. Also shown are the approximate weight and pressure altitude at which the airplane will level off considering 100 ft/min residual rate of climb.

The level off altitude is dependent on air temperature (ISA deviation).

Driftdown/LRC Range Capability

This table shows the range capability from the start of driftdown. Driftdown is continued to level off altitude. As weight decreases due to fuel burn, the airplane is accelerated to Long Range Cruise speed. Cruise is continued at level off altitude and Long Range Cruise speed.

To determine fuel required, enter the Ground to Air Miles Conversion table with the desired ground distance and adjust for anticipated winds to obtain air distance to destination. Then enter the Driftdown/Cruise Fuel and Time table with air distance and weight at start of driftdown to determine fuel and time required. If altitudes other than the level off altitude is used, fuel and time required may be obtained by using the Engine Inoperative Long Range Cruise Enroute Fuel and Time table.

Long Range Cruise Altitude Capability

The table shows the maximum altitude that can be maintained at a given weight and air temperature (ISA deviation), based on Long Range Cruise speed, Max Continuous thrust, and 100 ft/min residual rate of climb.

Long Range Cruise Control

The table provides target %N1, engine inoperative Long Range Cruise Mach number, IAS and fuel flow for the airplane weight and pressure altitude. The fuel flow values in this table reflect single engine fuel burn.

APU Operation During Flight

For APU operation during flight, increase fuel flow according to the following table. These increments include the APU fuel flow and the effect of increased drag from the APU door.

PRESSURE ALTITUDE (1000 FT)	APU FUEL FLOW (KG/HR)
39	45
35	45
31	50
25	60
20	65
15	75
10	85
5	95

Long Range Cruise Diversion Fuel and Time

Tables are provided for crews to determine the fuel and time required to proceed to an alternate airfield with one engine inoperative. The data is based on single engine Long Range Cruise speed and .78/280/250 descent. Enter with Air Distance as determined from the Ground to Air Miles Conversion table and read Fuel and Time required at the cruise pressure altitude. Adjust the fuel obtained for deviation from the reference weight at checkpoint as required by entering the off reference fuel adjustments table with the fuel required for the reference weight and the actual weight at checkpoint. Read fuel required and time for the actual weight.

Holding

Single engine holding data is provided in the same format as the all engine holding data and is based on the same assumptions.

Gear Down Landing Rate of Climb Available

Rate of climb data is provided as guidance information in the event an engine inoperative landing (manual or autoland) is planned. The tables show gear down rate of climb available for Flaps 15 and Flaps 30. Enter the table with TAT and pressure altitude to read rate of climb available. Apply adjustments shown to correct for weight.

Alternate Mode EEC

Introduction

This section contains performance data for airplane operation with the Electronic Engine Control (EEC) in the alternate mode (ALTN EEC switch illuminated) for applicable thrust ratings. The data includes engine bleed effects for normal air conditioning operation i.e., two packs on at normal flow all engines operating.

Operation with derate and/or assumed temperature reduced thrust is not permitted with the EEC in alternate mode.

Limit Weight

A simplified method which conservatively accounts for the effects of EEC in alternate mode is to reduce the normal mode (ON EEC switch illuminated) performance limited weights. The Limit Weight table provides takeoff field, climb, and obstacle limit weights. To determine limit weights for operations with the EEC in alternate mode, enter the table with the limit weights for normal mode EEC operation and read the associated limit weight for each performance condition. The most limiting of the takeoff weights must be used. Analysis from the Airplane Flight Manual - Digital Performance Information may yield less restrictive limit weights.

Takeoff Speed Adjustment

Takeoff speeds for the reduced weight should be increased by the amount shown in the Takeoff Speeds Adjustment table. The adjusted V1 should not exceed the adjusted VR.

Note: The FMC does not incorporate alternate mode EEC performance in its takeoff speeds calculations.

Max Takeoff %N1

The alternate mode EEC thrust schedule provides equal or greater thrust than the normal mode thrust for the same thrust lever position. Thrust limit protection is not provided in alternate mode EEC and maximum rated thrust may be reached at thrust lever position less than full forward. As a result, thrust overboost may occur if the target alternate mode EEC Max Takeoff %N1 settings are not observed.

To find alternate mode EEC Max Takeoff %N1 based on normal engine bleed for air conditioning packs on, enter the Alternate Mode EEC Max Takeoff %N1 table with airport pressure altitude and airport OAT and read %N1. For packs off apply the %N1 adjustment provided below the table. No %N1 adjustment is required for engine or wing anti-ice.

Gear Down

This section contains performance for airplane operation with the landing gear extended. The data is based on engine bleeds for normal air conditioning.

Note: The Flight Management Computer System (FMCS) does not contain special provisions for operation with landing gear extended. As a result, the FMCS may generate inappropriate enroute speed schedules, display non-conservative predictions of fuel burn, estimated time of arrival (ETA), maximum altitude, and compute overly shallow descent path. An accurate estimated time of arrival (ETA) is available if current speed or Mach is entered into the VNAV cruise page.

Tables for gear down performance in this section are identical in format and used in the same manner as tables for the gear up configuration previously described.

Performance Inflight Chapter PI

Table of Contents Section 60

737-800WSFP1 CFM56-7B26 C M KG FAA CATC/N (FMC Model 737-800W.1)

General

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

Serial and tabulation number are supplied by Boeing.

Registry Number	Serial Number	Tabulation Number
B-6887	43884	YV604
B-6889	43914	YV605

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Takeoff Speeds - Dry Runway

V1, VR, V2 for Max Takeoff Thrust

WEIGHT	FLAPS 1			FLAPS 5			FLAPS 10			FLAPS 15			FLAPS 25		
(1000 KG)	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
90	167	169	173	160	162	166	158	158	163						
80	157	159	165	150	152	159	148	149	155	145	146	152	142	143	150
70	146	148	157	140	142	150	138	139	147	134	136	144	132	133	142
60	134	135	147	128	129	141	126	127	138	123	124	135	121	122	133
50	120	121	136	115	116	131	113	113	128	110	111	125	108	109	124
40	105	105	124	101	101	119	99	99	117	96	97	114	95	95	113

Check V1(MCG).

V1, VR, V2 Adjustments*

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

Slope and Wind V1 Adjustments*

WEIGHT	SLOPE (%)					WIND (KTS)							
(1000 KG)	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
90	-4	-3	0	1	1	-2	-2	-1	0	0	0	0	1
80	-3	-2	0	1	1	-2	-1	-1	0	0	0	1	1
70	-2	-1	0	1	1	-2	-1	-1	0	0	1	1	1
60	-1	-1	0	1	1	-2	-1	0	0	0	1	1	1
50	-1	0	0	0	0	-2	-1	0	0	0	0	0	0
40	0	0	0	0	0	-2	-1	0	0	0	0	0	0

***V1 not to exceed VR.**

V1(MCG)

Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	95	93					
60	140	95	93	92	90			
50	122	97	95	92	90	88	86	83
40	104	101	99	96	93	89	86	83
30	86	104	103	100	96	92	88	85
20	68	104	104	101	98	94	90	87
-60	-76	106	105	102	99	95	92	89

Takeoff Speeds - Wet Runway
V1, VR, V2 for Max Takeoff Thrust

WEIGHT (1000 KG)	FLAPS 1			FLAPS 5			FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
90	162	169	173	154	162	166	154	158	163						
80	150	159	165	143	152	159	141	149	155	138	146	152	135	143	150
70	138	148	157	132	142	150	130	139	147	126	136	144	124	133	142
60	125	135	147	119	129	141	117	127	138	114	124	135	112	122	133
50	110	121	136	105	116	131	103	113	128	101	111	125	99	109	124
40	94	105	124	90	101	119	88	99	117	86	97	114	84	95	113

Check V1(MCG).

V1, VR, V2 Adjustment*

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

Slope and Wind V1 Adjustment*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
90	-5	-3	0	3	6	-3	-2	-1	0	1	1	2	3
80	-5	-2	0	3	5	-4	-2	-1	0	1	1	2	3
70	-4	-2	0	2	4	-4	-2	-1	0	1	1	2	3
60	-3	-2	0	2	3	-4	-3	-1	0	1	2	2	3
50	-2	-1	0	1	3	-5	-3	-1	0	1	2	3	4
40	-2	-1	0	1	2	-5	-3	-2	0	1	2	3	4

***V1 not to exceed VR.**

V1(MCG)
Max Takeoff Thrust

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	95	93					
60	140	95	93	92	90			
50	122	97	95	92	90	88	86	83
40	104	101	99	96	93	89	86	83
30	86	104	103	100	96	92	88	85
20	68	104	104	101	98	94	90	87
-60	-76	106	105	102	99	95	92	89

Maximum Allowable Clearway

FIELD LENGTH (M)	DRY RUNWAY MAX ALLOWABLE CLEARWAY FOR V1 REDUCTION (M)
1200	160
1600	180
2000	220
2400	240
2800	270
3200	300

Clearway and Stopway V1 Adjustments

CLEARWAY MINUS STOPWAY (M)	NORMAL V1 (KIAS)							
	DRY RUNWAY				WET RUNWAY			
	100	120	140	160	100	120	140	160
300	-4	-4	-4	-4				
200	-4	-4	-3	-3				
100	-2	-2	-2	-2				
0	0	0	0	0	0	0	0	0
-100	0	0	0	0	2	2	1	1
-200	0	0	0	0	4	3	2	1
-300	0	0	0	0	4	3	2	1

Use of clearway not allowed on wet runways.
V1 not to exceed VR.

Stab Trim Setting

Max Takeoff Thrust

Flaps 1 and 5

WEIGHT (1000 KG)	C.G. (%MAC)									
	6	9	11	16	23	26	30	32	33	36
80	8 1/2	8	7 3/4	7	5 3/4	5 1/4	4 1/2	4 1/4	4	3 1/2
70	8	7 1/2	7 1/4	6 1/2	5 1/4	4 3/4	4 1/4	3 3/4	3 3/4	3 1/4
60	7 1/4	6 3/4	6 1/2	5 3/4	4 3/4	4 1/4	3 3/4	3 1/2	3 1/4	2 3/4
50	6 1/2	6 1/4	6	5 1/4	4 1/4	3 3/4	3 1/4	3	2 3/4	2 3/4
40	6 1/4	5 3/4	5 1/2	4 3/4	4	3 1/2	3	2 3/4	2 3/4	2 3/4
35	6 1/4	5 3/4	5 1/2	4 3/4	4	3 1/2	3	2 3/4	2 3/4	2 3/4

Flaps 10, 15 and 25

WEIGHT (1000 KG)	C.G. (%MAC)									
	6	9	11	16	23	26	30	32	33	36
80	8 1/2	8 1/2	8	6 1/4	4 3/4	4 1/4	3 1/2	3	2 3/4	2 3/4
70	8 1/2	7 3/4	7 1/4	5 3/4	4 1/2	3 3/4	3	2 3/4	2 3/4	2 3/4
60	7 3/4	7	6 1/2	5 1/4	4	3 1/4	2 3/4	2 3/4	2 3/4	2 3/4
50	6 1/4	5 3/4	5 1/4	4 1/4	3 1/4	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4
40	5 1/4	4 3/4	4 1/2	3 3/4	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4
35	5 1/4	4 3/4	4 1/2	3 3/4	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4

VREF

WEIGHT (1000 KG)	FLAPS		
	40	30	15
85	159	167	174
80	154	162	169
75	148	156	163
70	143	151	157
65	139	147	153
60	133	141	147
55	127	134	140
50	121	128	133
45	114	121	126
40	107	114	119

Flap Maneuver Speeds

FLAP POSITION	MANEUVER SPEED
UP	VREF40 + 70
1	VREF40 + 50
5	VREF40 + 30
10	VREF40 + 30
15	VREF40 + 20
25	VREF40 + 10
30	VREF30
40	VREF40

ADVISORY INFORMATION

Slush/Standing Water Takeoff

Maximum Reverse Thrust

Weight Adjustments (1000 KG)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	-11.1	-12.9	-14.6	-14.0	-15.7	-17.5	-20.0	-23.2	-26.5
90	-10.3	-12.0	-13.8	-12.8	-14.5	-16.3	-18.0	-21.3	-24.5
85	-9.4	-11.1	-12.9	-11.5	-13.3	-15.0	-16.1	-19.3	-22.6
80	-8.5	-10.3	-12.0	-10.3	-12.1	-13.8	-14.1	-17.4	-20.6
75	-7.7	-9.4	-11.2	-9.1	-10.9	-12.6	-12.2	-15.5	-18.7
70	-6.8	-8.6	-10.3	-8.0	-9.7	-11.5	-10.5	-13.7	-17.0
65	-6.0	-7.7	-9.5	-6.9	-8.6	-10.4	-8.8	-12.1	-15.3
60	-5.1	-6.8	-8.6	-5.8	-7.5	-9.3	-7.3	-10.6	-13.8
55	-4.2	-6.0	-7.7	-4.7	-6.5	-8.2	-5.9	-9.1	-12.4
50	-3.3	-5.1	-6.8	-3.7	-5.5	-7.2	-4.6	-7.9	-11.1
45	-2.5	-4.2	-6.0	-2.8	-4.5	-6.3	-3.5	-6.7	-10.0
40	-1.6	-3.3	-5.1	-1.8	-3.6	-5.3	-2.4	-5.6	-8.9

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1200				30.8			36.3		
1400	45.9			49.1	33.1		54.5	38.6	
1600	65.5	48.3	32.2	68.8	51.4	35.3	74.0	56.9	40.8
1800	87.4	68.2	50.6	90.4	71.4	53.8	94.7	76.5	59.2
2000		90.2	70.8		93.2	74.0		97.3	79.1
2200			93.0			95.9			99.9

1. **Enter Weight Adjustment table with slush/standing water depth and dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -25 m/+25 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-16	-11	-6	-9	-4	0	0	0	0
85	-17	-12	-7	-11	-6	-1	0	0	0
80	-18	-13	-8	-13	-8	-3	-1	0	0
75	-20	-15	-10	-15	-10	-5	-4	0	0
70	-21	-16	-11	-17	-12	-7	-6	-1	0
65	-22	-17	-12	-18	-13	-8	-9	-4	0
60	-23	-18	-13	-20	-15	-10	-12	-7	-2
55	-24	-19	-14	-21	-16	-11	-15	-10	-5
50	-25	-20	-15	-23	-18	-13	-18	-13	-8
45	-26	-21	-16	-24	-19	-14	-21	-16	-11
40	-27	-22	-17	-26	-21	-16	-23	-18	-13

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff

No Reverse Thrust

Weight Adjustments (1000 KG)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	-14.7	-16.2	-17.7	-17.6	-19.1	-20.6	-23.5	-27.0	-30.5
90	-13.7	-15.2	-16.7	-16.2	-17.7	-19.2	-21.3	-24.8	-28.3
85	-12.6	-14.1	-15.6	-14.8	-16.3	-17.8	-19.2	-22.7	-26.2
80	-11.6	-13.1	-14.6	-13.4	-14.9	-16.4	-17.1	-20.6	-24.1
75	-10.5	-12.0	-13.5	-12.0	-13.5	-15.0	-15.1	-18.6	-22.1
70	-9.5	-11.0	-12.5	-10.7	-12.2	-13.7	-13.2	-16.7	-20.2
65	-8.5	-10.0	-11.5	-9.4	-10.9	-12.4	-11.4	-14.9	-18.4
60	-7.5	-9.0	-10.5	-8.2	-9.7	-11.2	-9.8	-13.3	-16.8
55	-6.5	-8.0	-9.5	-7.1	-8.6	-10.1	-8.2	-11.7	-15.2
50	-5.6	-7.1	-8.6	-6.0	-7.5	-9.0	-6.9	-10.4	-13.9
45	-4.6	-6.1	-7.6	-4.9	-6.4	-7.9	-5.6	-9.1	-12.6
40	-3.7	-5.2	-6.7	-4.0	-5.5	-7.0	-4.5	-8.0	-11.5

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1800							51.5	34.0	
2000	42.0			57.3	35.5		76.5	57.6	39.8
2200	74.9	49.6		87.1	64.6	42.7	103.1	83.1	63.7
2400		84.3	57.6		94.6	72.1			89.8
2600			94.0			102.2			

1. **Enter Weight Adjustment table with slush/standing water depth and dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -35 m/+35 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-24	-14	-4	-14	-4	0	0	0	0
85	-26	-16	-6	-17	-7	0	0	0	0
80	-28	-18	-8	-20	-10	0	-2	0	0
75	-30	-20	-10	-23	-13	-3	-6	0	0
70	-32	-22	-12	-26	-16	-6	-11	-1	0
65	-33	-23	-13	-28	-18	-8	-15	-5	0
60	-35	-25	-15	-31	-21	-11	-20	-10	0
55	-37	-27	-17	-34	-24	-14	-24	-14	-4
50	-39	-29	-19	-36	-26	-16	-29	-19	-9
45	-41	-31	-21	-39	-29	-19	-34	-24	-14
40	-43	-33	-23	-41	-31	-21	-38	-28	-18

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff

Maximum Reverse Thrust

Weight Adjustment (1000 KG)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	0.0	0.0	0.0	-5.3	-5.3	-5.3	-10.2	-10.2	-10.2
90	-0.1	-0.1	-0.1	-5.3	-5.3	-5.3	-9.8	-9.8	-9.8
85	-0.3	-0.3	-0.3	-5.2	-5.2	-5.2	-9.4	-9.4	-9.4
80	-0.5	-0.5	-0.5	-5.2	-5.2	-5.2	-9.0	-9.0	-9.0
75	-0.7	-0.7	-0.7	-5.0	-5.0	-5.0	-8.5	-8.5	-8.5
70	-0.8	-0.8	-0.8	-4.8	-4.8	-4.8	-8.0	-8.0	-8.0
65	-0.7	-0.7	-0.7	-4.5	-4.5	-4.5	-7.4	-7.4	-7.4
60	-0.6	-0.6	-0.6	-4.1	-4.1	-4.1	-6.7	-6.7	-6.7
55	-0.4	-0.4	-0.4	-3.6	-3.6	-3.6	-5.9	-5.9	-5.9
50	-0.2	-0.2	-0.2	-3.0	-3.0	-3.0	-5.1	-5.1	-5.1
45	0.0	0.0	0.0	-2.3	-2.3	-2.3	-4.1	-4.1	-4.1
40	0.0	0.0	0.0	-1.5	-1.5	-1.5	-3.1	-3.1	-3.1

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1000	43.2								
1200	74.7	59.0	43.2						
1400		90.3	74.7	50.6	34.8				
1600				73.6	56.1	39.9	33.7		
1800				99.1	79.9	61.7	46.6	32.1	
2000						86.3	60.6	44.9	30.5
2200							76.5	58.8	43.3
2400							94.3	74.4	57.0
2600								92.0	72.3
2800									89.8

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 -15 m/+15 m for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -15 m/+15 m for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -35 m/+35 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-6	-1	0	-15	-10	-5	-25	-20	-15
85	-7	-2	0	-16	-11	-6	-27	-22	-17
80	-8	-3	0	-18	-13	-8	-30	-25	-20
75	-8	-3	0	-19	-14	-9	-32	-27	-22
70	-9	-4	0	-20	-15	-10	-34	-29	-24
65	-10	-5	0	-22	-17	-12	-35	-30	-25
60	-11	-6	-1	-23	-18	-13	-37	-32	-27
55	-12	-7	-2	-25	-20	-15	-39	-34	-29
50	-13	-8	-3	-26	-21	-16	-40	-35	-30
45	-15	-10	-5	-28	-23	-18	-42	-37	-32
40	-16	-11	-6	-29	-24	-19	-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.**

ADVISORY INFORMATION

Slippery Runway Takeoff

No Reverse Thrust

Weight Adjustments (1000 KG)

DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	-1.0	-1.0	-1.0	-8.1	-8.1	-8.1	-14.5	-14.5	-14.5
90	-1.3	-1.3	-1.3	-8.0	-8.0	-8.0	-13.9	-13.9	-13.9
85	-1.6	-1.6	-1.6	-7.9	-7.9	-7.9	-13.3	-13.3	-13.3
80	-1.9	-1.9	-1.9	-7.8	-7.8	-7.8	-12.7	-12.7	-12.7
75	-2.1	-2.1	-2.1	-7.7	-7.7	-7.7	-12.0	-12.0	-12.0
70	-2.2	-2.2	-2.2	-7.4	-7.4	-7.4	-11.3	-11.3	-11.3
65	-2.3	-2.3	-2.3	-7.0	-7.0	-7.0	-10.4	-10.4	-10.4
60	-2.2	-2.2	-2.2	-6.5	-6.5	-6.5	-9.5	-9.5	-9.5
55	-2.0	-2.0	-2.0	-6.0	-6.0	-6.0	-8.5	-8.5	-8.5
50	-1.7	-1.7	-1.7	-5.3	-5.3	-5.3	-7.4	-7.4	-7.4
45	-1.4	-1.4	-1.4	-4.5	-4.5	-4.5	-6.2	-6.2	-6.2
40	-0.9	-0.9	-0.9	-3.6	-3.6	-3.6	-4.9	-4.9	-4.9

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1200	47.5								
1400	89.6	70.6	47.5						
1600		108.1	89.6						
1800				41.4					
2000				83.4	51.9				
2200					93.9	62.5			
2400						104.4			
2800							30.3		
3000							62.1		
3200							95.7	54.0	
3400								87.2	46.0
3600									78.7

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 -20 m/+20 m for every 5°C above/below 4°C.**
   Adjust "Medium" field length available by -20 m/+20 m for every 5°C above/below 4°C.
   Adjust "Poor" field length available by -40 m/+40 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff
No Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-8	-3	0	-20	-15	-10	-39	-34	-29
85	-9	-4	0	-22	-17	-12	-42	-37	-32
80	-10	-5	0	-24	-19	-14	-46	-41	-36
75	-12	-7	-2	-27	-22	-17	-49	-44	-39
70	-13	-8	-3	-29	-24	-19	-53	-48	-43
65	-14	-9	-4	-32	-27	-22	-56	-51	-46
60	-16	-11	-6	-35	-30	-25	-60	-55	-50
55	-18	-13	-8	-38	-33	-28	-63	-58	-53
50	-20	-15	-10	-41	-36	-31	-67	-62	-57
45	-22	-17	-12	-44	-39	-34	-71	-66	-61
40	-24	-19	-14	-48	-43	-38	-74	-69	-64

1. **Obtain V1, VR and V2 for the actual weight using the Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Takeoff %N1

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

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
60	94.8	95.4	95.8	95.9	96.0	96.1	96.2	96.3	96.2	95.9	95.8	95.7	95.7
55	95.4	96.0	96.5	96.6	96.7	96.8	96.9	97.1	96.9	96.6	96.3	95.7	95.0
50	96.0	96.6	97.1	97.3	97.4	97.6	97.7	97.8	97.7	97.4	97.1	96.6	96.1
45	96.8	97.4	97.8	98.0	98.1	98.3	98.4	98.5	98.4	98.1	97.8	97.5	97.1
40	97.4	98.1	98.6	98.7	98.8	98.9	99.0	99.2	99.1	98.8	98.5	98.4	98.1
35	98.0	98.7	99.4	99.5	99.6	99.7	99.8	99.9	99.8	99.5	99.2	99.1	99.0
30	97.6	98.8	100.3	100.3	100.4	100.4	100.5	100.5	100.4	100.3	100.0	99.9	99.9
25	96.8	98.1	99.5	100.1	100.7	100.8	100.7	100.7	100.7	100.7	100.6	100.6	100.7
20	96.0	97.3	98.8	99.3	99.9	100.2	100.5	100.8	100.8	100.9	100.8	100.8	100.8
15	95.2	96.5	98.0	98.6	99.2	99.5	99.8	100.1	100.5	100.9	101.1	101.1	101.1
10	94.5	95.8	97.2	97.8	98.4	98.7	99.0	99.4	99.7	100.1	100.5	101.0	101.5
5	93.7	95.0	96.4	97.0	97.6	98.0	98.3	98.6	99.0	99.4	99.8	100.3	100.7
0	92.9	94.2	95.6	96.3	96.9	97.2	97.5	97.9	98.2	98.6	99.0	99.5	100.0
-5	92.0	93.4	94.8	95.5	96.1	96.4	96.7	97.1	97.5	97.9	98.3	98.7	99.2
-10	91.2	92.6	94.0	94.7	95.3	95.6	96.0	96.3	96.7	97.1	97.5	98.0	98.4
-15	90.4	91.7	93.2	93.9	94.5	94.8	95.2	95.6	95.9	96.3	96.7	97.2	97.6
-20	89.6	90.9	92.4	93.0	93.7	94.0	94.4	94.8	95.2	95.6	95.9	96.4	96.8
-25	88.7	90.1	91.6	92.2	92.9	93.2	93.6	94.0	94.4	94.8	95.2	95.6	96.0
-30	87.9	89.2	90.7	91.4	92.0	92.4	92.8	93.2	93.6	94.0	94.3	94.8	95.2
-35	87.0	88.4	89.9	90.5	91.2	91.6	91.9	92.4	92.8	93.1	93.5	94.0	94.4
-40	86.1	87.5	89.0	89.7	90.3	90.7	91.1	91.5	91.9	92.3	92.7	93.1	93.6
-45	85.3	86.6	88.2	88.8	89.5	89.9	90.3	90.7	91.1	91.5	91.9	92.3	92.7
-50	84.4	85.7	87.3	87.9	88.6	89.0	89.4	89.9	90.3	90.6	91.0	91.5	91.9

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.9	1.0

Assumed Temperature Reduced Thrust

Maximum Assumed Temperature (Table 1 of 3)

Based on 25% Takeoff Thrust Reduction

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
55	73	71	69	67								
50	73	71	69	67	65	63						
45	73	71	69	67	65	63	61	59	57			
40	73	71	69	67	65	63	61	59	57	55		
35	71	71	69	67	65	63	61	59	57	55	53	
30	69	67	67	67	65	63	61	59	57	55	53	51
25	69	67	66	64	65	63	61	59	57	55	53	51
20	69	67	66	64	64	63	61	59	57	55	53	51
15	69	67	66	64	64	63	61	59	57	55	53	51
10 & BELOW	69	67	66	64	64	63	61	59	57	55	53	51

Takeoff %N1 (Table 2 of 3)

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

ASSUMED TEMP (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
75	93.4	93.7	94.2	94.7	95.4	96.1	96.9	97.3	97.6	97.8	97.8	97.7
70	94.1	94.4	94.4	94.4	94.7	95.4	96.2	96.6	96.9	97.1	97.1	97.1
65	94.8	95.1	95.2	95.2	95.3	95.4	95.5	96.0	96.2	96.5	96.4	96.4
60	95.4	95.8	95.9	96.0	96.1	96.2	96.3	96.2	95.9	95.8	95.7	95.7
55	96.0	96.5	96.6	96.7	96.8	96.9	97.1	96.9	96.6	96.3	95.7	95.0
50	96.6	97.1	97.3	97.4	97.6	97.7	97.8	97.7	97.4	97.1	96.6	96.1
45	97.4	97.8	98.0	98.1	98.3	98.4	98.5	98.4	98.1	97.8	97.5	97.1
40	98.1	98.6	98.7	98.8	98.9	99.0	99.2	99.1	98.8	98.5	98.4	98.1
35	98.7	99.4	99.5	99.6	99.7	99.8	99.9	99.8	99.5	99.2	99.1	99.0
30	98.8	100.3	100.3	100.4	100.4	100.5	100.5	100.4	100.3	100.0	99.9	99.9
25	98.1	99.5	100.1	100.7	100.8	100.7	100.7	100.7	100.7	100.6	100.6	100.7
20	97.3	98.8	99.3	99.9	100.2	100.5	100.8	100.8	100.9	100.8	100.8	100.8
15	96.5	98.0	98.6	99.2	99.5	99.8	100.1	100.5	100.9	101.1	101.1	101.1
10	95.8	97.2	97.8	98.4	98.7	99.0	99.4	99.7	100.1	100.5	101.0	101.5
MINIMUM ASSUMED TEMP (°C)	32	30	28	26	24	22	20	18	16	15	12	10

With engine bleed for packs off, increase %N1 by 1.0.

Assumed Temperature Reduced Thrust

%N1 Adjustment for Temperature Difference (Table 3 of 3)

ASSUMED TEMP MINUS OAT (°C)	OUTSIDE AIR TEMPERATURE (°C)													
	-40	-20	0	5	10	15	20	25	30	35	40	45	50	55
110	14.9													
100	14.9	10.9												
90	14.0	11.7												
80	12.9	11.6	7.8											
70	11.2	10.7	8.6	7.8	6.3									
60	9.2	9.5	8.5	8.4	7.1	6.3	4.9							
50	7.8	7.8	7.5	7.1	6.9	7.0	5.6	4.9	3.4					
40		6.0	6.2	6.1	5.9	5.8	5.7	5.6	4.7	4.4	5.3			
30		4.6	4.6	4.6	4.6	4.5	4.4	4.3	4.3	4.2	4.1	4.0	3.9	
20			2.9	3.0	3.0	3.0	3.0	3.0	2.9	2.9	2.8	2.8	2.7	2.6
10			1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.4
0			0	0	0	0	0	0	0	0	0	0	0	0

1. **Determine Maximum Assumed Temperature allowed from Table 1.**
2. **Find Maximum %N1 from Table 2 using the desired assumed temperature (no greater than temperature from Table 1).**
3. **Use the difference between assumed temperature and OAT to determine the %N1 adjustment from Table 3.**
4. **Subtract %N1 adjustment from Maximum %N1 in Table 2.**

Takeoff Speeds - Dry Runway (24K Derate)

V1, VR, V2

WEIGHT (1000 KG)	FLAPS 1			FLAPS 5			FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
90	171	171	174												
80	159	160	164	153	154	158	150	150	154						
70	148	149	156	142	143	149	140	140	146	136	137	143	134	134	141
60	136	137	146	130	131	140	128	128	137	125	125	134	122	123	132
50	122	122	135	117	117	130	114	115	127	112	112	124	110	110	123
40	107	107	123	102	102	118	100	100	116	97	98	113	96	96	112

Check V1(MCG).

V1, VR, V2 Adjustments*

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

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
90	-4	-2	0	1	1	-2	-1	-1	0	0	0	0	1
80	-3	-2	0	1	1	-1	-1	-1	0	0	0	1	1
70	-2	-1	0	1	1	-1	-1	0	0	0	1	1	1
60	-1	-1	0	0	1	-1	-1	0	0	0	0	0	1
50	-1	0	0	0	0	-1	-1	0	0	0	0	0	0
40	0	0	0	0	0	-1	0	0	0	0	0	0	0

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	90	88					
60	140	90	88	87	85			
50	122	92	90	87	85	83	81	79
40	104	97	95	91	88	84	81	79
30	86	100	99	95	92	88	85	81
20	68	100	99	97	95	92	88	85
-60	-76	101	101	98	96	94	91	89

Takeoff Speeds - Wet Runway (24K Derate)

V1, VR, V2

WEIGHT (1000 KG)	FLAPS1			FLAPS5			FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
90	166	171	174												
80	154	161	164	146	154	158	145	150	154						
70	141	149	156	135	143	149	133	140	146	129	137	143	127	134	141
60	128	137	146	122	131	140	120	128	137	117	125	134	115	123	132
50	113	122	135	108	117	130	106	115	127	103	112	124	101	110	123
40	97	107	123	92	102	118	91	100	116	89	98	113	87	96	112

Check V1(MCG).

V1, VR, V2 Adjustment*

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

Slope and Wind V1 Adjustment*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
90	-6	-3	0	3	6	-3	-2	-1	0	1	1	2	2
80	-5	-3	0	3	5	-3	-2	-1	0	0	1	2	2
70	-4	-2	0	2	4	-3	-2	-1	0	1	1	2	2
60	-3	-2	0	2	3	-4	-2	-1	0	1	1	2	3
50	-2	-1	0	1	3	-4	-3	-1	0	1	2	2	3
40	-2	-1	0	1	2	-5	-3	-1	0	1	2	3	4

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	90	88					
60	140	90	88	87	85			
50	122	92	90	87	85	83	81	79
40	104	97	95	91	88	84	81	79
30	86	100	99	95	92	88	85	81
20	68	100	99	97	95	92	88	85
-60	-76	101	101	98	96	94	91	89

Maximum Allowable Clearway (24K Derate)

FIELD LENGTH (M)	DRY RUNWAY MAX ALLOWABLE CLEARWAY FOR V1 REDUCTION (M)
1200	160
1600	190
2000	210
2400	240
2800	270
3200	290

Clearway and Stopway V1 Adjustments (24K Derate)

CLEARWAY MINUS STOPWAY (M)	NORMAL V1 (KIAS)							
	DRY RUNWAY				WET RUNWAY			
	100	120	140	160	100	120	140	160
300	-4	-4	-4	-4				
200	-3	-3	-3	-3				
100	-2	-2	-2	-2				
0	0	0	0	0	0	0	0	0
-100	0	0	0	0	1	1	0	0
-200	0	0	0	0	1	1	0	0
-300	0	0	0	0	1	1	0	0

Use of clearway not allowed on wet runways.
V1 not to exceed VR.

Stab Trim Setting (24K Derate)

Flaps 1 and 5

WEIGHT (1000 KG)	C.G. (%MAC)									
	6	9	11	16	23	26	30	32	33	36
80	8 1/2	8 1/4	8	7 1/4	6	5 1/2	4 3/4	4 1/2	4 1/4	3 3/4
70	8 1/4	7 3/4	7 1/2	6 3/4	5 1/2	5	4 1/2	4	4	3 1/2
60	7 1/2	7	6 3/4	6	5	4 1/2	4	3 3/4	3 1/2	3
50	7	6 1/2	6 1/4	5 1/2	4 1/2	4	3 1/2	3 1/4	3	2 3/4
40	6 1/2	6	5 3/4	5	4	3 3/4	3 1/4	2 3/4	2 3/4	2 3/4
35	6 1/2	6	5 3/4	5	4	3 3/4	3 1/4	2 3/4	2 3/4	2 3/4

Flaps 10, 15 and 25

WEIGHT (1000 KG)	C.G. (%MAC)									
	6	9	11	16	23	26	30	32	33	36
80	8 1/2	8 1/2	8	6 1/2	5 1/4	4 1/2	3 3/4	3 1/4	3	2 3/4
70	8 1/2	7 3/4	7 1/4	6	4 1/2	4	3 1/4	2 3/4	2 3/4	2 3/4
60	7 3/4	7	6 1/2	5 1/2	4	3 1/2	2 3/4	2 3/4	2 3/4	2 3/4
50	6 1/2	6	5 1/2	4 3/4	3 1/2	3	2 3/4	2 3/4	2 3/4	2 3/4
40	5 3/4	5 1/4	5	4 1/4	3	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4
35	5 3/4	5 1/4	5	4 1/4	3	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4

ADVISORY INFORMATION

Slush/Standing Water Takeoff (24K Derate)

Maximum Reverse Thrust

Weight Adjustments (1000 KG)

24K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	-11.0	-12.2	-13.5	-14.1	-15.3	-16.6	-20.7	-23.4	-26.2
90	-10.2	-11.5	-12.7	-12.9	-14.2	-15.4	-18.8	-21.5	-24.3
85	-9.4	-10.7	-11.9	-11.8	-13.0	-14.3	-16.8	-19.6	-22.3
80	-8.6	-9.9	-11.1	-10.6	-11.9	-13.1	-14.9	-17.6	-20.4
75	-7.8	-9.1	-10.3	-9.5	-10.7	-12.0	-13.0	-15.7	-18.5
70	-7.0	-8.3	-9.5	-8.3	-9.6	-10.8	-11.2	-13.9	-16.7
65	-6.2	-7.4	-8.7	-7.2	-8.5	-9.7	-9.5	-12.2	-15.0
60	-5.3	-6.6	-7.8	-6.1	-7.4	-8.6	-7.9	-10.6	-13.4
55	-4.4	-5.7	-6.9	-5.1	-6.3	-7.6	-6.4	-9.1	-11.9
50	-3.6	-4.8	-6.1	-4.0	-5.3	-6.5	-5.0	-7.7	-10.5
45	-2.6	-3.9	-5.1	-3.0	-4.2	-5.5	-3.7	-6.4	-9.2
40	-1.7	-3.0	-4.2	-1.9	-3.2	-4.4	-2.5	-5.2	-8.0

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1200	34.3			37.1			42.1		
1400	54.2	36.7		57.0	39.5		61.6	44.5	
1600	76.0	56.8	39.1	78.7	59.6	42.0	82.7	64.2	46.9
1800	99.8	78.9	59.4	101.7	81.5	62.2	104.6	85.4	66.7
2000		102.8	81.9		104.6	84.4			88.2

1. **Enter Weight Adjustment table with slush/standing water depth and 24K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -25 m/+25 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (24K Derate)
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-12	-7	-2	-5	0	0	0	0	0
85	-14	-9	-4	-8	-3	0	0	0	0
80	-16	-11	-6	-10	-5	0	0	0	0
75	-17	-12	-7	-12	-7	-2	0	0	0
70	-19	-14	-9	-14	-9	-4	-2	0	0
65	-20	-15	-10	-16	-11	-6	-6	-1	0
60	-21	-16	-11	-18	-13	-8	-9	-4	0
55	-22	-17	-12	-19	-14	-9	-13	-8	-3
50	-23	-18	-13	-21	-16	-11	-16	-11	-6
45	-24	-19	-14	-22	-17	-12	-18	-13	-8
40	-25	-20	-15	-24	-19	-14	-21	-16	-11

1. **Obtain V1, VR and V2 for the actual weight using the 24K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (24K Derate)

No Reverse Thrust

Weight Adjustments (1000 KG)

24K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	-14.5	-16.0	-17.5	-17.7	-19.2	-20.7	-24.3	-27.8	-31.3
90	-13.5	-15.0	-16.5	-16.4	-17.9	-19.4	-22.2	-25.7	-29.2
85	-12.6	-14.1	-15.6	-15.0	-16.5	-18.0	-20.0	-23.5	-27.0
80	-11.6	-13.1	-14.6	-13.6	-15.1	-16.6	-17.9	-21.4	-24.9
75	-10.6	-12.1	-13.6	-12.3	-13.8	-15.3	-15.8	-19.3	-22.8
70	-9.7	-11.2	-12.7	-11.0	-12.5	-14.0	-13.8	-17.3	-20.8
65	-8.7	-10.2	-11.7	-9.7	-11.2	-12.7	-12.0	-15.5	-19.0
60	-7.7	-9.2	-10.7	-8.5	-10.0	-11.5	-10.3	-13.8	-17.3
55	-6.7	-8.2	-9.7	-7.3	-8.8	-10.3	-8.7	-12.2	-15.7
50	-5.8	-7.3	-8.8	-6.2	-7.7	-9.2	-7.2	-10.7	-14.2
45	-4.8	-6.3	-7.8	-5.1	-6.6	-8.1	-5.9	-9.4	-12.9
40	-3.8	-5.3	-6.8	-4.1	-5.6	-7.1	-4.7	-8.2	-11.7

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1600							41.0		
1800	33.1			48.8			66.8	41.0	
2000	69.6	33.1		80.3	48.8		94.3	66.8	41.0
2200	104.7	69.6	33.1		80.3	48.8		94.3	66.8
2400		104.7	69.6			80.3			94.3
2600			104.7						

1. **Enter Weight Adjustment table with slush/standing water depth and 24K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -35 m/+35 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (24K Derate)

No Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-19	-12	-4	-8	-1	0	0	0	0
85	-21	-14	-6	-12	-4	0	0	0	0
80	-24	-16	-9	-15	-7	0	0	0	0
75	-26	-18	-11	-18	-11	-3	0	0	0
70	-28	-20	-13	-21	-14	-6	-3	0	0
65	-30	-23	-15	-24	-17	-9	-9	-2	0
60	-32	-25	-17	-27	-20	-12	-15	-7	0
55	-34	-27	-19	-30	-23	-15	-20	-13	-5
50	-36	-29	-21	-33	-25	-18	-25	-18	-10
45	-38	-30	-23	-36	-28	-21	-30	-22	-15
40	-40	-32	-25	-38	-31	-23	-34	-27	-19

1. **Obtain V1, VR and V2 for the actual weight using the 24K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (24K Derate)

Maximum Reverse Thrust

Weight Adjustment (1000 KG)

24K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	-0.1	-0.1	-0.1	-5.1	-5.1	-5.1	-9.7	-9.7	-9.7
90	-0.2	-0.2	-0.2	-5.0	-5.0	-5.0	-9.4	-9.4	-9.4
85	-0.4	-0.4	-0.4	-5.0	-5.0	-5.0	-9.0	-9.0	-9.0
80	-0.6	-0.6	-0.6	-5.0	-5.0	-5.0	-8.7	-8.7	-8.7
75	-0.7	-0.7	-0.7	-4.9	-4.9	-4.9	-8.4	-8.4	-8.4
70	-0.8	-0.8	-0.8	-4.7	-4.7	-4.7	-7.9	-7.9	-7.9
65	-0.7	-0.7	-0.7	-4.5	-4.5	-4.5	-7.4	-7.4	-7.4
60	-0.7	-0.7	-0.7	-4.1	-4.1	-4.1	-6.8	-6.8	-6.8
55	-0.5	-0.5	-0.5	-3.6	-3.6	-3.6	-6.0	-6.0	-6.0
50	-0.2	-0.2	-0.2	-3.1	-3.1	-3.1	-5.2	-5.2	-5.2
45	0.0	0.0	0.0	-2.5	-2.5	-2.5	-4.3	-4.3	-4.3
40	0.0	0.0	0.0	-1.7	-1.7	-1.7	-3.3	-3.3	-3.3

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1000	50.5	30.4							
1200	82.1	62.4	42.4	35.6					
1400		93.9	74.3	57.8	38.3				
1600				82.7	60.8	41.0	38.3		
1800					86.0	63.8	52.2	35.0	
2000						89.3	67.7	48.6	31.6
2200							85.4	63.6	45.1
2400							104.1	80.8	59.7
2600								99.4	76.2
2800									94.8

1. **Enter Weight Adjustment table with reported braking action and 24K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust “Good” field length available by -20 m/+20 m for every 5°C above/below 4°C.**
   Adjust “Medium” field length available by -20 m/+20 m for every 5°C above/below 4°C.
   Adjust “Poor” field length available by -30 m/+30 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (24K Derate)
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-5	-2	0	-12	-9	-7	-21	-19	-16
85	-6	-3	-1	-13	-11	-8	-23	-21	-18
80	-7	-4	-2	-15	-13	-10	-26	-23	-21
75	-8	-5	-3	-17	-14	-12	-28	-26	-23
70	-9	-6	-4	-19	-16	-14	-30	-28	-25
65	-10	-7	-5	-20	-18	-15	-33	-30	-28
60	-11	-8	-6	-22	-19	-17	-35	-32	-30
55	-12	-9	-7	-23	-21	-18	-36	-34	-31
50	-13	-10	-8	-25	-22	-20	-38	-36	-33
45	-14	-11	-9	-26	-23	-21	-40	-37	-35
40	-15	-12	-10	-27	-25	-22	-41	-39	-36

1. **Obtain V1, VR and V2 for the actual weight using the 24K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (24K Derate)

No Reverse Thrust

Weight Adjustments (1000 KG)

24K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	-1.0	-1.0	-1.0	-7.6	-7.6	-7.6	-13.7	-13.7	-13.7
90	-1.2	-1.2	-1.2	-7.6	-7.6	-7.6	-13.3	-13.3	-13.3
85	-1.5	-1.5	-1.5	-7.5	-7.5	-7.5	-12.8	-12.8	-12.8
80	-1.8	-1.8	-1.8	-7.5	-7.5	-7.5	-12.4	-12.4	-12.4
75	-2.0	-2.0	-2.0	-7.4	-7.4	-7.4	-11.8	-11.8	-11.8
70	-2.1	-2.1	-2.1	-7.2	-7.2	-7.2	-11.2	-11.2	-11.2
65	-2.1	-2.1	-2.1	-6.9	-6.9	-6.9	-10.5	-10.5	-10.5
60	-2.1	-2.1	-2.1	-6.5	-6.5	-6.5	-9.7	-9.7	-9.7
55	-2.0	-2.0	-2.0	-6.0	-6.0	-6.0	-8.8	-8.8	-8.8
50	-1.7	-1.7	-1.7	-5.4	-5.4	-5.4	-7.8	-7.8	-7.8
45	-1.4	-1.4	-1.4	-4.7	-4.7	-4.7	-6.7	-6.7	-6.7
40	-1.0	-1.0	-1.0	-3.9	-3.9	-3.9	-5.5	-5.5	-5.5

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1200	62.6	30.7							
1400	100.8	77.8	51.0						
1600			91.6						
1800				63.9					
2000				103.7	69.2				
2200					108.6	74.4			
2400						113.5			
2800							58.5		
3000							90.7		
3200								62.8	
3400								94.5	31.0
3600									67.0
3800									98.4

1. **Enter Weight Adjustment table with reported braking action and 24K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust “Good” field length available by -20 m/+20 m for every 5°C above/below 4°C.**
   Adjust “Medium” field length available by -20 m/+20 m for every 5°C above/below 4°C.
   Adjust “Poor” field length available by -40 m/+40 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (24K Derate)

No Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-6	-1	0	-16	-11	-6	-32	-27	-22
85	-7	-2	0	-19	-14	-9	-36	-31	-26
80	-9	-4	0	-21	-16	-11	-40	-35	-30
75	-10	-5	0	-23	-18	-13	-44	-39	-34
70	-11	-6	-1	-26	-21	-16	-47	-42	-37
65	-13	-8	-3	-29	-24	-19	-51	-46	-41
60	-15	-10	-5	-31	-26	-21	-55	-50	-45
55	-16	-11	-6	-34	-29	-24	-59	-54	-49
50	-18	-13	-8	-37	-32	-27	-63	-58	-53
45	-20	-15	-10	-41	-36	-31	-66	-61	-56
40	-22	-17	-12	-44	-39	-34	-70	-65	-60

1. **Obtain V1, VR and V2 for the actual weight using the 24K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Takeoff %N1 - (24K Derate)

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

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
60	90.3	90.8	91.2	91.2	91.1	91.1	91.0	91.1	91.2	91.0	91.2	91.3	91.4
55	91.0	91.6	92.0	92.0	92.0	91.9	91.9	91.9	92.0	91.9	91.7	91.3	90.8
50	91.8	92.4	92.8	92.8	92.8	92.7	92.7	92.7	92.7	92.6	92.6	92.2	91.8
45	92.6	93.2	93.6	93.6	93.6	93.6	93.5	93.5	93.5	93.4	93.3	93.1	92.8
40	93.4	94.0	94.4	94.4	94.4	94.3	94.3	94.2	94.2	94.1	94.1	94.0	93.8
35	94.2	94.8	95.2	95.2	95.2	95.1	95.1	95.0	95.0	94.9	94.8	94.8	94.7
30	93.8	95.0	96.1	96.0	96.0	96.0	95.9	95.8	95.8	95.7	95.7	95.6	95.6
25	93.1	94.3	95.4	95.9	96.4	96.7	96.7	96.6	96.6	96.5	96.4	96.4	96.3
20	92.3	93.5	94.6	95.1	95.7	96.3	96.9	97.6	97.5	97.5	97.4	97.3	97.2
15	91.6	92.7	93.8	94.3	94.9	95.5	96.1	96.8	97.5	98.2	98.6	98.6	98.5
10	90.8	92.0	93.0	93.6	94.1	94.7	95.3	96.0	96.7	97.5	98.2	99.1	100.0
5	90.0	91.2	92.2	92.8	93.3	93.9	94.5	95.2	95.9	96.7	97.4	98.4	99.3
0	89.2	90.4	91.4	92.0	92.5	93.1	93.7	94.4	95.1	95.9	96.7	97.6	98.5
-5	88.4	89.6	90.6	91.2	91.7	92.3	92.9	93.6	94.3	95.1	95.9	96.8	97.7
-10	87.6	88.8	89.8	90.4	90.9	91.5	92.1	92.8	93.5	94.3	95.1	96.1	97.0
-15	86.8	88.0	89.0	89.5	90.0	90.6	91.3	92.0	92.7	93.5	94.3	95.3	96.2
-20	86.0	87.1	88.2	88.7	89.2	89.8	90.5	91.2	91.9	92.6	93.5	94.5	95.4
-25	85.2	86.3	87.3	87.9	88.4	89.0	89.6	90.3	91.0	91.8	92.6	93.7	94.6
-30	84.4	85.5	86.5	87.0	87.5	88.1	88.8	89.5	90.2	91.0	91.8	92.9	93.8
-35	83.5	84.6	85.6	86.2	86.6	87.3	87.9	88.6	89.3	90.1	91.0	92.1	93.0
-40	82.7	83.8	84.8	85.3	85.8	86.4	87.0	87.8	88.5	89.3	90.1	91.2	92.2
-45	81.8	82.9	83.9	84.4	84.9	85.5	86.2	86.9	87.6	88.4	89.3	90.4	91.4
-50	81.0	82.0	83.0	83.5	84.0	84.6	85.3	86.0	86.7	87.5	88.4	89.5	90.5

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.9	1.0

Assumed Temperature Reduced Thrust (24K Derate)

Maximum Assumed Temperature (Table 1 of 3)

Based on 25% Takeoff Thrust Reduction

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
55	73	71	69	67								
50	73	71	69	67	65	63						
45	73	71	69	67	65	63	61	59	57			
40	73	71	69	67	65	63	61	59	57	55		
35	67	67	67	67	65	63	61	59	57	55	53	
30	64	61	62	61	61	61	61	59	57	55	53	51
25	64	61	59	57	56	56	57	57	57	55	53	51
20	64	61	59	57	56	54	53	53	53	53	52	51
15	64	61	59	57	56	54	53	52	50	49	48	47
10 & BELOW	64	61	59	57	56	54	53	52	50	48	45	43

Takeoff %N1 (Table 2 of 3)

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

ASSUMED TEMP (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
75	88.3	88.6	89.1	89.6	90.2	90.8	91.5	92.2	92.7	93.1	93.3	93.4
70	89.1	89.5	89.4	89.3	89.6	90.1	90.8	91.6	92.0	92.5	92.6	92.7
65	90.0	90.4	90.3	90.2	90.2	90.1	90.2	90.9	91.4	91.8	91.9	92.1
60	90.8	91.2	91.2	91.1	91.1	91.0	91.1	91.2	91.0	91.2	91.3	91.4
55	91.6	92.0	92.0	92.0	91.9	91.9	91.9	92.0	91.9	91.7	91.3	90.8
50	92.4	92.8	92.8	92.8	92.7	92.7	92.7	92.7	92.6	92.6	92.2	91.8
45	93.2	93.6	93.6	93.6	93.6	93.5	93.5	93.5	93.4	93.3	93.1	92.8
40	94.0	94.4	94.4	94.4	94.3	94.3	94.2	94.2	94.1	94.1	94.0	93.8
35	94.8	95.2	95.2	95.2	95.1	95.1	95.0	95.0	94.9	94.8	94.8	94.7
30	95.0	96.1	96.0	96.0	96.0	95.9	95.8	95.8	95.7	95.7	95.6	95.6
25	94.3	95.4	95.9	96.4	96.7	96.7	96.6	96.6	96.5	96.4	96.4	96.3
20	93.5	94.6	95.1	95.7	96.3	96.9	97.6	97.5	97.5	97.4	97.3	97.2
15	92.7	93.8	94.3	94.9	95.5	96.1	96.8	97.5	98.2	98.6	98.6	98.5
10	92.0	93.0	93.6	94.1	94.7	95.3	96.0	96.7	97.5	98.2	99.1	100.0
MINIMUM ASSUMED TEMP (°C)	32	30	28	26	24	22	20	18	16	15	12	10

With engine bleed for packs off, increase %N1 by 1.0

Assumed Temperature Reduced Thrust (24K Derate)

%N1 Adjustment for Temperature Difference (Table 3 of 3)

ASSUMED TEMP MINUS OAT (°C)	OUTSIDE AIR TEMPERATURE (°C)													
	-40	-20	0	5	10	15	20	25	30	35	40	45	50	55
110	12.1													
100	11.3	8.5												
90	11.7	8.9												
80	12.5	8.0	5.5											
70	11.3	8.4	5.9	5.6	4.0									
60	9.7	9.2	4.8	4.7	4.4	4.2	2.6							
50	7.8	7.9	5.3	3.5	3.3	3.6	3.0	2.7	1.2					
40		6.4	6.0	5.5	3.7	3.2	3.7	3.0	2.8	3.0	3.7			
30		4.6	4.6	4.6	4.5	4.3	4.2	4.0	4.1	4.0	3.9	3.8	3.7	
20			3.1	3.1	3.1	3.0	2.9	2.9	2.8	2.7	2.7	2.6	2.6	2.5
10			1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.3	1.3
0			0	0	0	0	0	0	0	0	0	0	0	0

1. **Determine Maximum Assumed Temperature allowed from Table 1.**
2. **Find Maximum %N1 from Table 2 using the desired assumed temperature (no greater than temperature from Table 1).**
3. **Use the difference between assumed temperature and OAT to determine the %N1 adjustment from Table 3.**
4. **Subtract %N1 adjustment from Maximum %N1 in Table 2.**

Takeoff Speeds - Dry Runway (22K Derate)

V1, VR, V2

WEIGHT	FLAPS1			FLAPS5			FLAPS 10			FLAPS 15			FLAPS 25		
(1000 KG)	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
80	161	161	164	154	154	157									
75	156	156	160	149	149	153	146	146	150						
70	150	150	155	144	144	149	141	141	146	137	138	143	135	135	140
65	144	144	150	138	138	144	135	135	141	132	132	138	130	130	136
60	137	138	145	131	132	139	129	129	137	126	126	134	124	124	132
55	130	131	140	125	125	134	123	123	131	120	120	129	118	118	127
50	123	123	134	118	118	129	116	116	126	113	113	124	111	111	122
45	116	116	128	111	111	123	109	109	121	106	106	118	104	104	117
40	108	108	122	103	103	117	101	101	115	99	99	113	97	97	111

Check V1(MCG).

V1, VR, V2 Adjustments*

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

Slope and Wind V1 Adjustments*

WEIGHT	SLOPE (%)					WIND (KTS)							
(1000 KG)	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
80	-3	-2	0	0	0	-1	-1	0	0	0	0	0	0
75	-2	-1	0	0	0	-1	-1	0	0	0	0	0	0
70	-2	-1	0	0	0	-1	-1	0	0	0	0	0	0
65	-2	-1	0	0	0	-1	-1	0	0	0	0	0	0
60	-1	-1	0	0	0	-1	-1	0	0	0	0	0	0
55	-1	0	0	0	0	-1	-1	0	0	0	0	0	0
50	-1	0	0	0	0	-1	-1	0	0	0	0	0	0
45	0	0	0	0	0	-1	0	0	0	0	0	0	0
40	0	0	0	0	0	-1	0	0	0	0	0	0	0

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	87	85					
60	140	87	85	84	83			
50	122	89	87	84	83	81	79	77
40	104	94	91	88	85	82	79	77
30	86	96	96	93	89	86	82	79
20	68	97	96	94	93	90	86	82
-60	-76	98	98	96	94	91	89	87

Takeoff Speeds - Wet Runway (22K Derate)

V1, VR, V2

WEIGHT (1000 KG)	FLAPS1			FLAPS5			FLAPS 10			FLAPS 15			FLAPS 25		
	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2	V1	VR	V2
80	156	161	164	149	154	157									
75	150	156	160	143	149	153	142	146	150						
70	143	150	155	137	144	149	135	141	146	132	138	143	130	135	140
65	137	144	150	130	138	144	128	135	141	125	132	138	123	130	136
60	130	138	145	124	132	139	122	129	137	119	126	134	117	124	132
55	122	131	140	117	125	134	115	123	131	112	120	129	110	118	127
50	115	123	134	110	118	129	108	116	126	105	113	124	103	111	122
45	107	116	128	102	111	123	101	109	121	98	106	118	96	104	117
40	99	108	122	95	103	117	93	101	115	91	99	113	89	97	111

Check V1(MCG).

V1, VR, V2 Adjustments*

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

Slope and Wind V1 Adjustments*

WEIGHT (1000 KG)	SLOPE (%)					WIND (KTS)							
	-2	-1	0	1	2	-15	-10	-5	0	10	20	30	40
80	-5	-3	0	3	5	-3	-2	-1	0	1	1	2	2
75	-4	-2	0	2	5	-3	-2	-1	0	1	1	2	2
70	-4	-2	0	2	4	-3	-2	-1	0	1	1	2	2
65	-3	-2	0	2	4	-3	-2	-1	0	1	1	2	3
60	-3	-2	0	2	3	-3	-2	-1	0	1	1	2	3
55	-3	-1	0	1	3	-4	-2	-1	0	1	1	2	3
50	-2	-1	0	1	3	-4	-3	-1	0	1	2	2	3
45	-2	-1	0	1	2	-4	-3	-1	0	1	2	2	3
40	-2	-1	0	1	2	-5	-3	-2	0	1	2	3	3

***V1 not to exceed VR.**

V1(MCG)

TEMP		PRESSURE ALTITUDE (FT)						
°C	°F	-2000	0	2000	4000	6000	8000	10000
70	158	87	85					
60	140	87	85	84	83			
50	122	89	87	84	83	81	79	77
40	104	94	91	88	85	82	79	77
30	86	96	96	93	89	86	82	79
20	68	97	96	94	93	90	86	82
-60	-76	98	98	96	94	91	89	87

Maximum Allowable Clearway (22K Derate)

FIELD LENGTH (M)	DRY RUNWAY MAX ALLOWABLE CLEARWAY FOR V1 REDUCTION (M)
1200	160
1600	180
2000	220
2400	240
2800	260
3200	300

Clearway and Stopway V1 Adjustments (22K Derate)

CLEARWAY MINUS STOPWAY (M)	NORMAL V1 (KIAS)							
	DRY RUNWAY				WET RUNWAY			
	100	120	140	160	100	120	140	160
300	-4	-4	-4	-4				
200	-3	-3	-3	-3				
100	-2	-2	-2	-2				
0	0	0	0	0	0	0	0	0
-100	0	0	0	0	1	0	0	0
-200	0	0	0	0	0	0	0	0
-300	0	0	0	0	0	0	0	0

Use of clearway not allowed on wet runways.
V1 not to exceed VR.

Stab Trim Setting (22K Derate)

Flaps 1 and 5

WEIGHT (1000 KG)	C.G. (%MAC)									
	6	9	11	16	23	26	30	32	33	36
80	8 1/2	8 1/2	8 1/4	7 1/2	6 1/4	5 3/4	5	4 3/4	4 1/2	4
70	8 1/2	8 1/4	7 3/4	7	5 3/4	5 1/4	4 3/4	4 1/4	4 1/4	3 3/4
60	8	7 1/2	7 1/4	6 1/2	5 1/4	5	4 1/4	4	3 3/4	3 1/4
50	7 1/4	6 3/4	6 1/2	5 3/4	4 3/4	4 1/4	3 3/4	3 1/2	3 1/4	3
40	6 3/4	6 1/4	6	5 1/2	4 1/2	4	3 1/2	3 1/4	3	2 3/4
35	6 3/4	6 1/4	6	5 1/2	4 1/2	4	3 1/2	3 1/4	3	2 3/4

Flaps 10, 15 and 25

WEIGHT (1000 KG)	C.G. (%MAC)									
	6	9	11	16	23	26	30	32	33	36
80	8 1/2	8 1/2	8	6 3/4	5 1/4	4 3/4	4	3 1/2	3 1/4	2 3/4
70	8 1/2	8	7 1/2	6 1/4	4 3/4	4 1/4	3 1/2	3 1/4	3	2 3/4
60	7 3/4	7	6 1/2	5 1/2	4 1/4	3 3/4	3	2 3/4	2 3/4	2 3/4
50	6 3/4	6	5 3/4	4 3/4	3 1/2	3	2 3/4	2 3/4	2 3/4	2 3/4
40	6	5 1/2	5 1/4	4 1/2	3 1/4	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4
35	6	5 1/2	5 1/4	4 1/2	3 1/4	2 3/4	2 3/4	2 3/4	2 3/4	2 3/4

ADVISORY INFORMATION

Slush/Standing Water Takeoff (22K Derate)

Maximum Reverse Thrust

Weight Adjustments (1000 KG)

22K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	-10.5	-12.0	-13.5	-13.9	-15.4	-16.9	-20.0	-22.5	-25.0
90	-9.8	-11.3	-12.8	-12.8	-14.3	-15.8	-18.3	-20.8	-23.3
85	-9.1	-10.6	-12.1	-11.7	-13.2	-14.7	-16.6	-19.1	-21.6
80	-8.4	-9.9	-11.4	-10.6	-12.1	-13.6	-14.8	-17.3	-19.8
75	-7.7	-9.2	-10.7	-9.5	-11.0	-12.5	-13.2	-15.7	-18.2
70	-7.0	-8.5	-10.0	-8.4	-9.9	-11.4	-11.5	-14.0	-16.5
65	-6.2	-7.7	-9.2	-7.4	-8.9	-10.4	-9.9	-12.4	-14.9
60	-5.4	-6.9	-8.4	-6.3	-7.8	-9.3	-8.3	-10.8	-13.3
55	-4.5	-6.0	-7.5	-5.2	-6.7	-8.2	-6.8	-9.3	-11.8
50	-3.7	-5.2	-6.7	-4.2	-5.7	-7.2	-5.3	-7.8	-10.3
45	-2.8	-4.3	-5.8	-3.1	-4.6	-6.1	-3.9	-6.4	-8.9
40	-1.9	-3.4	-4.9	-2.1	-3.6	-5.1	-2.5	-5.0	-7.5

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1200	40.0			42.6			47.0		
1400	61.3	42.6		63.8	45.1		67.6	49.5	32.3
1600	85.2	64.2	45.1	87.1	66.6	47.7	89.5	70.2	52.1
1800		88.3	67.0		90.1	69.4		92.2	72.9
2000			91.4			93.2			95.0

1. **Enter Weight Adjustment table with slush/standing water depth and 22K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -20 m/+20 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (22K Derate)

Maximum Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-10	-5	0	-3	0	0	0	0	0
85	-11	-6	-1	-5	0	0	0	0	0
80	-13	-8	-3	-7	-2	0	0	0	0
75	-15	-10	-5	-10	-5	0	0	0	0
70	-17	-12	-7	-12	-7	-2	0	0	0
65	-18	-13	-8	-14	-9	-4	-3	0	0
60	-20	-15	-10	-16	-11	-6	-7	-2	0
55	-21	-16	-11	-18	-13	-8	-11	-6	-1
50	-22	-17	-12	-19	-14	-9	-14	-9	-4
45	-23	-18	-13	-21	-16	-11	-16	-11	-6
40	-24	-19	-14	-22	-17	-12	-19	-14	-9

1. **Obtain V1, VR and V2 for the actual weight using the 22K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slush/Standing Water Takeoff (22K Derate)

No Reverse Thrust

Weight Adjustments (1000 KG)

22K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	-14.1	-15.6	-17.1	-17.8	-19.3	-20.8	-24.6	-28.1	-31.6
90	-13.2	-14.7	-16.2	-16.4	-17.9	-19.4	-22.5	-26.0	-29.5
85	-12.3	-13.8	-15.3	-15.1	-16.6	-18.1	-20.4	-23.9	-27.4
80	-11.4	-12.9	-14.4	-13.7	-15.2	-16.7	-18.3	-21.8	-25.3
75	-10.5	-12.0	-13.5	-12.4	-13.9	-15.4	-16.2	-19.7	-23.2
70	-9.6	-11.1	-12.6	-11.1	-12.6	-14.1	-14.3	-17.8	-21.3
65	-8.7	-10.2	-11.7	-9.8	-11.3	-12.8	-12.4	-15.9	-19.4
60	-7.7	-9.2	-10.7	-8.6	-10.1	-11.6	-10.7	-14.2	-17.7
55	-6.8	-8.3	-9.8	-7.5	-9.0	-10.5	-9.0	-12.5	-16.0
50	-5.9	-7.4	-8.9	-6.4	-7.9	-9.4	-7.5	-11.0	-14.5
45	-4.9	-6.4	-7.9	-5.3	-6.8	-8.3	-6.1	-9.6	-13.1
40	-4.0	-5.5	-7.0	-4.3	-5.8	-7.3	-4.8	-8.3	-11.8

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1600				33.5			52.2		
1800	55.2			66.4			79.6	48.8	
2000	92.6	50.5		100.5	62.2			76.1	45.4
2200		87.9	45.7		96.2	58.0		103.7	72.7
2400			83.3			91.9			100.3

1. **Enter Weight Adjustment table with slush/standing water depth and 22K Derate dry field/obstacle limit weight to obtain slush/standing water weight adjustment.**
2. **Adjust field length available by -30 m/+30 m for every 5°C above/below 4°C.**
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slush/standing water limited weight is lesser of weights from 1 and 3.**

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	SLUSH/STANDING WATER DEPTH								
	3 mm (0.12 INCHES)			6 mm (0.25 INCHES)			13 mm (0.50 INCHES)		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-15	-7	0	-4	0	0	0	0	0
85	-17	-10	-2	-7	0	0	0	0	0
80	-20	-13	-5	-11	-3	0	0	0	0
75	-23	-15	-8	-14	-7	0	0	0	0
70	-25	-17	-10	-18	-10	-3	0	0	0
65	-27	-20	-12	-21	-13	-6	-4	0	0
60	-29	-22	-14	-24	-17	-9	-11	-3	0
55	-32	-24	-17	-27	-20	-12	-16	-9	-1
50	-34	-26	-19	-30	-23	-15	-22	-14	-7
45	-36	-28	-21	-33	-25	-18	-27	-19	-12
40	-37	-30	-22	-36	-28	-21	-31	-23	-16

1. **Obtain V1, VR and V2 for the actual weight using the 22K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (22K Derate)

Maximum Reverse Thrust

Weight Adjustment (1000 KG)

22K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	0.0	0.0	0.0	-4.0	-4.0	-4.0	-8.6	-8.6	-8.6
90	0.0	0.0	0.0	-4.1	-4.1	-4.1	-8.5	-8.5	-8.5
85	0.0	0.0	0.0	-4.2	-4.2	-4.2	-8.3	-8.3	-8.3
80	-0.1	-0.1	-0.1	-4.4	-4.4	-4.4	-8.1	-8.1	-8.1
75	-0.4	-0.4	-0.4	-4.4	-4.4	-4.4	-7.9	-7.9	-7.9
70	-0.6	-0.6	-0.6	-4.4	-4.4	-4.4	-7.6	-7.6	-7.6
65	-0.6	-0.6	-0.6	-4.3	-4.3	-4.3	-7.2	-7.2	-7.2
60	-0.6	-0.6	-0.6	-4.0	-4.0	-4.0	-6.7	-6.7	-6.7
55	-0.5	-0.5	-0.5	-3.6	-3.6	-3.6	-6.1	-6.1	-6.1
50	-0.3	-0.3	-0.3	-3.2	-3.2	-3.2	-5.3	-5.3	-5.3
45	0.0	0.0	0.0	-2.6	-2.6	-2.6	-4.5	-4.5	-4.5
40	0.0	0.0	0.0	-1.9	-1.9	-1.9	-3.6	-3.6	-3.6

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1000	56.0	36.0							
1200	88.1	68.1	48.0	40.6					
1400		100.2	80.1	63.9	43.4				
1600				90.4	67.1	46.2	42.3		
1800					93.8	70.2	57.1	38.8	
2000						97.3	73.9	53.2	35.3
2200							93.0	69.5	49.5
2400								88.2	65.2
2600									83.3
2800									102.7

1. **Enter Weight Adjustment table with reported braking action and 22K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust “Good” field length available by -20 m/+20 m for every 5°C above/below 4°C.**
   Adjust “Medium” field length available by -20 m/+20 m for every 5°C above/below 4°C.
   Adjust “Poor” field length available by -30 m/+30 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (22K Derate)
Maximum Reverse Thrust
V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-4	-1	0	-9	-7	-4	-18	-15	-13
85	-5	-2	0	-11	-9	-6	-20	-18	-15
80	-6	-3	-1	-13	-11	-8	-23	-20	-18
75	-7	-4	-2	-15	-13	-10	-25	-23	-20
70	-8	-5	-3	-17	-14	-12	-28	-25	-23
65	-9	-6	-4	-19	-16	-14	-30	-28	-25
60	-10	-7	-5	-20	-18	-15	-32	-30	-27
55	-11	-8	-6	-22	-19	-17	-34	-32	-29
50	-12	-9	-7	-23	-21	-18	-36	-34	-31
45	-13	-10	-8	-24	-22	-19	-38	-35	-33
40	-14	-11	-9	-26	-23	-21	-39	-37	-34

1. **Obtain V1, VR and V2 for the actual weight using the 22K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

ADVISORY INFORMATION

Slippery Runway Takeoff (22K Derate)

No Reverse Thrust

Weight Adjustments (1000 KG)

22K DERATE DRY FIELD/OBSTACLE LIMIT WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
95	0.0	0.0	0.0	-6.3	-6.3	-6.3	-12.8	-12.8	-12.8
90	-0.2	-0.2	-0.2	-6.4	-6.4	-6.4	-12.4	-12.4	-12.4
85	-0.7	-0.7	-0.7	-6.6	-6.6	-6.6	-12.1	-12.1	-12.1
80	-1.1	-1.1	-1.1	-6.8	-6.8	-6.8	-11.8	-11.8	-11.8
75	-1.5	-1.5	-1.5	-6.8	-6.8	-6.8	-11.4	-11.4	-11.4
70	-1.8	-1.8	-1.8	-6.8	-6.8	-6.8	-10.9	-10.9	-10.9
65	-1.9	-1.9	-1.9	-6.6	-6.6	-6.6	-10.3	-10.3	-10.3
60	-2.0	-2.0	-2.0	-6.3	-6.3	-6.3	-9.6	-9.6	-9.6
55	-1.9	-1.9	-1.9	-5.9	-5.9	-5.9	-8.9	-8.9	-8.9
50	-1.7	-1.7	-1.7	-5.4	-5.4	-5.4	-8.0	-8.0	-8.0
45	-1.4	-1.4	-1.4	-4.8	-4.8	-4.8	-7.1	-7.1	-7.1
40	-1.0	-1.0	-1.0	-4.0	-4.0	-4.0	-6.0	-6.0	-6.0

V1(MCG) Limit Weight (1000 KG)

ADJUSTED FIELD LENGTH (M)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
1200	72.3	44.3							
1400		86.7	61.9						
1600			100.7	36.2					
1800				80.8	42.3				
2000					85.9	48.3			
2200						90.9			
2600							46.8		
2800							80.7		
3000								46.8	
3200								80.7	
3400									46.8
3600									80.7

1. **Enter Weight Adjustment table with reported braking action and 22K Derate dry field/obstacle limit weight to obtain slippery runway weight adjustment.**
2. **Adjust “Good” field length available by -20 m/+20 m for every 5°C above/below 4°C.**
   Adjust “Medium” field length available by -20 m/+20 m for every 5°C above/below 4°C.
   Adjust “Poor” field length available by -40 m/+40 m for every 5°C above/below 4°C.
3. **Find V1(MCG) limit weight for adjusted field length and pressure altitude.**
4. **Max allowable slippery runway limited weight is lesser of weights from 1 and 3.**

ADVISORY INFORMATION

Slippery Runway Takeoff (22K Derate)

No Reverse Thrust

V1 Adjustment (KIAS)

WEIGHT (1000 KG)	REPORTED BRAKING ACTION								
	GOOD			MEDIUM			POOR		
	PRESS ALT (FT)			PRESS ALT (FT)			PRESS ALT (FT)		
	S.L.	5000	10000	S.L.	5000	10000	S.L.	5000	10000
90	-5	0	0	-13	-8	-3	-27	-22	-17
85	-6	-1	0	-16	-11	-6	-31	-26	-21
80	-8	-3	0	-18	-13	-8	-35	-30	-25
75	-9	-4	0	-21	-16	-11	-39	-34	-29
70	-10	-5	0	-23	-18	-13	-43	-38	-33
65	-12	-7	-2	-26	-21	-16	-47	-42	-37
60	-13	-8	-3	-29	-24	-19	-51	-46	-41
55	-15	-10	-5	-32	-27	-22	-55	-50	-45
50	-17	-12	-7	-35	-30	-25	-58	-53	-48
45	-19	-14	-9	-38	-33	-28	-62	-57	-52
40	-21	-16	-11	-41	-36	-31	-66	-61	-56

1. **Obtain V1, VR and V2 for the actual weight using the 22K Derate Dry Runway Takeoff Speeds table.**
2. **If V1(MCG) limited, set V1 = V1(MCG). If not V1(MCG) limited, enter V1 Adjustment table with the actual weight to obtain V1 speed adjustment. If adjusted V1 is less than V1(MCG), set V1 = V1(MCG). V1 not to exceed VR.**

Takeoff %N1 (22K Derate)

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

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
60	87.7	88.3	88.7	88.8	88.9	89.1	89.2	89.2	89.1	88.6	88.3	88.7	89.2
55	88.5	89.1	89.5	89.7	89.8	89.9	90.0	90.0	90.0	89.5	89.0	88.8	88.6
50	89.3	89.8	90.4	90.5	90.6	90.7	90.9	90.8	90.8	90.4	89.9	89.7	89.6
45	90.2	90.7	91.2	91.3	91.4	91.5	91.7	91.6	91.6	91.2	90.8	90.7	90.5
40	91.1	91.6	92.1	92.2	92.3	92.4	92.5	92.4	92.4	92.1	91.7	91.6	91.5
35	91.9	92.5	93.0	93.1	93.2	93.2	93.3	93.3	93.2	92.9	92.5	92.5	92.4
30	91.5	92.6	93.8	93.9	94.0	94.0	94.1	94.0	93.9	93.7	93.4	93.3	93.2
25	90.8	91.9	93.1	93.7	94.4	94.8	94.9	94.8	94.8	94.4	94.0	94.0	94.0
20	90.0	91.1	92.3	93.0	93.6	94.3	95.0	95.6	95.6	95.3	94.9	94.8	94.7
15	89.3	90.4	91.6	92.2	92.8	93.6	94.3	94.8	95.3	95.9	96.1	95.9	95.5
10	88.5	89.6	90.8	91.4	92.1	92.8	93.5	94.0	94.5	95.1	95.7	96.4	97.1
5	87.8	88.9	90.0	90.7	91.3	92.0	92.7	93.2	93.7	94.3	94.9	95.6	96.3
0	87.0	88.1	89.2	89.9	90.5	91.2	91.9	92.4	92.9	93.5	94.1	94.8	95.5
-5	86.2	87.3	88.4	89.1	89.7	90.4	91.1	91.6	92.1	92.7	93.3	94.0	94.7
-10	85.4	86.5	87.6	88.3	88.9	89.6	90.3	90.8	91.3	91.9	92.5	93.2	93.9
-15	84.6	85.7	86.8	87.5	88.1	88.8	89.4	90.0	90.5	91.1	91.7	92.4	93.1
-20	83.8	84.9	86.0	86.6	87.3	87.9	88.6	89.1	89.7	90.3	90.8	91.6	92.3
-25	83.0	84.1	85.2	85.8	86.4	87.1	87.8	88.3	88.8	89.4	90.0	90.7	91.5
-30	82.2	83.3	84.4	85.0	85.6	86.3	86.9	87.4	88.0	88.6	89.2	89.9	90.6
-35	81.4	82.4	83.5	84.1	84.7	85.4	86.1	86.6	87.1	87.7	88.3	89.0	89.8
-40	80.6	81.6	82.7	83.3	83.9	84.5	85.2	85.7	86.2	86.8	87.4	88.2	88.9
-45	79.7	80.7	81.8	82.4	83.0	83.7	84.3	84.8	85.3	86.0	86.6	87.3	88.0
-50	78.9	79.9	80.9	81.5	82.1	82.8	83.4	83.9	84.5	85.1	85.7	86.4	87.2

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.9	0.9	0.9

Assumed Temperature Reduced Thrust (22K Derate)

Maximum Assumed Temperature (Table 1 of 3)

Based on 25% Takeoff Thrust Reduction

OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
55	73	71	69	67								
50	73	71	69	67	65	63						
45	73	71	69	67	65	63	61	59	57			
40	72	71	69	67	65	63	61	59	57	55		
35	66	66	66	66	65	63	61	59	57	55	53	
30	63	61	61	61	61	61	61	59	57	55	53	51
25	63	61	59	57	56	56	56	56	56	55	53	51
20	63	61	59	57	55	53	51	51	51	50	50	50
15	63	61	59	57	55	53	51	50	47	45	45	45
10 & BELOW	63	61	59	57	55	53	51	50	47	45	43	41

Takeoff %N1 (Table 2 of 3)

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

ASSUMED TEMP (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
75	85.7	86.0	86.7	87.4	88.2	88.9	89.5	90.1	90.2	90.2	90.6	91.1
70	86.6	87.0	87.1	87.1	87.5	88.3	88.9	89.4	89.5	89.6	90.0	90.4
65	87.4	87.8	88.0	88.0	88.2	88.3	88.3	88.8	88.9	88.9	89.4	89.8
60	88.3	88.7	88.8	88.9	89.1	89.2	89.2	89.1	88.6	88.3	88.7	89.2
55	89.1	89.5	89.7	89.8	89.9	90.0	90.0	90.0	89.5	89.0	88.8	88.6
50	89.8	90.4	90.5	90.6	90.7	90.9	90.8	90.8	90.4	89.9	89.7	89.6
45	90.7	91.2	91.3	91.4	91.5	91.7	91.6	91.6	91.2	90.8	90.7	90.5
40	91.6	92.1	92.2	92.3	92.4	92.5	92.4	92.4	92.1	91.7	91.6	91.5
35	92.5	93.0	93.1	93.2	93.2	93.3	93.3	93.2	92.9	92.5	92.5	92.4
30	92.6	93.8	93.9	94.0	94.0	94.1	94.0	93.9	93.7	93.4	93.3	93.2
25	91.9	93.1	93.7	94.4	94.8	94.9	94.8	94.8	94.4	94.0	94.0	94.0
20	91.1	92.3	93.0	93.6	94.3	95.0	95.6	95.6	95.3	94.9	94.8	94.7
15	90.4	91.6	92.2	92.8	93.6	94.3	94.8	95.3	95.9	96.1	95.9	95.5
10	89.6	90.8	91.4	92.1	92.8	93.5	94.0	94.5	95.1	95.7	96.4	97.1
MINIMUM ASSUMED TEMP (°C)	32	30	28	26	24	22	20	18	16	15	12	10

With engine bleed for packs off, increase %N1 by 0.9.

Assumed Temperature Reduced Thrust (22K Derate)

%N1 Adjustment for Temperature Difference (Table 3 of 3)

ASSUMED TEMP MINUS OAT (°C)	OUTSIDE AIR TEMPERATURE (°C)													
	-40	-20	0	5	10	15	20	25	30	35	40	45	50	55
110	11.6													
100	10.3	7.9												
90	10.8	8.4												
80	12.2	7.1	5.0											
70	11.0	7.6	5.4	5.2	3.5									
60	9.6	9.0	4.1	4.0	3.9	3.8	2.1							
50	8.0	7.7	4.5	2.8	2.6	2.7	2.6	2.4	0.8					
40		6.2	5.9	4.7	3.0	2.6	2.7	2.8	2.6	2.5	2.9			
30		4.7	4.6	4.5	4.4	4.2	4.1	4.0	4.0	3.9	3.8	3.7	3.6	
20			3.1	3.0	3.0	3.0	2.9	2.8	2.7	2.7	2.6	2.6	2.5	2.4
10			1.5	1.5	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.3	1.3	1.3
0			0	0	0	0	0	0	0	0	0	0	0	0

1. **Determine Maximum Assumed Temperature allowed from Table 1.**
2. **Find Maximum %N1 from Table 2 using the desired assumed temperature (no greater than temperature from Table 1).**
3. **Use the difference between assumed temperature and OAT to determine the %N1 adjustment from Table 3.**
4. **Subtract %N1 adjustment from Maximum %N1 in Table 2.**

Max Climb %N1

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

TAT (°C)	PRESSURE ALTITUDE (FT)/SPEED (KIAS/MACH)									
	0	5000	10000	15000	20000	25000	30000	35000	37000	41000
	280	280	280	280	280	280	280	.78	.78	.78
60	90.2	90.5	90.4	90.6	90.4	92.1	93.8	95.1	95.2	93.5
55	91.0	91.2	91.3	91.4	90.8	91.5	93.1	94.4	94.5	92.8
50	91.7	92.0	92.1	92.2	91.7	91.5	92.4	93.7	93.8	92.1
45	92.4	92.6	92.8	93.0	92.6	92.4	92.4	93.0	93.1	91.4
40	93.1	93.3	93.6	93.8	93.4	93.2	93.2	92.3	92.4	90.7
35	93.6	94.0	94.3	94.5	94.3	94.0	94.0	93.0	92.4	90.8
30	92.9	94.8	95.0	95.2	95.1	94.8	94.7	93.9	93.3	91.8
25	92.2	94.8	95.7	95.9	95.9	95.5	95.4	94.7	94.1	92.8
20	91.4	94.0	96.5	96.7	96.6	96.2	96.1	95.4	94.9	93.7
15	90.6	93.2	95.9	97.5	97.4	96.9	96.7	96.2	95.7	94.6
10	89.9	92.5	95.1	97.8	98.3	97.7	97.4	96.9	96.5	95.6
5	89.1	91.7	94.3	97.0	99.2	98.6	98.1	97.7	97.3	96.5
0	88.3	90.9	93.5	96.2	98.6	99.6	99.1	98.5	98.2	97.5
-5	87.6	90.1	92.7	95.4	97.8	99.6	100.0	99.2	99.0	98.4
-10	86.8	89.3	91.9	94.6	97.1	98.8	100.3	100.2	99.8	99.4
-15	86.0	88.5	91.0	93.8	96.3	98.0	99.6	101.1	100.8	100.4
-20	85.2	87.6	90.2	93.0	95.5	97.2	98.7	100.8	101.3	101.0
-25	84.3	86.8	89.4	92.2	94.7	96.4	97.9	100.0	100.5	100.1
-30	83.5	86.0	88.5	91.3	93.9	95.6	97.1	99.1	99.6	99.3
-35	82.7	85.1	87.7	90.5	93.1	94.8	96.3	98.3	98.8	98.4
-40	81.8	84.3	86.8	89.6	92.3	93.9	95.4	97.4	97.9	97.6

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)					
	0	10	20	30	35	41
ENGINE ANTI-ICE	-0.6	-0.8	-0.9	-0.9	-0.8	-0.8
ENGINE & WING ANTI-ICE*	-1.8	-2.1	-2.5	-2.7	-3.0	-3.0

***Dual bleed sources**

Go-around %N1

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

AIRPORT OAT		TAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)											
°C	°F		-2000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
57	134	60	95.0	96.2	96.8									
52	125	55	95.9	96.7	96.6	96.8	97.5							
47	116	50	96.6	97.6	97.8	97.8	97.7	97.5	98.2	98.8				
42	108	45	97.4	98.4	98.5	98.6	98.7	98.8	98.7	98.5	98.5	99.0		
37	99	40	98.0	99.1	99.2	99.3	99.4	99.5	99.6	99.5	99.1	98.9	98.8	99.1
32	90	35	98.1	99.9	100.0	100.1	100.1	100.3	100.3	100.2	99.9	99.6	99.6	99.5
27	81	30	97.3	99.8	100.4	100.7	100.7	100.7	100.7	100.7	100.6	100.4	100.4	100.3
22	72	25	96.6	99.1	99.7	100.2	100.6	100.9	100.9	100.9	100.9	100.9	100.9	100.8
17	63	20	95.8	98.3	98.9	99.5	99.8	100.2	100.5	100.9	101.0	101.1	101.0	101.0
12	54	15	95.0	97.5	98.1	98.7	99.1	99.4	99.8	100.1	100.5	100.9	101.3	101.2
7	45	10	94.2	96.8	97.4	98.0	98.3	98.7	99.0	99.4	99.8	100.2	100.5	100.9
2	36	5	93.4	96.0	96.6	97.2	97.6	97.9	98.3	98.7	99.0	99.4	99.8	100.2
-3	27	0	92.6	95.2	95.8	96.4	96.8	97.2	97.5	97.9	98.3	98.7	99.0	99.4
-8	18	-5	91.8	94.4	95.0	95.6	96.0	96.4	96.8	97.2	97.5	97.9	98.3	98.6
-13	9	-10	91.0	93.6	94.2	94.8	95.2	95.6	96.0	96.4	96.8	97.1	97.5	97.9
-17	1	-15	90.2	92.8	93.4	94.0	94.4	94.8	95.2	95.6	96.0	96.4	96.7	97.1
-22	-8	-20	89.3	92.0	92.6	93.2	93.6	94.0	94.4	94.8	95.2	95.6	95.9	96.3
-27	-17	-25	88.5	91.1	91.8	92.4	92.8	93.2	93.6	94.0	94.4	94.8	95.1	95.5
-32	-26	-30	87.6	90.3	90.9	91.6	92.0	92.4	92.8	93.3	93.6	94.0	94.3	94.7
-37	-35	-35	86.8	89.4	90.1	90.7	91.1	91.6	92.0	92.4	92.8	93.2	93.5	93.9
-42	-44	-40	85.9	88.6	89.2	89.9	90.3	90.7	91.2	91.6	92.0	92.4	92.7	93.0
-47	-53	-45	85.0	87.7	88.4	89.0	89.4	89.9	90.3	90.8	91.2	91.5	91.9	92.2
-52	-62	-50	84.1	86.8	87.5	88.2	88.6	89.0	89.5	90.0	90.3	90.7	91.0	91.4

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (FT)											
	-2000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.8	0.8	0.8	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9
A/C HIGH	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Climb (280/.76)

Flaps Up, Set Max Climb Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		40	50	60	70	80
40000	**PITCH ATT**	**4.0**	**4.0**	**4.0**		
	V/S (FT/MIN)	1700	1100	600		
30000	**PITCH ATT**	**4.0**	**4.0**	**3.5**	**4.0**	**4.0**
	V/S (FT/MIN)	2500	1900	1500	1100	800
20000	**PITCH ATT**	**7.0**	**6.5**	**6.0**	**6.0**	**6.0**
	V/S (FT/MIN)	4200	3300	2600	2100	1700
10000	**PITCH ATT**	**11.0**	**9.5**	**8.5**	**8.0**	**8.0**
	V/S (FT/MIN)	5600	4400	3600	3000	2500
SEA LEVEL	**PITCH ATT**	**14.5**	**12.5**	**11.0**	**10.0**	**9.5**
	V/S (FT/MIN)	6700	5300	4400	3700	3100

Cruise (.76/280)

Flaps Up, %N1 for Level Flight

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		40	50	60	70	80
40000	**PITCH ATT**	**2.0**	**2.5**	**3.5**		
	%N1	83	85	90		
35000	**PITCH ATT**	**1.0**	**2.0**	**2.5**	**3.0**	**3.5**
	%N1	81	83	84	87	90
30000	**PITCH ATT**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**
	%N1	81	82	83	84	86
25000	**PITCH ATT**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**
	%N1	77	78	79	81	82
20000	**PITCH ATT**	**1.0**	**1.5**	**2.0**	**2.5**	**3.5**
	%N1	74	74	75	77	78
15000	**PITCH ATT**	**1.0**	**1.5**	**2.0**	**3.0**	**3.5**
	%N1	70	71	72	73	74

Descent (.76/280)

Flaps Up, Set Idle Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		40	50	60	70	80
40000	**PITCH ATT**	**-1.5**	**-0.5**	**0.5**	**1.0**	**1.5**
	V/S (FT/MIN)	-2700	-2400	-2300	-2500	-2700
30000	**PITCH ATT**	**-3.5**	**-2.0**	**-1.0**	**0.5**	**0.5**
	V/S (FT/MIN)	-3100	-2600	-2300	-2100	-2000
20000	**PITCH ATT**	**-3.5**	**-2.0**	**-1.0**	**0.0**	**0.5**
	V/S (FT/MIN)	-2800	-2300	-2000	-1900	-1700
10000	**PITCH ATT**	**-3.5**	**-2.0**	**-1.0**	**0.0**	**0.5**
	V/S (FT/MIN	-2500	-2100	-1800	-1700	-1500
SEA LEVEL	**PITCH ATT**	**-3.5**	**-2.5**	**-1.0**	**0.5**	**0.5**
	V/S (FT/MIN)	-2300	-1900	-1700	-1500	-1400

Flight With Unreliable Airspeed/ Turbulent Air Penetration

Altitude and/or vertical speed indications may also be unreliable.

Holding (VREF40 + 70)

Flaps Up, %N1 for Level Flight

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		40	50	60	70	80
15000	**PITCH ATT**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
	%N1	56	62	66	70	73
	KIAS	177	193	212	229	246
10000	**PITCH ATT**	**5.0**	**5.0**	**5.0**	**5.0**	**5.0**
	%N1	52	58	62	66	69
	KIAS	177	192	211	228	244
5000	**PITCH ATT**	**5.0**	**5.5**	**5.0**	**5.0**	**5.0**
	%N1	49	54	58	62	66
	KIAS	177	191	210	227	243

Terminal Area (5000 FT)

%N1 for Level Flight

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS UP (GEAR UP)	**PITCH ATT.**	**4.5**	**5.0**	**5.5**	**6.0**	**6.0**
(VREF40 + 70)	%N1	49	54	58	62	65
FLAPS 1 (GEAR UP)	**PITCH ATT.**	**4.5**	**5.0**	**5.5**	**6.0**	**6.0**
(VREF40 + 50)	%N1	51	56	60	64	68
FLAPS 5 (GEAR UP)	**PITCH ATT.**	**5.5**	**5.5**	**6.0**	**6.5**	**6.5**
(VREF40 + 30)	%N1	51	57	61	65	69
FLAPS 15 (GEAR DOWN)	**PITCH ATT.**	**5.0**	**5.5**	**5.5**	**6.0**	**6.0**
(VREF40 + 20)	%N1	58	63	68	73	76

Final Approach (1500 FT)

Gear Down, %N1 for 3° Glideslope

FLAP POSITION (VREF + INCREMENT)		WEIGHT (1000 KG)				
		40	50	60	70	80
FLAPS 15	**PITCH ATT**	**2.0**	**2.0**	**2.0**	**2.5**	**2.5**
(VREF15 + 10)	%N1	40	44	48	51	54
FLAPS 30	**PITCH ATT**	**0.5**	**1.0**	**1.0**	**1.0**	**1.0**
(VREF30 + 10)	%N1	47	52	56	60	63
FLAPS 40	**PITCH ATT**	**-0.5**	**-0.5**	**-0.5**	**0.0**	**0.0**
(VREF40 + 10)	%N1	52	58	62	66	70

Go-Around

Flaps 15, Gear Up, Set Go-Around Thrust

PRESSURE ALTITUDE (FT)		WEIGHT (1000 KG)				
		40	50	60	70	80
10000	**PITCH ATT**	**20.0**	**16.0**	**13.5**	**11.5**	**10.5**
	V/S (FT/MIN)	3900	3100	2500	2000	1600
	KIAS	128	142	155	165	175
5000	**PITCH ATT**	**24.0**	**19.0**	**16.0**	**14.0**	**12.0**
	V/S (FT/MIN)	4600	3700	3000	2500	2100
	KIAS	128	142	154	164	175
SEA LEVEL	**PITCH ATT**	**28.0**	**22.0**	**18.0**	**16.0**	**14.0**
	V/S (FT/MIN)	5200	4200	3500	2900	2500
	KIAS	128	142	154	164	174

Performance Inflight — Chapter PI

All Engine — Section 61

Long Range Cruise Maximum Operating Altitude

Max Cruise Thrust

ISA + 10°C and Below

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
85	32300	-10	34300*	34300*	33800	32200	30800
80	33600	-13	35800*	35800*	35100	33500	32100
75	35000	-16	37100*	37100*	36400	34900	33500
70	36400	-18	38400*	38400*	37900	36300	35000
65	38000	-18	39800*	39800*	39400	37800	36500
60	39600	-18	41000	41000	41000	39500	38200
55	41000	-18	41000	41000	41000	41000	40000
50	41000	-18	41000	41000	41000	41000	41000
45	41000	-18	41000	41000	41000	41000	41000
40	41000	-18	41000	41000	41000	41000	41000

ISA + 15°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
85	32300	-4	33000*	33000*	33000*	32200	30800
80	33600	-7	34700*	34700*	34700*	33500	32100
75	35000	-10	36200*	36200*	36200*	34900	33500
70	36400	-12	37600*	37600*	37600*	36300	35000
65	38000	-12	38900*	38900*	38900*	37800	36500
60	39600	-12	40400*	40400*	40400*	39500	38200
55	41000	-12	41000	41000	41000	41000	40000
50	41000	-12	41000	41000	41000	41000	41000
45	41000	-12	41000	41000	41000	41000	41000
40	41000	-12	41000	41000	41000	41000	41000

ISA + 20°C

WEIGHT (1000 KG)	OPTIMUM ALT (FT)	TAT (°C)	MARGIN TO INITIAL BUFFET 'G' (BANK ANGLE)				
			1.20 (33°)	1.25 (36°)	1.30 (39°)	1.40 (44°)	1.50 (48°)
85	32300	2	29400*	29400*	29400*	29400*	29400*
80	33600	-1	32200*	32200*	32200*	32200*	32100
75	35000	-4	34700*	34700*	34700*	34700*	33500
70	36400	-7	36200*	36200*	36200*	36200*	35000
65	38000	-7	37700*	37700*	37700*	37700*	36500
60	39600	-7	39100*	39100*	39100*	39100*	38200
55	41000	-7	40500*	40500*	40500*	40500*	40000
50	41000	-7	41000	41000	41000	41000	41000
45	41000	-7	41000	41000	41000	41000	41000
40	41000	-7	41000	41000	41000	41000	41000

***Denotes altitude thrust limited in level flight, 100 fpm residual rate of climb.**

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)								
		25	27	29	31	33	35	37	39	41
85	%N1	85.0	86.4	87.6	88.8	90.3				
	MACH	.735	.759	.776	.788	.792				
	KIAS	308	306	300	292	281				
	FF/ENG	1539	1536	1527	1510	1500				
80	%N1	83.7	85.1	86.4	87.6	88.8	91.1			
	MACH	.715	.743	.765	.780	.790	.790			
	KIAS	299	299	296	289	281	268			
	FF/ENG	1447	1451	1446	1432	1414	1426			
75	%N1	82.1	83.7	85.0	86.4	87.6	88.9	92.6		
	MACH	.692	.723	.750	.770	.784	.792	.788		
	KIAS	289	290	289	285	278	269	255		
	FF/ENG	1348	1362	1363	1353	1338	1321	1366		
70	%N1	80.3	82.0	83.6	85.0	86.3	87.5	89.5		
	MACH	.668	.699	.730	.755	.774	.787	.792		
	KIAS	278	280	281	279	274	267	257		
	FF/ENG	1250	1264	1275	1272	1259	1244	1244		
65	%N1	78.6	80.2	81.8	83.4	84.8	86.1	87.7	90.6	
	MACH	.645	.673	.705	.735	.760	.777	.789	.791	
	KIAS	268	269	271	271	269	263	256	245	
	FF/ENG	1155	1166	1180	1186	1180	1166	1162	1179	
60	%N1	77.0	78.3	79.9	81.6	83.1	84.5	86.2	88.2	91.6
	MACH	.627	.647	.676	.709	.739	.763	.779	.790	.790
	KIAS	260	258	259	261	261	258	252	245	233
	FF/ENG	1076	1070	1082	1093	1096	1088	1086	1085	1111
55	%N1	75.4	76.5	77.8	79.4	81.2	82.7	84.5	86.6	88.7
	MACH	.611	.627	.647	.677	.711	.741	.765	.781	.791
	KIAS	253	249	247	248	250	250	247	241	234
	FF/ENG	1007	990	985	995	1003	1005	1006	1008	1008
50	%N1	73.7	74.8	75.9	77.2	78.9	80.6	82.5	84.8	86.8
	MACH	.595	.610	.626	.646	.676	.710	.741	.765	.781
	KIAS	246	242	238	236	237	239	239	236	230
	FF/ENG	944	921	906	899	906	914	921	928	930
45	%N1	71.5	72.9	74.0	75.2	76.4	78.1	80.2	82.6	84.8
	MACH	.569	.591	.607	.624	.643	.673	.707	.739	.763
	KIAS	235	234	231	227	224	225	227	227	224
	FF/ENG	868	857	838	823	825	828	839	852	859
40	%N1	68.8	70.5	71.9	73.1	74.2	75.4	77.3	79.9	82.3
	MACH	.538	.561	.584	.602	.619	.637	.665	.699	.732
	KIAS	222	222	222	219	215	212	212	214	214
	FF/ENG	801	796	787	769	751	739	742	757	771

Shaded area approximates optimum altitude.

Long Range Cruise Enroute Fuel and Time - Low Altitudes

Ground to Air Miles Conversions

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
295	270	248	230	214	200	190	181	173	165	158
444	406	373	345	321	300	285	272	259	248	238
594	543	498	461	429	400	380	362	346	331	318
744	680	623	576	536	500	476	453	432	414	397
894	817	749	692	643	600	571	544	519	496	476
1045	954	874	808	751	700	666	634	605	579	556
1197	1092	1000	924	858	800	761	725	692	662	635
1349	1230	1126	1039	966	900	856	816	778	745	714
1502	1369	1252	1155	1073	1000	951	906	865	827	793
1655	1508	1379	1272	1181	1100	1046	996	951	909	872
1809	1647	1505	1388	1288	1200	1141	1086	1037	992	951
1963	1787	1632	1505	1396	1300	1236	1177	1123	1074	1030
2118	1927	1760	1621	1504	1400	1331	1268	1210	1157	1109
2274	2068	1888	1738	1612	1500	1426	1358	1296	1239	1188
2430	2209	2015	1856	1720	1600	1521	1448	1381	1321	1267
2587	2350	2143	1972	1828	1700	1616	1538	1467	1403	1346
2744	2492	2271	2090	1936	1800	1711	1628	1553	1486	1425
2902	2634	2400	2207	2044	1900	1805	1719	1639	1568	1504
3060	2777	2529	2325	2153	2000	1900	1809	1725	1650	1582

Reference Fuel And Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		20		24		28	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	1.4	0:42	1.3	0:40	1.1	0:38	0.9	0:37	0.9	0:36
300	2.2	1:02	2.0	0:59	1.7	0:54	1.5	0:53	1.4	0:51
400	3.0	1:22	2.7	1:17	2.3	1:11	2.1	1:09	1.9	1:07
500	3.7	1:42	3.4	1:36	3.0	1:28	2.7	1:25	2.5	1:22
600	4.5	2:02	4.1	1:55	3.6	1:45	3.2	1:42	3.0	1:38
700	5.2	2:22	4.8	2:14	4.2	2:02	3.8	1:58	3.5	1:54
800	6.0	2:43	5.5	2:33	4.8	2:19	4.4	2:14	4.1	2:09
900	6.7	3:03	6.2	2:52	5.5	2:37	4.9	2:31	4.6	2:25
1000	7.5	3:24	6.9	3:11	6.1	2:54	5.5	2:47	5.1	2:41
1100	8.2	3:45	7.6	3:31	6.7	3:11	6.1	3:04	5.7	2:57
1200	8.9	4:06	8.2	3:50	7.3	3:29	6.6	3:20	6.2	3:12
1300	9.7	4:27	8.9	4:10	7.9	3:47	7.2	3:37	6.7	3:28
1400	10.4	4:48	9.6	4:30	8.5	4:04	7.7	3:53	7.2	3:44
1500	11.1	5:10	10.3	4:50	9.1	4:22	8.3	4:10	7.7	4:01
1600	11.8	5:31	10.9	5:10	9.7	4:40	8.8	4:27	8.2	4:17
1700	12.5	5:53	11.6	5:30	10.3	4:58	9.4	4:43	8.7	4:33
1800	13.2	6:15	12.2	5:50	10.9	5:16	9.9	5:00	9.2	4:49
1900	13.9	6:37	12.9	6:11	11.5	5:34	10.4	5:17	9.7	5:05
2000	14.6	6:59	13.6	6:31	12.1	5:53	11.0	5:34	10.2	5:22

Long Range Cruise Enroute Fuel and Time - Low Altitudes
Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	40	50	60	70	80
1	-0.1	0.0	0.0	0.1	0.1
2	-0.2	-0.1	0.0	0.1	0.3
3	-0.4	-0.2	0.0	0.2	0.5
4	-0.5	-0.2	0.0	0.3	0.6
5	-0.6	-0.3	0.0	0.4	0.8
6	-0.7	-0.4	0.0	0.5	1.0
7	-0.9	-0.4	0.0	0.6	1.2
8	-1.0	-0.5	0.0	0.7	1.4
9	-1.1	-0.6	0.0	0.8	1.6
10	-1.2	-0.6	0.0	0.9	1.8
11	-1.3	-0.7	0.0	1.0	1.9
12	-1.5	-0.8	0.0	1.1	2.1
13	-1.6	-0.9	0.0	1.2	2.3
14	-1.7	-0.9	0.0	1.3	2.5
15	-1.8	-1.0	0.0	1.4	2.7

Long Range Cruise Enroute Fuel and Time - High Altitudes

Ground to Air Miles Conversions

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
540	505	474	446	422	400	382	366	351	337	324
808	757	710	669	633	600	574	549	527	506	488
1078	1009	947	892	844	800	765	733	703	676	651
1348	1262	1184	1116	1055	1000	956	916	879	845	814
1619	1515	1421	1339	1266	1200	1148	1099	1055	1014	977
1890	1768	1658	1562	1477	1400	1339	1283	1231	1183	1140
2162	2023	1897	1786	1689	1600	1531	1466	1406	1352	1302
2435	2277	2135	2011	1900	1800	1722	1649	1582	1521	1465
2708	2532	2374	2235	2112	2000	1913	1832	1757	1689	1627
2982	2788	2612	2459	2324	2200	2104	2015	1933	1858	1789
3256	3044	2851	2684	2535	2400	2295	2198	2109	2026	1951
3532	3300	3091	2909	2747	2600	2486	2381	2283	2194	2113
3808	3557	3331	3133	2959	2800	2677	2563	2458	2362	2274
4085	3815	3571	3359	3171	3000	2868	2746	2633	2529	2435
4362	4072	3811	3584	3383	3200	3059	2928	2807	2697	2596
4639	4330	4051	3809	3595	3400	3250	3111	2982	2864	2757
4917	4588	4292	4035	3807	3600	3441	3293	3156	3031	2917
5196	4847	4533	4260	4019	3800	3631	3474	3330	3197	3077
5476	5107	4775	4487	4231	4000	3821	3656	3503	3364	3237
5757	5368	5017	4713	4444	4200	4012	3837	3677	3530	3396
6040	5629	5260	4939	4656	4400	4202	4019	3850	3695	3556
6322	5891	5503	5166	4869	4600	4392	4200	4023	3861	3714
6606	6153	5746	5393	5082	4800	4583	4381	4196	4026	3873
6892	6417	5990	5621	5295	5000	4773	4562	4368	4191	4031

Long Range Cruise Enroute Fuel and Time - High Altitudes

Reference Fuel And Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	29		31		33		35		37	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
400	1.9	1:06	1.8	1:04	1.8	1:02	1.7	1:01	1.7	1:01
600	3.0	1:37	2.9	1:34	2.8	1:31	2.7	1:29	2.6	1:28
800	4.0	2:07	3.9	2:03	3.8	1:59	3.6	1:57	3.5	1:55
1000	5.1	2:38	4.9	2:33	4.7	2:28	4.6	2:24	4.5	2:22
1200	6.1	3:10	5.9	3:03	5.7	2:57	5.5	2:53	5.4	2:49
1400	7.1	3:41	6.9	3:34	6.7	3:26	6.5	3:21	6.3	3:17
1600	8.1	4:13	7.9	4:05	7.6	3:56	7.4	3:49	7.2	3:44
1800	9.1	4:45	8.8	4:36	8.6	4:26	8.3	4:18	8.1	4:12
2000	10.1	5:17	9.8	5:07	9.5	4:56	9.2	4:47	9.0	4:40
2200	11.1	5:50	10.8	5:39	10.4	5:26	10.1	5:16	9.9	5:08
2400	12.0	6:22	11.7	6:11	11.4	5:57	11.0	5:45	10.8	5:36
2600	13.0	6:55	12.6	6:43	12.3	6:28	11.9	6:15	11.6	6:04
2800	13.9	7:28	13.6	7:15	13.2	6:59	12.8	6:45	12.5	6:33
3000	14.9	8:01	14.5	7:47	14.1	7:31	13.7	7:15	13.3	7:02
3200	15.8	8:35	15.4	8:20	14.9	8:03	14.5	7:46	14.1	7:31
3400	16.8	9:09	16.3	8:53	15.8	8:35	15.4	8:16	15.0	8:00
3600	17.7	9:42	17.2	9:26	16.7	9:07	16.2	8:48	15.8	8:30
3800	18.6	10:17	18.1	10:00	17.6	9:40	17.1	9:19	16.6	9:00
4000	19.5	10:51	19.0	10:33	18.4	10:12	17.9	9:51	17.4	9:30
4200	20.4	11:25	19.8	11:07	19.3	10:45	18.7	10:23	18.2	10:01
4400	21.3	12:00	20.7	11:41	20.1	11:19	19.5	10:55	19.0	10:31
4600	22.2	12:36	21.6	12:15	21.0	11:52	20.4	11:28	19.8	11:03
4800	23.1	13:11	22.4	12:49	21.8	12:26	21.2	12:01	20.6	11:34
5000	24.0	13:47	23.3	13:24	22.6	12:59	22.0	12:33	21.4	12:06

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	40	50	60	70	80
2	-0.3	-0.2	0.0	0.2	0.7
4	-0.5	-0.3	0.0	0.4	1.3
6	-0.8	-0.5	0.0	0.6	1.8
8	-1.1	-0.6	0.0	0.9	2.3
10	-1.4	-0.8	0.0	1.1	2.7
12	-1.7	-0.9	0.0	1.3	3.2
14	-2.0	-1.0	0.0	1.5	3.6
16	-2.4	-1.2	0.0	1.7	4.0
18	-2.7	-1.4	0.0	1.9	4.4
20	-3.0	-1.5	0.0	2.0	4.8
22	-3.4	-1.7	0.0	2.2	5.1
24	-3.8	-1.8	0.0	2.4	5.4
26	-4.1	-2.0	0.0	2.6	5.7
28	-4.5	-2.2	0.0	2.7	6.0
30	-4.9	-2.4	0.0	2.9	6.3

Long Range Cruise Wind-Altitude Trade

PRESSURE ALTITUDE (1000 FT)	CRUISE WEIGHT (1000 KG)									
	85	80	75	70	65	60	55	50	45	40
41					30	7	0	4	16	33
39				22	4	0	4	15	30	45
37		37	14	2	0	5	15	28	43	56
35	23	7	0	0	6	16	28	41	54	64
33	2	0	2	8	18	29	41	53	62	68
31	0	4	11	21	31	42	52	61	67	70
29	7	15	24	34	43	53	61	67	70	70
27	19	27	36	45	54	61	66	70	70	68
25	31	40	48	55	62	67	70	70	69	64

The above wind factor tables are for calculation of wind required to maintain present range capability at new pressure altitude, i.e., break-even wind.

Method:

1. **Read wind factors for present and new altitudes from table.**
2. **Determine difference (new altitude wind factor minus present altitude wind factor); This difference may be negative or positive.**
3. **Break-even wind at new altitude is present altitude wind plus difference from step 2.**

Descent

.78/280/250

PRESSURE ALTITUDE (FT)	TIME (MIN)	FUEL (KG)	DISTANCE (NM)			
			LANDING WEIGHT (1000 KG)			
			40	50	60	70
41000	27	340	102	119	133	142
39000	26	340	97	114	127	136
37000	25	330	92	108	121	130
35000	24	330	88	103	116	125
33000	24	320	84	99	111	120
31000	23	320	80	94	105	113
29000	22	310	75	88	98	106
27000	21	300	70	82	92	99
25000	20	300	66	77	86	92
23000	19	290	61	71	79	85
21000	18	280	57	66	73	78
19000	17	270	52	61	67	72
17000	15	250	48	55	61	65
15000	14	240	44	50	55	58
10000	11	200	30	34	37	39
5000	7	150	18	19	20	21
1500	4	110	9	9	9	9

Allowances for a straight-in approach are included.

Holding

Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)								
		1500	5000	10000	15000	20000	25000	30000	35000	41000
85	%N1	64.3	67.0	70.7	74.7	78.9	83.0	87.0		
	KIAS	250	251	252	253	255	257	260		
	FF/ENG	1500	1470	1460	1450	1430	1430	1460		
80	%N1	62.6	65.5	69.1	73.2	77.3	81.6	85.5		
	KIAS	242	243	244	245	247	249	252		
	FF/ENG	1420	1390	1380	1370	1340	1340	1360		
75	%N1	60.9	63.9	67.5	71.6	75.6	80.0	83.9	88.2	
	KIAS	235	236	236	238	239	241	243	247	
	FF/ENG	1340	1310	1300	1290	1260	1250	1270	1300	
70	%N1	59.2	62.0	65.9	69.8	73.9	78.3	82.3	86.5	
	KIAS	227	227	228	229	231	232	235	238	
	FF/ENG	1260	1240	1220	1200	1180	1160	1180	1200	
65	%N1	57.4	60.0	64.2	67.8	72.1	76.4	80.5	84.7	
	KIAS	219	219	220	221	222	224	226	228	
	FF/ENG	1180	1160	1140	1120	1100	1080	1090	1110	
60	%N1	55.6	58.1	62.1	65.9	70.1	74.3	78.6	82.7	
	KIAS	210	210	211	212	213	214	216	219	
	FF/ENG	1110	1080	1060	1040	1020	990	1010	1020	
55	%N1	53.6	56.1	59.8	64.0	67.9	72.2	76.5	80.7	87.9
	KIAS	200	201	202	203	204	205	207	209	212
	FF/ENG	1030	1000	980	960	940	920	920	930	980
50	%N1	51.4	53.9	57.5	61.7	65.5	69.9	74.0	78.4	85.5
	KIAS	191	191	192	193	194	195	196	198	201
	FF/ENG	950	920	900	880	860	860	850	850	890
45	%N1	49.1	51.5	55.1	58.9	63.1	67.2	71.4	75.9	82.9
	KIAS	184	184	184	184	184	185	186	187	190
	FF/ENG	880	850	840	820	800	780	770	770	800
40	%N1	46.5	48.9	52.4	56.0	60.3	64.2	68.6	73.0	80.1
	KIAS	177	177	177	177	177	177	177	177	178
	FF/ENG	820	790	760	740	720	710	700	690	710

This table includes 5% additional fuel for holding in a racetrack pattern.

Intentionally
Blank

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF15	ONE REV	NO REV

Dry Runway

MAX MANUAL	975	75/-60	20/30	-35/120	10/-10	20/-20	35	20	40
AUTOBRAKE MAX	1270	70/-70	30/40	-45/155	0/0	30/-30	60	0	5
AUTOBRAKE 3	1815	105/-115	50/65	-75/255	0/0	50/-50	100	0	0
AUTOBRAKE 2	2300	150/-160	70/95	-105/350	30/-45	70/-70	95	80	80
AUTOBRAKE 1	2530	180/-190	85/110	-120/410	70/-80	75/-75	90	220	335

Good Reported Braking Action

MAX MANUAL	1330	75/-80	35/45	-60/200	30/-25	35/-35	45	65	145
AUTOBRAKE MAX	1430	80/-85	40/50	-60/210	30/-25	35/-35	55	75	165
AUTOBRAKE 3	1820	105/-115	50/65	-75/260	5/-5	50/-50	100	5	10
AUTOBRAKE 2	2300	150/-160	70/95	-105/350	30/-45	70/-70	95	80	80
AUTOBRAKE 1	2530	180/-190	85/110	-120/410	70/-80	75/-75	90	220	335

Medium Reported Braking Action

MAX MANUAL	1845	120/-120	60/75	-95/335	80/-65	50/-50	60	190	455
AUTOBRAKE MAX	1885	125/-125	60/80	-95/340	75/-60	50/-55	70	190	460
AUTOBRAKE 3	2005	125/-130	60/80	-100/350	60/-40	55/-60	100	130	375
AUTOBRAKE 2	2350	155/-165	75/95	-115/395	65/-60	70/-70	95	115	230
AUTOBRAKE 1	2540	180/-190	85/110	-125/430	90/-85	75/-75	90	235	390

Poor Reported Braking Action

MAX MANUAL	2430	175/-175	85/115	-140/535	205/-135	70/-75	75	415	1105
AUTOBRAKE MAX	2430	175/-175	85/115	-140/535	205/-130	70/-75	80	415	1105
AUTOBRAKE 3	2460	175/-175	85/115	-145/535	195/-125	70/-75	90	420	1115
AUTOBRAKE 2	2625	185/-190	90/125	-150/555	190/-125	75/-80	95	350	960
AUTOBRAKE 1	2740	195/-200	95/130	-155/570	195/-140	80/-85	90	400	990

Reference distance is based on sea level, standard day, no wind or slope, VREF15 approach speed, two-engine detent No. 2 reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 60 m.
For autobrake and manual speedbrakes, increase reference landing distance by 50 m.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF30	ONE REV	NO REV

Dry Runway

MAX MANUAL	935	60/-55	20/25	-35/120	10/-10	20/-20	35	15	35
AUTOBRAKE MAX	1200	60/-65	25/35	-45/145	0/0	30/-30	55	0	5
AUTOBRAKE 3	1700	100/-105	45/60	-75/245	0/-5	45/-45	85	0	0
AUTOBRAKE 2	2120	140/-145	65/85	-100/335	30/-40	60/-60	85	80	80
AUTOBRAKE 1	2325	160/-170	75/100	-115/395	65/-70	70/-70	80	185	300

Good Reported Braking Action

MAX MANUAL	1275	70/-75	35/45	-55/195	30/-25	30/-30	45	60	130
AUTOBRAKE MAX	1375	75/-80	35/45	-60/205	30/-25	35/-35	55	65	145
AUTOBRAKE 3	1705	100/-105	45/60	-75/250	5/-10	45/-45	85	5	10
AUTOBRAKE 2	2120	140/-145	65/85	-100/335	30/-40	60/-60	85	80	80
AUTOBRAKE 1	2325	160/-170	75/100	-115/395	65/-70	70/-70	80	185	300

Medium Reported Braking Action

MAX MANUAL	1740	110/-115	55/70	-90/325	80/-60	45/-50	60	165	390
AUTOBRAKE MAX	1790	115/-120	55/75	-90/330	75/-60	50/-50	70	165	400
AUTOBRAKE 3	1885	115/-120	55/75	-95/340	55/-45	55/-55	85	115	330
AUTOBRAKE 2	2175	140/-150	65/90	-110/380	65/-60	65/-65	85	115	215
AUTOBRAKE 1	2340	160/-170	75/100	-120/410	90/-75	70/-70	80	195	350

Poor Reported Braking Action

MAX MANUAL	2265	160/-160	75/105	-135/520	190/-125	65/-70	70	355	920
AUTOBRAKE MAX	2275	160/-160	80/105	-135/520	190/-120	65/-70	80	350	920
AUTOBRAKE 3	2305	160/-160	80/105	-140/520	185/-120	65/-70	80	360	930
AUTOBRAKE 2	2435	170/-170	80/110	-145/535	180/-120	70/-75	85	315	810
AUTOBRAKE 1	2530	175/-180	85/115	-145/550	190/-130	75/-80	80	340	845

Reference distance is based on sea level, standard day, no wind or slope, VREF30 approach speed, two-engine detent No. 2 reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 60 m.
For autobrake and manual speedbrakes, increase reference landing distance by 50 m.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Normal Configuration Landing Distance

Flaps 40

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF40	ONE REV	NO REV
Dry Runway									
MAX MANUAL	890	50/-50	20/25	-35/115	10/-10	20/-20	35	15	30
AUTOBRAKE MAX	1120	55/-60	25/30	-40/140	0/0	25/-25	55	0	0
AUTOBRAKE 3	1565	90/-100	40/55	-70/235	0/-5	40/-40	85	0	0
AUTOBRAKE 2	1980	125/-135	60/75	-95/325	25/-35	55/-55	90	40	40
AUTOBRAKE 1	2185	150/-155	70/90	-110/380	55/-65	65/-65	85	145	225
Good Reported Braking Action									
MAX MANUAL	1220	65/-70	30/40	-55/195	30/-25	30/-30	45	55	120
AUTOBRAKE MAX	1310	70/-75	35/45	-60/200	25/-25	30/-30	55	60	130
AUTOBRAKE 3	1570	90/-100	40/55	-70/240	10/-5	40/-45	90	5	10
AUTOBRAKE 2	1980	125/-135	60/75	-95/325	25/-35	55/-55	90	40	40
AUTOBRAKE 1	2185	150/-155	70/90	-110/380	55/-65	65/-65	85	145	225
Medium Reported Braking Action									
MAX MANUAL	1660	105/-105	50/65	-90/320	75/-60	45/-45	60	150	350
AUTOBRAKE MAX	1695	110/-110	50/70	-90/325	70/-55	45/-45	70	150	355
AUTOBRAKE 3	1760	110/-115	50/70	-90/330	60/-45	50/-50	85	115	325
AUTOBRAKE 2	2035	130/-140	60/80	-105/370	60/-55	60/-60	90	80	175
AUTOBRAKE 1	2195	150/-155	70/95	-115/400	80/-70	65/-65	85	160	275
Poor Reported Braking Action									
MAX MANUAL	2160	150/-150	70/100	-135/510	190/-120	60/-65	70	325	830
AUTOBRAKE MAX	2165	150/-150	75/100	-135/510	190/-120	60/-65	75	325	830
AUTOBRAKE 3	2185	155/-155	75/100	-135/510	185/-120	60/-65	80	330	840
AUTOBRAKE 2	2300	160/-160	75/105	-140/525	175/-115	65/-70	85	275	730
AUTOBRAKE 1	2390	165/-170	80/110	-145/540	180/-125	70/-75	80	305	745

Reference distance is based on sea level, standard day, no wind or slope, VREF40 approach speed, two-engine detent No. 2 reverse thrust, and auto speedbrakes.
For max manual braking and manual speedbrakes, increase reference landing distance by 55 m.
For autobrake and manual speedbrakes, increase reference landing distance by 45 m.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Airspeed Unreliable (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1035	85/-60	25/30	-35/125	10/-10	25/-25	N/A	25	50
AUTOBRAKE MAX	1390	70/-75	35/45	-50/160	0/0	35/-35	N/A	0	5
AUTOBRAKE 2	2450	160/-170	80/105	-110/360	50/-55	75/-75	N/A	160	185

Good Reported Braking Action

MAX MANUAL	1410	80/-80	40/50	-60/205	30/-30	35/-35	N/A	75	175
AUTOBRAKE MAX	1530	85/-90	40/55	-60/215	30/-20	40/-40	N/A	85	195
AUTOBRAKE 2	2450	160/-170	80/105	-110/360	50/-55	75/-75	N/A	160	185

Medium Reported Braking Action

MAX MANUAL	1935	125/-125	60/80	-95/340	80/-65	55/-55	N/A	215	520
AUTOBRAKE MAX	1995	125/-130	65/85	-95/345	75/-60	55/-55	N/A	220	535
AUTOBRAKE 3	2185	130/-140	65/90	-100/365	55/-50	65/-65	N/A	125	385

Poor Reported Braking Action

MAX MANUAL	2515	175/-175	90/120	-145/535	195/-130	75/-80	N/A	455	1230
AUTOBRAKE MAX	2530	180/-180	90/125	-145/535	195/-125	75/-80	N/A	450	1225
AUTOBRAKE 3	2590	175/-180	90/125	-145/540	185/-120	75/-80	N/A	430	1215

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Airspeed Unreliable (Flaps 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	995	65/-55	20/30	-35/125	10/-10	20/-20	N/A	20	45
AUTOBRAKE MAX	1315	65/-70	30/40	-45/155	0/0	30/-30	N/A	0	5
AUTOBRAKE 2	2265	145/-155	70/95	-105/345	45/-50	65/-65	N/A	135	185

Good Reported Braking Action

MAX MANUAL	1355	75/-75	35/50	-60/200	30/-25	35/-35	N/A	70	155
AUTOBRAKE MAX	1465	80/-85	40/50	-60/210	30/-20	35/-35	N/A	80	175
AUTOBRAKE 2	2265	145/-155	70/95	-105/345	45/-50	65/-65	N/A	135	185

Medium Reported Braking Action

MAX MANUAL	1830	115/-115	55/75	-90/330	80/-60	50/-50	N/A	185	450
AUTOBRAKE MAX	1895	120/-120	60/80	-95/335	75/-60	50/-55	N/A	190	465
AUTOBRAKE 3	2040	120/-125	60/80	-100/350	60/-50	60/-60	N/A	115	340

Poor Reported Braking Action

MAX MANUAL	2360	160/-160	80/110	-140/520	185/-125	65/-70	N/A	390	1025
AUTOBRAKE MAX	2385	165/-165	85/110	-140/525	180/-120	70/-75	N/A	390	1025
AUTOBRAKE 3	2420	165/-165	80/110	-140/525	180/-115	70/-75	N/A	365	1010

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Airspeed Unreliable (Flaps 40)

VREF40

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	955	55/-50	20/30	-35/120	10/-10	20/-20	N/A	20	40
AUTOBRAKE MAX	1225	60/-65	30/35	-45/150	0/0	30/-30	N/A	0	0
AUTOBRAKE 2	2130	135/-145	65/85	-100/335	40/-45	60/-60	N/A	105	125

Good Reported Braking Action

MAX MANUAL	1305	70/-75	35/45	-55/200	30/-25	35/-35	N/A	65	145
AUTOBRAKE MAX	1400	75/-80	35/50	-60/210	30/-25	35/-35	N/A	70	160
AUTOBRAKE 2	2130	135/-145	65/85	-100/335	40/-45	60/-60	N/A	105	125

Medium Reported Braking Action

MAX MANUAL	1755	110/-110	55/70	-90/325	75/-60	50/-50	N/A	170	410
AUTOBRAKE MAX	1810	110/-115	55/75	-90/330	75/-60	50/-50	N/A	175	420
AUTOBRAKE 3	1910	110/-120	55/75	-95/345	60/-45	55/-55	N/A	115	335

Poor Reported Braking Action

MAX MANUAL	2255	155/-155	75/105	-135/515	185/-120	65/-70	N/A	355	925
AUTOBRAKE MAX	2275	155/-155	80/105	-135/515	185/-115	65/-70	N/A	355	925
AUTOBRAKE 3	2300	155/-155	75/105	-135/520	180/-115	65/-70	N/A	355	935

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

All Flaps Up Landing

VREF40 + 55

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1320	190/-80	50/105	-45/200	20/-15	35/-35	45	40	85
AUTOBRAKE MAX	1815	90/-85	45/75	-60/190	5/0	50/-50	75	5	15
AUTOBRAKE 2	3435	195/-225	115/150	-130/435	60/-75	105/-105	115	215	225

Good Reported Braking Action

MAX MANUAL	1800	90/-100	50/70	-70/235	40/-35	50/-50	50	110	255
AUTOBRAKE MAX	1985	90/-100	55/75	-75/245	30/-25	55/-55	75	95	250
AUTOBRAKE 2	3435	195/-225	115/150	-130/435	60/-75	105/-105	115	215	225

Medium Reported Braking Action

MAX MANUAL	2570	155/-160	85/115	-110/390	110/-90	75/-75	70	320	795
AUTOBRAKE MAX	2625	155/-160	90/115	-115/395	105/-85	75/-80	80	325	805
AUTOBRAKE 3	2930	150/-165	90/120	-120/420	65/-45	90/-90	125	185	570

Poor Reported Braking Action

MAX MANUAL	3440	230/-235	130/175	-170/620	270/-180	105/-110	90	715	1990
AUTOBRAKE MAX	3430	230/-235	130/175	-170/615	270/-175	105/-110	95	710	1975
AUTOBRAKE 3	3510	225/-225	130/175	-170/625	245/-155	110/-115	120	675	1955

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

ANTISKID INOPERATIVE (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1710	100/-105	50/65	-80/280	50/-45	45/-45	60	125	295
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1920	120/-120	55/75	-95/340	75/-60	50/-50	65	185	460
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2465	170/-170	85/115	-140/535	190/-125	70/-75	75	410	1125
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	3305	250/-245	120/175	-235/985	600/-290	90/-110	90	1005	3480
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
ANTISKID INOPERATIVE (Flaps 30)
VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1635	95/-100	45/60	-75/275	50/-40	40/-40	55	110	260
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1825	110/-115	55/70	-90/335	75/-60	45/-50	65	165	395
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2320	155/-155	75/105	-135/520	180/-120	65/-70	75	355	940
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	3085	225/-225	110/160	-230/960	560/-270	85/-105	85	860	2845
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
ANTISKID INOPERATIVE (Flaps 40)
VREF40

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1565	90/-95	40/55	-75/270	50/-40	40/-40	60	100	235
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1750	105/-110	50/65	-90/330	75/-60	45/-45	65	150	360
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2220	150/-150	70/100	-135/510	180/-115	60/-65	75	325	850
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	2955	215/-215	105/150	-225/945	550/-265	80/-100	85	795	2590
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Jammed or Restricted Flight Controls (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	970	75/-60	20/30	-35/120	10/-10	20/-20	35	20	45
AUTOBRAKE MAX	1270	70/-70	30/40	-45/155	0/0	30/-30	60	0	5
AUTOBRAKE 2	2270	150/-160	70/95	-105/350	35/-45	65/-65	90	105	105

Good Reported Braking Action

MAX MANUAL	1320	75/-75	35/45	-55/200	30/-25	35/-35	45	70	160
AUTOBRAKE MAX	1420	80/-85	40/50	-60/210	30/-20	35/-35	55	80	175
AUTOBRAKE 2	2270	150/-160	70/95	-105/350	35/-45	65/-65	90	105	105

Medium Reported Braking Action

MAX MANUAL	1815	120/-120	55/75	-90/330	80/-65	50/-50	60	195	485
AUTOBRAKE MAX	1860	120/-125	60/80	-95/335	75/-60	50/-55	70	200	490
AUTOBRAKE 3	1990	125/-130	60/80	-95/350	55/-40	55/-60	100	125	390

Poor Reported Braking Action

MAX MANUAL	2375	170/-170	85/115	-140/525	195/-125	70/-75	75	425	1165
AUTOBRAKE MAX	2375	170/-170	85/115	-140/525	195/-125	70/-75	75	425	1160
AUTOBRAKE 3	2405	170/-170	85/115	-140/530	185/-115	70/-75	90	425	1165

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

LEADING EDGE FLAPS TRANSIT (Flaps 15)

VREF15 + 15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1080	80/-65	25/35	-40/130	15/-10	25/-25	35	25	55
AUTOBRAKE MAX	1450	75/-75	35/45	-50/165	0/0	35/-35	65	0	5
AUTOBRAKE 2	2575	170/-180	85/110	-110/370	50/-60	75/-75	90	175	210

Good Reported Braking Action

MAX MANUAL	1480	80/-85	40/55	-60/210	35/-30	40/-40	45	85	195
AUTOBRAKE MAX	1605	85/-90	45/60	-65/220	30/-20	40/-40	65	95	215
AUTOBRAKE 2	2575	170/-180	85/110	-110/370	50/-60	75/-75	90	175	210

Medium Reported Braking Action

MAX MANUAL	2030	130/-130	65/90	-100/350	85/-70	55/-60	60	235	575
AUTOBRAKE MAX	2095	135/-135	70/90	-100/355	80/-65	60/-60	70	240	590
AUTOBRAKE 3	2295	135/-145	70/95	-105/370	60/-50	65/-70	95	140	430

Poor Reported Braking Action

MAX MANUAL	2635	185/-185	95/130	-145/545	205/-140	75/-80	75	490	1340
AUTOBRAKE MAX	2655	185/-185	95/130	-145/550	205/-130	80/-85	85	490	1340
AUTOBRAKE 3	2715	185/-185	95/130	-150/555	190/-125	80/-85	90	465	1325

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

LOSS OF SYSTEM A (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1085	70/-60	25/35	-40/130	15/-15	25/-25	45	30	50
AUTOBRAKE MAX	1275	65/-70	30/40	-45/150	5/0	30/-30	60	0	5
AUTOBRAKE 2	2395	150/-165	70/90	-105/360	0/-10	70/-70	140	0	0

Good Reported Braking Action

MAX MANUAL	1570	90/-95	45/60	-65/230	45/-40	40/-40	70	120	245
AUTOBRAKE MAX	1605	95/-100	45/60	-70/230	40/-35	40/-45	75	125	255
AUTOBRAKE 2	2395	150/-165	70/90	-105/360	5/-10	70/-70	140	0	0

Medium Reported Braking Action

MAX MANUAL	2165	145/-150	70/95	-105/375	110/-90	60/-65	90	325	775
AUTOBRAKE MAX	2165	150/-150	70/100	-105/375	115/-90	60/-65	90	325	775
AUTOBRAKE 3	2165	150/-150	70/100	-105/375	115/-80	60/-65	90	325	775

Poor Reported Braking Action

MAX MANUAL	2820	210/-210	105/145	-160/580	255/-170	80/-90	105	675	1905
AUTOBRAKE MAX	2820	215/-210	105/145	-160/580	260/-175	85/-90	105	675	1910
AUTOBRAKE 3	2820	215/-210	105/145	-160/580	260/-175	85/-90	105	675	1910

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

LOSS OF SYSTEM A (Flaps 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1035	65/-55	25/30	-40/125	15/-15	25/-25	45	25	45
AUTOBRAKE MAX	1200	60/-65	25/35	-45/145	0/0	30/-30	55	0	5
AUTOBRAKE 2	2230	140/-150	65/85	-105/345	0/-10	65/-65	130	0	0

Good Reported Braking Action

MAX MANUAL	1490	85/-90	40/55	-65/220	45/-40	40/-40	65	105	210
AUTOBRAKE MAX	1515	90/-95	40/55	-65/225	40/-35	40/-40	70	105	215
AUTOBRAKE 2	2230	140/-150	65/85	-105/345	0/-10	65/-65	130	0	0

Medium Reported Braking Action

MAX MANUAL	2035	135/-135	65/90	-100/360	105/-85	55/-60	85	275	645
AUTOBRAKE MAX	2025	135/-135	65/90	-100/360	110/-85	55/-60	85	275	640
AUTOBRAKE 3	2030	135/-135	65/90	-100/360	105/-75	55/-60	90	275	645

Poor Reported Braking Action

MAX MANUAL	2625	190/-190	95/130	-150/565	240/-155	75/-80	95	565	1530
AUTOBRAKE MAX	2625	195/-190	95/130	-150/565	245/-160	75/-80	95	565	1530
AUTOBRAKE 3	2625	195/-190	95/130	-150/565	245/-160	75/-80	95	565	1530

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

LOSS OF SYSTEM A (Flaps 40)

VREF40

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV
Dry Runway									
MAX MANUAL	990	60/-50	20/30	-35/125	15/-15	20/-20	45	25	35
AUTOBRAKE MAX	1120	55/-60	25/30	-40/140	0/0	25/-25	55	5	10
AUTOBRAKE 2	2035	125/-140	60/75	-95/330	0/-5	60/-60	125	0	0
Good Reported Braking Action									
MAX MANUAL	1420	80/-85	40/50	-65/220	45/-35	35/-35	70	95	190
AUTOBRAKE MAX	1420	80/-90	40/50	-65/220	35/-30	35/-35	70	95	185
AUTOBRAKE 2	2035	125/-140	60/75	-95/330	0/-5	60/-60	125	0	0
Medium Reported Braking Action									
MAX MANUAL	1920	125/-130	60/85	-100/355	100/-80	55/-55	85	245	560
AUTOBRAKE MAX	1905	125/-130	60/85	-100/355	105/-80	55/-55	85	240	555
AUTOBRAKE 3	1910	125/-130	60/85	-100/355	105/-75	55/-55	90	240	555
Poor Reported Braking Action									
MAX MANUAL	2470	180/-180	85/120	-150/550	230/-150	70/-75	95	495	1305
AUTOBRAKE MAX	2465	180/-180	90/120	-145/550	235/-155	70/-75	95	495	1305
AUTOBRAKE 3	2465	180/-180	90/120	-145/550	235/-155	70/-75	95	495	1305

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

LOSS OF SYSTEM A AND SYSTEM B (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1535	80/-85	40/50	-60/195	35/-30	40/-40	75	-5	60
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	2240	135/-140	65/90	-100/335	100/-80	60/-60	105	90	425
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2980	200/-205	100/135	-145/520	215/-160	85/-85	125	355	1385
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	3710	275/-270	140/195	-210/780	475/-270	105/-115	135	805	3355
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance
LOSS OF SYSTEM B (Flaps 15)
VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1095	55/-60	25/35	-40/145	15/-15	25/-25	40	35	55
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	1565	95/-95	45/60	-70/245	45/-40	40/-40	55	120	250
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2125	145/-145	70/95	-110/400	115/-90	60/-60	75	305	730
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	2725	200/-200	100/140	-165/625	285/-170	80/-85	85	610	1695
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

MANUAL REVERSION (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1535	80/-85	40/50	-60/195	35/-30	40/-40	75	-5	60
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Good Reported Braking Action

MAX MANUAL	2240	135/-140	65/90	-100/335	100/-80	60/-60	105	90	425
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 2	Autobrake Inoperative								

Medium Reported Braking Action

MAX MANUAL	2980	200/-205	100/135	-145/520	215/-160	85/-85	125	355	1385
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Poor Reported Braking Action

MAX MANUAL	3710	275/-270	140/195	-210/780	475/-270	105/-115	135	805	3355
AUTOBRAKE MAX	Autobrake Inoperative								
AUTOBRAKE 3	Autobrake Inoperative								

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

One Engine Inoperative Landing (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	980	80/-60	20/30	-35/125	10/-10	20/-20	35	0	20
AUTOBRAKE MAX	1270	70/-70	30/40	-45/155	0/0	30/-30	60	0	0
AUTOBRAKE 2	2370	150/-160	70/90	-105/355	10/-30	70/-70	115	0	5

Good Reported Braking Action

MAX MANUAL	1370	75/-80	35/50	-60/210	35/-30	35/-35	50	0	85
AUTOBRAKE MAX	1485	85/-90	40/50	-65/220	35/-25	40/-40	60	0	95
AUTOBRAKE 2	2370	150/-160	70/90	-105/355	10/-30	70/-70	115	0	5

Medium Reported Braking Action

MAX MANUAL	1965	125/-130	60/80	-100/360	100/-80	55/-55	70	0	270
AUTOBRAKE MAX	2025	130/-135	60/80	-100/365	95/-75	60/-60	80	0	275
AUTOBRAKE 3	2085	135/-140	65/85	-105/370	80/-60	60/-60	95	0	245

Poor Reported Braking Action

MAX MANUAL	2700	190/-195	90/120	-160/590	270/-170	80/-85	85	0	675
AUTOBRAKE MAX	2705	195/-195	90/125	-160/590	270/-165	80/-85	95	0	680
AUTOBRAKE 3	2740	195/-200	95/125	-160/590	265/-170	80/-85	90	0	685

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

One Engine Inoperative Landing (Flaps 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	940	60/-55	20/25	-35/120	10/-10	20/-20	35	0	20
AUTOBRAKE MAX	1200	60/-65	25/35	-45/145	0/0	30/-30	55	0	0
AUTOBRAKE 2	2185	140/-145	65/85	-100/340	15/-35	65/-65	100	0	10

Good Reported Braking Action

MAX MANUAL	1310	75/-75	35/45	-60/205	35/-30	35/-35	50	0	75
AUTOBRAKE MAX	1420	80/-85	35/50	-60/215	30/-25	35/-35	60	0	85
AUTOBRAKE 2	2185	140/-145	65/85	-100/340	15/-35	65/-65	100	0	10

Medium Reported Braking Action

MAX MANUAL	1850	115/-120	55/75	-95/350	95/-75	50/-55	65	0	230
AUTOBRAKE MAX	1905	120/-125	55/75	-100/355	90/-70	55/-55	75	0	235
AUTOBRAKE 3	1955	120/-130	60/75	-100/360	80/-65	55/-55	85	0	210

Poor Reported Braking Action

MAX MANUAL	2500	175/-175	85/110	-150/565	245/-155	75/-75	80	0	555
AUTOBRAKE MAX	2505	175/-180	85/110	-150/565	245/-150	75/-80	90	0	555
AUTOBRAKE 3	2535	175/-180	85/110	-155/570	245/-160	75/-80	80	0	565

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Stabilizer Trim Inoperative (Flaps 15)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	970	75/-60	20/30	-35/120	10/-10	20/-20	35	20	45
AUTOBRAKE MAX	1270	70/-70	30/40	-45/155	0/0	30/-30	60	0	5
AUTOBRAKE 2	2270	150/-160	70/95	-105/350	35/-45	65/-65	90	105	105

Good Reported Braking Action

MAX MANUAL	1320	75/-75	35/45	-55/200	30/-25	35/-35	45	70	160
AUTOBRAKE MAX	1420	80/-85	40/50	-60/210	30/-20	35/-35	55	80	175
AUTOBRAKE 2	2270	150/-160	70/95	-105/350	35/-45	65/-65	90	105	105

Medium Reported Braking Action

MAX MANUAL	1815	120/-120	55/75	-90/330	80/-65	50/-50	60	195	485
AUTOBRAKE MAX	1860	120/-125	60/80	-95/335	75/-60	50/-55	70	200	490
AUTOBRAKE 3	1990	125/-130	60/80	-95/350	55/-40	55/-60	100	125	390

Poor Reported Braking Action

MAX MANUAL	2375	170/-170	85/115	-140/525	195/-125	70/-75	75	425	1165
AUTOBRAKE MAX	2375	170/-170	85/115	-140/525	195/-125	70/-75	75	425	1160
AUTOBRAKE 3	2405	170/-170	85/115	-140/530	185/-115	70/-75	90	425	1165

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Asymmetry (1 ≤ Flap Lever <15)

VREF40 + 30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1075	95/-60	25/40	-40/130	15/-10	25/-25	40	25	55
AUTOBRAKE MAX	1475	70/-75	35/45	-50/170	0/0	35/-35	65	0	5
AUTOBRAKE 2	2615	160/-175	85/110	-110/375	55/-60	80/-80	90	180	220

Good Reported Braking Action

MAX MANUAL	1450	75/-80	40/55	-60/210	30/-30	35/-40	45	80	175
AUTOBRAKE MAX	1610	80/-85	45/55	-65/220	25/-20	40/-40	65	70	175
AUTOBRAKE 2	2615	160/-175	85/110	-110/375	55/-60	80/-80	90	180	220

Medium Reported Braking Action

MAX MANUAL	2015	120/-125	65/85	-95/345	85/-65	55/-60	60	220	535
AUTOBRAKE MAX	2090	125/-130	65/90	-100/350	80/-65	60/-60	70	225	550
AUTOBRAKE 3	2325	125/-135	70/95	-105/375	55/-50	70/-70	95	125	375

Poor Reported Braking Action

MAX MANUAL	2650	180/-180	95/130	-145/545	205/-135	80/-85	75	480	1290
AUTOBRAKE MAX	2670	180/-180	95/130	-145/550	200/-130	80/-85	80	475	1290
AUTOBRAKE 3	2740	175/-180	95/130	-150/555	190/-125	80/-85	95	435	1260

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Asymmetry (Flap Lever 15 or 25)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	970	75/-60	20/30	-35/120	10/-10	20/-20	35	20	45
AUTOBRAKE MAX	1270	70/-70	30/40	-45/155	0/0	30/-30	60	0	5
AUTOBRAKE 2	2270	150/-160	70/95	-105/350	35/-45	65/-65	90	105	105

Good Reported Braking Action

MAX MANUAL	1320	75/-75	35/45	-55/200	30/-25	35/-35	45	70	160
AUTOBRAKE MAX	1420	80/-85	40/50	-60/210	30/-20	35/-35	55	80	175
AUTOBRAKE 2	2270	150/-160	70/95	-105/350	35/-45	65/-65	90	105	105

Medium Reported Braking Action

MAX MANUAL	1815	120/-120	55/75	-90/330	80/-65	50/-50	60	195	485
AUTOBRAKE MAX	1860	120/-125	60/80	-95/335	75/-60	50/-55	70	200	490
AUTOBRAKE 3	1990	125/-130	60/80	-95/350	55/-40	55/-60	100	125	390

Poor Reported Braking Action

MAX MANUAL	2375	170/-170	85/115	-140/525	195/-125	70/-75	75	425	1165
AUTOBRAKE MAX	2375	170/-170	85/115	-140/525	195/-125	70/-75	75	425	1160
AUTOBRAKE 3	2405	170/-170	85/115	-140/530	185/-115	70/-75	90	425	1165

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.

MAX MANUAL assumes maximum achievable manual braking.

Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.

Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Asymmetry (Flap Lever 30)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	930	60/-55	20/25	-35/120	10/-10	20/-20	35	20	35
AUTOBRAKE MAX	1200	60/-65	25/35	-45/145	0/0	30/-30	55	0	5
AUTOBRAKE 2	2100	140/-145	65/85	-100/335	35/-45	60/-60	85	95	100

Good Reported Braking Action

MAX MANUAL	1265	70/-70	35/45	-55/195	30/-25	30/-30	45	65	140
AUTOBRAKE MAX	1355	75/-80	35/45	-60/205	25/-20	35/-35	55	70	155
AUTOBRAKE 2	2100	140/-145	65/85	-100/335	35/-45	60/-60	85	95	100

Medium Reported Braking Action

MAX MANUAL	1715	110/-110	55/70	-90/325	75/-60	45/-50	60	170	415
AUTOBRAKE MAX	1760	115/-115	55/70	-90/325	70/-55	50/-50	70	175	425
AUTOBRAKE 3	1870	115/-120	55/75	-95/340	55/-45	50/-55	85	115	340

Poor Reported Braking Action

MAX MANUAL	2220	155/-155	75/105	-135/510	180/-120	65/-70	70	365	970
AUTOBRAKE MAX	2230	155/-155	75/105	-135/510	185/-115	65/-70	80	365	965
AUTOBRAKE 3	2260	160/-160	75/105	-135/515	175/-115	65/-70	80	365	975

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Disagree (1 ≤ Indicated Flaps <15)

VREF40 + 30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1075	95/-60	25/40	-40/130	15/-10	25/-25	40	25	55
AUTOBRAKE MAX	1475	70/-75	35/45	-50/170	0/0	35/-35	65	0	5
AUTOBRAKE 2	2615	160/-175	85/110	-110/375	55/-60	80/-80	90	180	220

Good Reported Braking Action

MAX MANUAL	1450	75/-80	40/55	-60/210	30/-30	35/-40	45	80	175
AUTOBRAKE MAX	1610	80/-85	45/55	-65/220	25/-20	40/-40	65	70	175
AUTOBRAKE 2	2615	160/-175	85/110	-110/375	55/-60	80/-80	90	180	220

Medium Reported Braking Action

MAX MANUAL	2015	120/-125	65/85	-95/345	85/-65	55/-60	60	220	535
AUTOBRAKE MAX	2090	125/-130	65/90	-100/350	80/-65	60/-60	70	225	550
AUTOBRAKE 3	2325	125/-135	70/95	-105/375	55/-50	70/-70	95	125	375

Poor Reported Braking Action

MAX MANUAL	2650	180/-180	95/130	-145/545	205/-135	80/-85	75	480	1290
AUTOBRAKE MAX	2670	180/-180	95/130	-145/550	200/-130	80/-85	80	475	1290
AUTOBRAKE 3	2740	175/-180	95/130	-150/555	190/-125	80/-85	95	435	1260

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Disagree (15 ≤ Indicated Flaps <30)

VREF15

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	970	75/-60	20/30	-35/120	10/-10	20/-20	35	20	45
AUTOBRAKE MAX	1270	70/-70	30/40	-45/155	0/0	30/-30	60	0	5
AUTOBRAKE 2	2270	150/-160	70/95	-105/350	35/-45	65/-65	90	105	105

Good Reported Braking Action

MAX MANUAL	1320	75/-75	35/45	-55/200	30/-25	35/-35	45	70	160
AUTOBRAKE MAX	1420	80/-85	40/50	-60/210	30/-20	35/-35	55	80	175
AUTOBRAKE 2	2270	150/-160	70/95	-105/350	35/-45	65/-65	90	105	105

Medium Reported Braking Action

MAX MANUAL	1815	120/-120	55/75	-90/330	80/-65	50/-50	60	195	485
AUTOBRAKE MAX	1860	120/-125	60/80	-95/335	75/-60	50/-55	70	200	490
AUTOBRAKE 3	1990	125/-130	60/80	-95/350	55/-40	55/-60	100	125	390

Poor Reported Braking Action

MAX MANUAL	2375	170/-170	85/115	-140/525	195/-125	70/-75	75	425	1165
AUTOBRAKE MAX	2375	170/-170	85/115	-140/525	195/-125	70/-75	75	425	1160
AUTOBRAKE 3	2405	170/-170	85/115	-140/530	185/-115	70/-75	90	425	1165

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flap Disagree (30 ≤ Indicated Flaps <40)

VREF30

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	930	60/-55	20/25	-35/120	10/-10	20/-20	35	20	35
AUTOBRAKE MAX	1200	60/-65	25/35	-45/145	0/0	30/-30	55	0	5
AUTOBRAKE 2	2100	140/-145	65/85	-100/335	35/-45	60/-60	85	95	100

Good Reported Braking Action

MAX MANUAL	1265	70/-70	35/45	-55/195	30/-25	30/-30	45	65	140
AUTOBRAKE MAX	1355	75/-80	35/45	-60/205	25/-20	35/-35	55	70	155
AUTOBRAKE 2	2100	140/-145	65/85	-100/335	35/-45	60/-60	85	95	100

Medium Reported Braking Action

MAX MANUAL	1715	110/-110	55/70	-90/325	75/-60	45/-50	60	170	415
AUTOBRAKE MAX	1760	115/-115	55/70	-90/325	70/-55	50/-50	70	175	425
AUTOBRAKE 3	1870	115/-120	55/75	-95/340	55/-45	50/-55	85	115	340

Poor Reported Braking Action

MAX MANUAL	2220	155/-155	75/105	-135/510	180/-120	65/-70	70	365	970
AUTOBRAKE MAX	2230	155/-155	75/105	-135/510	185/-115	65/-70	80	365	965
AUTOBRAKE 3	2260	160/-160	75/105	-135/515	175/-115	65/-70	80	365	975

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Non-Normal Configuration Landing Distance

Trailing Edge Flaps Up Landing

VREF40 + 40

	LANDING DISTANCE AND ADJUSTMENTS (M)								
	REF DIST	WT ADJ	ALT ADJ	WIND ADJ	SLOPE ADJ	TEMP ADJ	APP SPD ADJ	REVERSE THRUST ADJ	
BRAKING CONFIGURATION	65000 KG LANDING WEIGHT	PER 5000 KG ABV/BLW 65000 KG	PER 1000 FT STD/HIGH*	PER 10 KTS HEAD/ TAIL WIND	PER 1% DOWN/ UP HILL	PER 10°C ABV/ BLW ISA	PER 5 KTS ABOVE VREF	ONE REV	NO REV

Dry Runway

MAX MANUAL	1175	110/-70	30/70	-40/140	15/-15	30/-30	40	30	65
AUTOBRAKE MAX	1605	75/-75	40/50	-55/175	0/0	40/-40	70	0	10
AUTOBRAKE 2	2980	175/-195	100/125	-120/400	55/-65	90/-90	105	170	180

Good Reported Braking Action

MAX MANUAL	1620	85/-90	45/60	-65/225	40/-35	45/-45	50	95	210
AUTOBRAKE MAX	1770	85/-95	50/65	-70/235	30/-20	45/-50	70	90	220
AUTOBRAKE 2	2980	175/-195	100/125	-120/400	55/-65	90/-90	105	170	180

Medium Reported Braking Action

MAX MANUAL	2285	135/-145	75/100	-105/370	100/-80	65/-70	65	270	655
AUTOBRAKE MAX	2335	140/-145	75/100	-105/375	95/-75	65/-70	75	270	665
AUTOBRAKE 3	2565	135/-150	80/105	-115/395	60/-45	75/-80	115	160	485

Poor Reported Braking Action

MAX MANUAL	3035	205/-210	110/150	-160/585	240/-160	90/-95	85	590	1610
AUTOBRAKE MAX	3025	205/-210	110/150	-160/585	240/-155	90/-95	90	585	1600
AUTOBRAKE 3	3090	200/-205	110/150	-160/590	225/-140	95/-100	110	565	1595

Reference distance is based on sea level, standard day, no wind or slope, and maximum available reverse thrust.
MAX MANUAL assumes maximum achievable manual braking.
Reference Distance includes an air distance allowance of 305 m from threshold to touchdown.
Unfactored distances are shown. For wet/contaminated runways, the distances above should be multiplied by 1.15 to obtain the actual landing distances.

***For landing distance at or below 8000 ft pressure altitude, apply the STD adjustment. For altitudes higher than 8000 ft, first apply the STD adjustment to derive a new reference landing distance for 8000 ft then apply the HIGH adjustment to this new reference distance.**

ADVISORY INFORMATION

Recommended Brake Cooling Schedule

Reference Brake Energy Per Brake (Millions of Foot Pounds)

		WIND CORRECTED BRAKES ON SPEED (KIAS)*																	
		80			100			120			140			160			180		
WEIGHT (1000 KG)	OAT (°C)	PRESSURE ALTITUDE (1000 FT)																	
		0	5	10	0	5	10	0	5	10	0	5	10	0	5	10	0	5	10
80	0	15.1	17.0	19.3	22.4	25.3	28.9	30.9	35.0	40.2	40.4	45.9	53.0	50.8	57.9	67.3	60.8	69.6	81.2
	10	15.6	17.6	20.0	23.1	26.1	29.8	31.9	36.2	41.5	41.8	47.5	54.8	52.5	59.9	69.5	62.8	71.9	83.9
	15	15.8	17.8	20.2	23.5	26.5	30.3	32.4	36.7	42.1	42.4	48.2	55.6	53.3	60.7	70.5	63.7	72.9	85.1
	20	16.0	18.1	20.5	23.8	26.9	30.7	32.8	37.2	42.7	42.9	48.8	56.3	54.0	61.5	71.4	64.6	73.9	86.2
	30	16.4	18.5	21.1	24.4	27.6	31.5	33.7	38.2	43.8	44.0	50.0	57.7	55.3	63.1	73.2	66.2	75.7	88.4
	40	16.6	18.7	21.3	24.7	27.9	31.9	34.1	38.7	44.4	44.7	50.9	58.8	56.3	64.3	74.8	67.5	77.4	90.5
	50	16.6	18.7	21.3	24.8	28.0	32.1	34.3	39.0	44.9	45.2	51.5	59.7	57.1	65.4	76.3	68.7	79.0	92.9
70	0	13.7	15.4	17.5	20.2	22.8	26.0	27.7	31.3	35.9	36.1	41.0	47.2	45.3	51.6	59.7	54.9	62.7	72.9
	10	14.2	15.9	18.1	20.8	23.5	26.8	28.6	32.4	37.1	37.3	42.3	48.7	46.8	53.3	61.6	56.7	64.8	75.4
	15	14.4	16.2	18.4	21.1	23.9	27.2	29.0	32.8	37.6	37.8	43.0	49.4	47.5	54.0	62.5	57.5	65.7	76.4
	20	14.6	16.4	18.6	21.4	24.2	27.6	29.4	33.3	38.1	38.4	43.5	50.1	48.1	54.8	63.4	58.3	66.5	77.4
	30	14.9	16.8	19.1	22.0	24.8	28.3	30.2	34.1	39.1	39.3	44.6	51.4	49.3	56.1	64.9	59.8	68.2	79.4
	40	15.1	17.0	19.3	22.2	25.1	28.6	30.5	34.6	39.6	39.9	45.3	52.2	50.1	57.1	66.2	60.9	69.6	81.2
	50	15.1	17.0	19.3	22.3	25.2	28.8	30.7	34.8	40.0	40.2	45.8	52.9	50.7	58.0	67.4	61.8	70.9	83.0
60	0	12.3	13.9	15.7	18.0	20.3	23.1	24.4	27.6	31.6	31.7	35.9	41.2	39.6	45.0	51.8	48.1	54.8	63.5
	10	12.7	14.3	16.3	18.5	20.9	23.8	25.2	28.5	32.6	32.7	37.1	42.6	40.9	46.5	53.6	49.7	56.6	65.6
	15	12.9	14.6	16.5	18.8	21.2	24.2	25.6	29.0	33.1	33.2	37.6	43.2	41.5	47.1	54.4	50.4	57.4	66.5
	20	13.1	14.8	16.7	19.1	21.5	24.5	26.0	29.4	33.5	33.6	38.1	43.8	42.0	47.8	55.1	51.1	58.2	67.4
	30	13.4	15.1	17.2	19.6	22.1	25.1	26.6	30.1	34.4	34.5	39.1	44.9	43.1	49.0	56.5	52.3	59.6	69.1
	40	13.6	15.3	17.3	19.8	22.3	25.4	26.9	30.5	34.9	35.0	39.7	45.6	43.8	49.8	57.5	53.2	60.7	70.5
	50	13.5	15.3	17.3	19.8	22.4	25.5	27.0	30.6	35.1	35.2	40.0	46.0	44.2	50.4	58.3	53.9	61.7	71.9
50	0	11.0	12.3	14.0	15.7	17.7	20.2	21.2	23.9	27.3	27.2	30.8	35.3	33.8	38.3	44.1	40.9	46.4	53.6
	10	11.3	12.7	14.4	16.3	18.3	20.8	21.9	24.7	28.2	28.1	31.8	36.5	34.9	39.6	45.5	42.2	48.0	55.4
	15	11.5	12.9	14.7	16.5	18.6	21.1	22.2	25.1	28.6	28.6	32.3	37.0	35.4	40.2	46.2	42.8	48.7	56.2
	20	11.6	13.1	14.9	16.7	18.9	21.4	22.5	25.4	29.0	28.9	32.8	37.5	35.9	40.7	46.8	43.4	49.3	56.9
	30	11.9	13.4	15.2	17.2	19.3	22.0	23.1	26.1	29.7	29.7	33.6	38.4	36.8	41.8	48.0	44.5	50.6	58.4
	40	12.1	13.6	15.4	17.3	19.5	22.2	23.4	26.4	30.1	30.1	34.0	39.0	37.4	42.4	48.8	45.2	51.4	59.4
	50	12.0	13.6	15.4	17.3	19.6	22.3	23.4	26.5	30.3	30.2	34.2	39.3	37.6	42.8	49.3	45.7	52.1	60.3
40	0	9.6	10.8	12.3	13.5	15.2	17.3	17.9	20.2	23.0	22.8	25.8	29.4	28.1	31.8	36.4	33.7	38.2	43.9
	10	10.0	11.2	12.7	14.0	15.8	17.9	18.5	20.9	23.8	23.6	26.6	30.4	29.0	32.8	37.6	34.8	39.5	45.4
	15	10.1	11.4	12.9	14.2	16.0	18.1	18.8	21.2	24.1	23.9	27.0	30.8	29.4	33.3	38.2	35.3	40.0	46.0
	20	10.2	11.5	13.1	14.4	16.2	18.4	19.1	21.5	24.5	24.2	27.4	31.3	29.8	33.8	38.7	35.8	40.6	46.6
	30	10.5	11.8	13.4	14.8	16.6	18.9	19.6	22.1	25.1	24.9	28.1	32.1	30.6	34.6	39.7	36.7	41.6	47.8
	40	10.6	11.9	13.5	14.9	16.8	19.1	19.8	22.3	25.4	25.2	28.4	32.5	31.0	35.1	40.2	37.2	42.2	48.6
	50	10.6	11.9	13.5	14.9	16.8	19.1	19.8	22.3	25.5	25.2	28.6	32.7	31.1	35.3	40.6	37.5	42.6	49.1

***To correct for wind, enter table with the brakes on speed minus one half the headwind or plus 1.5 times the tailwind. If ground speed is used for brakes on speed, ignore wind and enter table with sea level, 15°C.**

ADVISORY INFORMATION

Recommended Brake Cooling Schedule
Adjusted Brake Energy Per Brake (Millions of Foot Pounds)
No Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)								
EVENT		10	20	30	40	50	60	70	80	90
RTO MAX MAN		10	20	30	40	50	60	70	80	90
LANDING	MAX MAN	7.8	16.3	25.3	34.7	44.7	55.0	65.7	76.6	87.9
	MAX AUTO	7.5	15.4	23.6	32.4	41.8	51.8	62.5	74.1	86.5
	AUTOBRAKE 3	7.3	14.7	22.3	30.2	38.6	47.6	57.4	68.1	80.0
	AUTOBRAKE 2	7.0	13.8	20.5	27.4	34.8	42.7	51.5	61.3	72.4
	AUTOBRAKE 1	6.7	13.1	19.2	25.3	31.8	38.8	46.6	55.4	65.5

Two Engine Detent Reverse Thrust

		REFERENCE BRAKE ENERGY PER BRAKE (MILLIONS OF FOOT POUNDS)								
EVENT		10	20	30	40	50	60	70	80	90
RTO MAX MAN		10	20	30	40	50	60	70	80	90
LANDING	MAX MAN	7.0	14.6	22.8	31.4	40.5	49.9	59.7	69.8	80.0
	MAX AUTO	5.8	12.3	19.5	27.2	35.6	44.5	53.9	63.7	74.1
	AUTOBRAKE 3	4.3	9.2	14.7	20.7	27.2	34.4	42.0	50.2	59.0
	AUTOBRAKE 2	2.5	5.6	9.1	13.1	17.8	23.0	28.8	35.2	42.3
	AUTOBRAKE 1	1.8	3.8	6.1	8.8	11.9	15.5	19.6	24.4	29.8

Cooling Time (Minutes) - Category C Steel Brakes

(Note: A placard showing carbon brakes configuration will be put at the Center Forward Panel upon modification.)

	EVENT ADJUSTED BRAKE ENERGY (MILLIONS OF FOOT POUNDS)								
	16 & BELOW	17	20	23	25	28	32	33 TO 48	49 & ABOVE
	BRAKE TEMPERATURE MONITOR SYSTEM INDICATION ON CDS								
	UP TO 2.4	2.6	3.1	3.5	3.9	4.4	4.9	5.0 TO 7.5	7.5 & ABOVE
INFLIGHT GEAR DOWN	NO SPECIAL PROCEDURE REQUIRED	1	2	3	4	5	6	CAUTION	FUSE PLUG MELT ZONE
GROUND		10	20	30	40	50	60		

Cooling Time (Minutes) - Category N Carbon Brakes

	EVENT ADJUSTED BRAKE ENERGY (MILLIONS OF FOOT POUNDS)								
	16 & BELOW	17	19	20.9	23.5	26.9	29.4	30 TO 41	41 & ABOVE
	BRAKE TEMPERATURE MONITOR SYSTEM INDICATION ON CDS								
	UP TO 2.5	2.6	3	3.3	3.8	4.5	4.9	5.0 TO 7.1	7.1 & ABOVE
INFLIGHT GEAR DOWN	NO SPECIAL PROCEDURE REQUIRED	1	4	5	6	7	7.6	CAUTION	FUSE PLUG MELT ZONE
GROUND		6.7	16.0	24.1	34.2	45.9	53.3		

Observe maximum quick turnaround limit.
Table shows energy per brake added by a single stop with all brakes operating. Energy is assumed to be equally distributed among the operating brakes. Total energy is the sum of residual energy plus energy added.
Add 1.0 million foot pounds per brake for each taxi mile.

When in caution zone, wheel fuse plugs may melt. Delay takeoff and inspect after one hour. If overheat occurs after takeoff, extend gear soon for at least 7 minutes.

When in fuse plug melt zone, clear runway immediately. Unless required, do not set parking brake. Do not approach gear or attempt to taxi for one hour. Tire, wheel and brake replacement may be required. If overheat occurs after takeoff, extend gear soon for at least 12 minutes.

Brake temperature monitor system (BTMS) indication on CDS systems page may be used 10 to 15 minutes after airplane has come to a complete stop or inflight with gear retracted to determine recommended cooling schedule.

Performance Inflight Chapter PI
Engine Inoperative Section 63

ENGINE INOP

Initial Max Continuous %N1

Based on .79M, A/C high and anti-ice off

TAT (°C)	PRESSURE ALTITUDE (1000 FT)								
	25	27	29	31	33	35	37	39	41
20	96.8	96.6	96.3	96.1	95.9	95.4	95.0	94.7	93.9
15	97.4	97.2	96.9	96.8	96.6	96.2	95.7	95.5	94.8
10	98.0	97.8	97.5	97.4	97.4	96.9	96.5	96.3	95.7
5	98.3	98.6	98.3	98.1	98.1	97.7	97.3	97.1	96.6
0	97.5	98.7	99.2	99.0	98.9	98.5	98.2	98.0	97.5
-5	96.7	98.0	99.1	99.8	99.7	99.3	98.9	98.7	98.4
-10	96.0	97.2	98.4	99.6	100.5	100.2	99.8	99.6	99.4
-15	95.2	96.4	97.6	98.8	100.1	101.0	100.8	100.6	100.3
-20	94.4	95.6	96.8	98.0	99.3	100.5	101.1	100.8	100.6
-25	93.6	94.9	96.0	97.2	98.5	99.7	100.2	100.0	99.8
-30	92.8	94.1	95.2	96.4	97.7	98.8	99.4	99.2	99.0
-35	92.0	93.2	94.4	95.6	96.8	98.0	98.5	98.3	98.1
-40	91.2	92.4	93.5	94.7	96.0	97.1	97.6	97.4	97.2

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)								
	25	27	29	31	33	35	37	39	41
ENGINE ANTI-ICE	-1.2	-1.1	-1.0	-0.9	-0.8	-0.8	-0.8	-0.8	-0.8
ENGINE & WING ANTI-ICE	-4.2	-4.4	-4.5	-4.7	-5.0	-4.8	-4.8	-4.8	-4.8

ENGINE INOP

Max Continuous %N1

37000 FT to 29000 FT Pressure Altitudes

37000 FT PRESS ALT		TAT (°C)											
KIAS	M	-55	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0
160	.51	96.6	97.6	98.5	99.4	100.2	99.6	98.8	97.6	96.3	94.7	93.2	91.8
200	.63	96.0	96.9	97.8	98.7	99.6	100.4	100.1	99.3	98.4	97.5	96.3	95.2
240	.74	95.1	96.0	96.8	97.7	98.6	99.4	100.3	100.7	100.0	99.2	98.4	97.5
280	.86	94.3	95.2	96.1	97.0	97.8	98.7	99.5	100.4	101.2	100.9	100.0	99.1

35000 FT PRESS ALT		TAT (°C)											
KIAS	M	-55	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0
160	.49	96.5	97.4	98.3	99.2	100.1	99.8	99.0	98.0	96.8	95.4	94.0	92.7
200	.60	96.1	97.0	97.9	98.8	99.7	100.6	100.5	99.6	98.6	97.6	96.5	95.4
240	.71	95.0	95.9	96.8	97.7	98.6	99.4	100.3	100.8	100.2	99.5	98.6	97.7
280	.82	93.8	94.6	95.5	96.4	97.3	98.1	98.9	99.8	100.6	100.3	99.5	98.8

33000 FT PRESS ALT		TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
160	.47	97.4	98.3	99.2	100.0	100.8	100.0	99.1	97.9	96.7	95.3	93.9	92.6
200	.58	97.0	97.9	98.8	99.7	100.6	101.4	100.6	99.6	98.6	97.5	96.3	95.1
240	.68	95.9	96.8	97.7	98.5	99.4	100.2	101.1	100.9	100.2	99.4	98.4	97.4
280	.79	94.3	95.1	96.0	96.8	97.7	98.5	99.3	100.2	100.5	99.7	98.9	98.1
320	.89	93.6	94.5	95.4	96.2	97.1	97.9	98.7	99.5	100.3	101.1	100.7	99.8

31000 FT PRESS ALT		TAT (°C)											
KIAS	M	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5
160	.45	97.3	98.2	99.1	100.0	100.9	101.1	100.2	99.2	98.0	96.6	95.2	93.9
200	.55	97.1	98.0	98.9	99.7	100.6	101.5	101.6	100.7	99.7	98.6	97.4	96.2
240	.66	95.6	96.5	97.4	98.3	99.1	100.0	100.8	101.3	100.5	99.8	98.8	97.8
280	.76	93.8	94.7	95.5	96.4	97.2	98.0	98.8	99.7	100.5	99.8	98.9	98.0
320	.85	92.4	93.2	94.1	94.9	95.7	96.5	97.4	98.2	98.9	99.7	99.9	99.1

29000 FT PRESS ALT		TAT (°C)											
KIAS	M	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
160	.43	98.1	99.0	99.9	100.8	101.6	101.2	100.2	99.1	97.9	96.4	95.1	93.8
200	.53	97.5	98.4	99.3	100.2	101.0	101.9	101.3	100.4	99.3	98.2	96.9	95.8
240	.63	96.3	97.1	98.0	98.9	99.7	100.5	101.4	101.1	100.2	99.2	98.3	97.2
280	.73	94.2	95.0	95.9	96.7	97.5	98.3	99.1	99.9	100.1	99.1	98.2	97.5
320	.82	92.1	92.9	93.7	94.5	95.3	96.1	96.9	97.7	98.5	99.2	98.5	97.6
360	.91	92.1	92.9	93.7	94.5	95.3	96.1	96.9	97.7	98.5	99.2	100.0	100.1

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)				
	29	31	33	35	37
ENGINE ANTI-ICE ON	-0.9	-0.9	-0.8	-0.8	-0.8
ENGINE & WING ANTI-ICE ON	-4.1	-4.3	-4.5	-4.7	-4.7

ENGINE INOP

Max Continuous %N1

27000 FT to 20000 FT Pressure Altitudes

27000 FT PRESS ALT		TAT (°C)											
KIAS	M	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10
160	.41	98.0	98.8	99.7	100.6	101.4	102.2	101.2	100.2	99.0	97.8	96.4	95.1
200	.51	96.9	97.8	98.7	99.6	100.4	101.2	101.8	100.8	99.9	98.8	97.6	96.4
240	.60	95.6	96.5	97.4	98.2	99.1	99.9	100.7	101.3	100.4	99.4	98.5	97.5
280	.70	93.6	94.4	95.3	96.1	96.9	97.7	98.5	99.3	100.1	99.4	98.4	97.6
320	.79	91.6	92.4	93.2	94.0	94.8	95.6	96.4	97.2	98.0	98.7	98.6	97.8
360	.88	91.0	91.8	92.6	93.4	94.2	95.0	95.8	96.6	97.3	98.1	98.8	99.4
25000 FT PRESS ALT		TAT (°C)											
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
160	.39	98.8	99.7	100.5	101.4	102.2	102.4	101.4	100.3	99.1	97.7	96.5	95.2
200	.49	97.5	98.3	99.2	100.0	100.9	101.7	101.5	100.6	99.5	98.4	97.3	96.2
240	.58	95.7	96.5	97.4	98.2	99.0	99.9	100.7	100.5	99.5	98.6	97.6	96.7
280	.67	93.9	94.7	95.5	96.3	97.1	97.9	98.7	99.5	99.5	98.6	97.6	96.9
320	.76	91.7	92.6	93.4	94.2	95.0	95.8	96.5	97.3	98.0	98.6	97.8	97.2
360	.85	90.4	91.2	92.1	92.9	93.7	94.5	95.3	96.1	96.9	97.6	98.4	98.2
24000 FT PRESS ALT		TAT (°C)											
KIAS	M	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
160	.38	98.6	99.5	100.4	101.2	102.1	102.9	101.9	100.8	99.6	98.4	97.1	95.8
200	.48	97.5	98.4	99.2	100.1	100.9	101.8	102.2	101.1	100.1	99.0	97.8	96.7
240	.57	95.9	96.8	97.6	98.5	99.3	100.1	100.9	101.2	100.2	99.2	98.2	97.3
280	.66	94.2	95.1	95.9	96.7	97.5	98.3	99.1	99.9	100.4	99.4	98.3	97.5
320	.75	92.1	93.0	93.8	94.6	95.4	96.2	96.9	97.7	98.5	99.2	98.6	97.8
360	.83	90.6	91.4	92.2	93.1	93.9	94.7	95.5	96.2	97.0	97.8	98.5	98.6
22000 FT PRESS ALT		TAT (°C)											
KIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
160	.37	99.1	100.0	100.9	101.7	102.5	102.8	101.8	100.7	99.5	98.2	97.0	95.8
200	.46	98.4	99.3	100.1	101.0	101.8	102.6	102.3	101.2	100.0	98.9	97.8	96.8
240	.55	97.2	98.1	98.9	99.7	100.5	101.3	102.1	101.6	100.5	99.4	98.5	97.5
280	.63	95.7	96.5	97.4	98.2	99.0	99.8	100.6	101.3	101.0	99.8	98.9	98.1
320	.72	93.9	94.7	95.5	96.3	97.1	97.9	98.6	99.4	100.1	100.2	99.3	98.6
360	.80	92.2	93.0	93.8	94.6	95.4	96.1	96.9	97.7	98.4	99.2	99.7	99.1
20000 FT PRESS ALT		TAT (°C)											
KIAS	M	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
160	.35	98.7	99.5	100.4	101.2	102.0	102.8	102.5	101.5	100.4	99.2	98.0	96.8
200	.44	98.3	99.2	100.0	100.9	101.7	102.5	103.3	102.3	101.1	100.0	98.9	97.8
240	.53	97.5	98.4	99.2	100.0	100.8	101.7	102.5	103.1	101.8	100.5	99.5	98.6
280	.61	96.2	97.0	97.8	98.7	99.5	100.3	101.1	101.8	102.5	101.3	100.1	99.3
320	.69	94.7	95.5	96.3	97.1	97.9	98.7	99.5	100.2	101.0	101.7	100.9	99.9
360	.77	93.0	93.8	94.6	95.4	96.2	97.0	97.7	98.5	99.2	100.0	100.7	100.4

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)				
	20	22	24	25	27
ENGINE ANTI-ICE ON	-0.9	-0.9	-1.0	-1.0	-1.0
ENGINE & WING ANTI-ICE ON	-3.6	-3.8	-3.8	-3.9	-4.0

Max Continuous %N1
18000 FT to 12000 FT Pressure Altitudes

18000 FT PRESS ALT		TAT (°C)											
KIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
160	.34	98.5	99.3	100.2	101.0	101.8	102.6	101.6	100.3	99.2	98.1	97.0	95.9
200	.42	98.7	99.6	100.4	101.2	102.0	102.8	103.1	101.7	100.4	99.3	98.3	97.3
240	.51	97.8	98.7	99.5	100.3	101.1	101.9	102.7	102.5	101.1	99.9	99.0	98.1
280	.59	96.3	97.1	97.9	98.7	99.5	100.3	101.0	101.8	101.6	100.5	99.6	98.8
320	.67	94.8	95.6	96.4	97.2	97.9	98.7	99.5	100.2	101.0	100.9	100.0	99.2
360	.75	93.0	93.8	94.6	95.3	96.1	96.9	97.6	98.4	99.1	99.9	100.2	99.6

16000 FT PRESS ALT		TAT (°C)											
KIAS	M	-30	-25	-20	-15	-10	-5	0	5	10	15	20	25
160	.33	97.1	98.0	98.8	99.6	100.4	101.2	101.6	100.3	99.1	98.1	97.1	96.1
200	.41	98.0	98.8	99.6	100.4	101.2	102.0	102.8	102.5	101.3	100.2	99.3	98.3
240	.49	97.1	97.9	98.7	99.5	100.3	101.1	101.9	102.7	101.8	100.5	99.6	98.7
280	.57	95.6	96.4	97.2	98.0	98.8	99.6	100.3	101.1	101.8	100.9	99.8	99.0
320	.64	94.0	94.8	95.6	96.4	97.2	97.9	98.7	99.4	100.2	100.9	100.2	99.4
360	.72	92.1	92.9	93.7	94.5	95.3	96.1	96.9	97.7	98.4	99.2	99.9	99.6

14000 FT PRESS ALT		TAT (°C)											
KIAS	M	-25	-20	-15	-10	-5	0	5	10	15	20	25	30
160	.31	96.6	97.4	98.2	99.0	99.8	100.6	100.4	99.1	98.0	97.1	96.2	95.3
200	.39	97.1	97.9	98.7	99.5	100.3	101.1	101.8	101.5	101.0	100.1	99.3	98.4
240	.47	96.6	97.4	98.2	99.0	99.8	100.6	101.3	101.8	101.1	100.3	99.5	98.7
280	.54	95.5	96.3	97.1	97.8	98.6	99.4	100.1	100.9	101.0	100.1	99.2	98.5
320	.62	94.1	94.9	95.7	96.5	97.2	98.0	98.7	99.5	100.2	100.3	99.5	98.8
360	.69	92.2	93.1	93.9	94.7	95.5	96.3	97.0	97.8	98.6	99.3	99.6	99.0

12000 FT PRESS ALT		TAT (°C)											
KIAS	M	-20	-15	-10	-5	0	5	10	15	20	25	30	35
160	.30	96.3	97.0	97.8	98.6	99.4	100.1	99.3	98.1	97.1	96.3	95.4	94.5
200	.38	97.1	97.9	98.7	99.5	100.3	101.0	101.5	100.8	99.8	99.0	98.2	97.3
240	.45	96.5	97.3	98.0	98.8	99.6	100.3	101.1	101.0	100.1	99.4	98.6	97.9
280	.52	95.5	96.3	97.0	97.8	98.6	99.3	100.0	100.8	100.3	99.4	98.6	98.0
320	.60	94.0	94.8	95.6	96.4	97.2	97.9	98.7	99.4	100.2	99.7	98.9	98.2
360	.67	92.3	93.2	94.0	94.8	95.6	96.4	97.1	97.9	98.7	99.4	99.1	98.5

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)			
	12	14	16	18
ENGINE ANTI-ICE ON	-0.9	-0.9	-0.9	-0.9
ENGINE & WING ANTI-ICE ON	-3.2	-3.4	-3.4	-3.5

ENGINE INOP

Max Continuous %N1

10000 FT to 1000 FT Pressure Altitudes

10000 FT PRESS ALT		TAT (°C)											
KIAS	M	-20	-15	-10	-5	0	5	10	15	20	25	30	35
160	.29	95.2	96.0	96.8	97.6	98.3	99.1	99.8	98.6	97.4	96.6	95.8	94.9
200	.36	96.0	96.7	97.5	98.3	99.0	99.8	100.5	100.5	99.4	98.5	97.8	97.0
240	.43	95.6	96.4	97.2	97.9	98.7	99.4	100.2	100.9	100.1	99.2	98.4	97.7
280	.51	94.5	95.3	96.1	96.9	97.6	98.4	99.1	99.9	100.4	99.5	98.7	98.0
320	.58	93.0	93.9	94.7	95.5	96.2	97.0	97.8	98.6	99.3	99.7	99.0	98.2
360	.65	91.6	92.4	93.2	94.0	94.8	95.6	96.4	97.2	98.0	98.7	99.1	98.5
5000 FT PRESS ALT		TAT (°C)											
KIAS	M	-10	-5	0	5	10	15	20	25	30	35	40	45
160	.26	94.9	95.7	96.4	97.2	98.0	98.8	99.2	98.3	97.4	96.6	95.9	95.1
200	.33	94.7	95.5	96.3	97.1	97.8	98.6	99.4	98.9	98.0	97.3	96.6	95.8
240	.40	94.0	94.8	95.6	96.4	97.2	97.9	98.7	99.5	98.7	97.9	97.2	96.5
280	.46	93.3	94.1	94.9	95.7	96.5	97.3	98.1	98.8	98.9	98.2	97.5	96.8
320	.53	92.5	93.3	94.1	94.9	95.7	96.5	97.2	98.0	98.7	98.4	97.7	97.1
360	.59	91.5	92.3	93.1	93.9	94.7	95.5	96.2	97.0	97.8	98.5	98.0	97.3
3000 FT PRESS ALT		TAT (°C)											
KIAS	M	-5	0	5	10	15	20	25	30	35	40	45	50
160	.26	94.8	95.6	96.4	97.2	98.0	98.7	98.8	97.9	97.1	96.4	95.6	94.8
200	.32	94.5	95.3	96.1	96.9	97.6	98.4	99.2	98.3	97.5	96.8	96.1	95.3
240	.38	94.1	94.9	95.6	96.4	97.2	98.0	98.7	98.8	98.0	97.2	96.6	95.9
280	.45	93.2	94.0	94.8	95.6	96.4	97.2	97.9	98.7	98.3	97.5	96.9	96.2
320	.51	92.5	93.3	94.1	94.9	95.7	96.4	97.2	98.0	98.5	97.8	97.1	96.5
360	.57	91.6	92.4	93.2	94.0	94.7	95.5	96.3	97.1	97.8	98.1	97.4	96.8
1000 FT PRESS ALT		TAT (°C)											
KIAS	M	-5	0	5	10	15	20	25	30	35	40	45	50
160	.25	93.9	94.7	95.4	96.2	97.0	97.8	98.5	98.2	97.4	96.7	96.0	95.2
200	.31	93.5	94.3	95.1	95.9	96.7	97.4	98.2	98.5	97.8	97.0	96.3	95.6
240	.37	93.0	93.8	94.6	95.4	96.1	96.9	97.7	98.4	98.1	97.3	96.6	95.9
280	.43	92.3	93.2	93.9	94.7	95.5	96.3	97.1	97.8	98.3	97.6	96.9	96.2
320	.49	91.6	92.4	93.2	94.0	94.8	95.6	96.3	97.1	97.9	97.9	97.2	96.5
360	.55	90.7	91.5	92.3	93.1	93.9	94.7	95.4	96.2	96.9	97.7	97.3	96.6

%N1 Adjustments for Engine Bleeds

BLEED CONFIGURATION	PRESSURE ALTITUDE (1000 FT)			
	1	3	5	10
ENGINE ANTI-ICE ON	-0.6	-0.8	-0.8	-0.8
ENGINE & WING ANTI-ICE ON	-2.9	-3.0	-2.7	-3.2

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

WEIGHT (1000 KG)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFTDOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
85	82	271	18500	17300	15900
80	77	263	20200	19000	17700
75	72	255	21600	20600	19400
70	67	247	23100	22200	21100
65	62	238	24700	23800	22800
60	57	229	26800	25800	24700
55	53	219	29100	28100	27000
50	48	209	31200	30400	29400
45	43	199	33300	32600	31700
40	38	187	35600	34900	34000

Includes APU fuel burn.

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown/LRC Cruise Range Capability

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
138	128	120	112	106	100	95	90	86	82	78
275	256	239	225	212	200	190	180	172	164	157
413	384	359	337	317	300	284	270	258	246	235
551	512	479	449	423	400	379	360	344	328	314
689	640	598	562	529	500	474	451	429	410	392
826	768	718	674	635	600	569	541	515	492	471
964	896	838	786	741	700	664	631	601	574	549
1102	1025	957	898	846	800	758	721	687	656	628
1240	1153	1077	1011	952	900	853	811	773	738	706
1377	1281	1197	1123	1058	1000	948	901	859	820	785
1515	1409	1317	1235	1164	1100	1043	991	945	902	863
1653	1537	1436	1348	1270	1200	1138	1081	1030	984	942
1792	1666	1556	1460	1375	1300	1232	1171	1116	1066	1020
1930	1794	1676	1573	1481	1400	1327	1261	1202	1148	1098
2068	1922	1796	1685	1587	1500	1422	1351	1288	1230	1177
2207	2051	1916	1798	1693	1600	1517	1441	1373	1312	1255
2345	2180	2036	1910	1799	1700	1611	1531	1459	1393	1333
2484	2309	2156	2023	1905	1800	1706	1621	1545	1475	1411

Driftdown/Cruise Fuel and Time

AIR DIST (NM)	FUEL REQUIRED (1000 KG)										TIME (HR:MIN)
	WEIGHT AT START OF DRIFTDOWN (1000 KG)										
	40	45	50	55	60	65	70	75	80	85	
100	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0:16
200	0.8	0.8	0.9	0.9	1.0	1.0	1.1	1.1	1.2	1.3	0:33
300	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	0:49
400	1.6	1.8	1.9	2.0	2.2	2.3	2.5	2.6	2.8	2.9	1:06
500	2.0	2.2	2.4	2.6	2.8	3.0	3.2	3.3	3.5	3.7	1:22
600	2.4	2.7	2.9	3.1	3.3	3.6	3.8	4.0	4.3	4.5	1:39
700	2.8	3.1	3.4	3.6	3.9	4.2	4.5	4.7	5.0	5.3	1:55
800	3.2	3.6	3.9	4.2	4.5	4.8	5.1	5.4	5.7	6.1	2:11
900	3.6	4.0	4.3	4.7	5.0	5.4	5.7	6.1	6.4	6.8	2:28
1000	4.0	4.4	4.8	5.2	5.6	6.0	6.4	6.7	7.1	7.6	2:44
1100	4.4	4.8	5.3	5.7	6.1	6.6	7.0	7.4	7.9	8.3	3:01
1200	4.8	5.3	5.7	6.2	6.7	7.1	7.6	8.1	8.6	9.0	3:17
1300	5.2	5.7	6.2	6.7	7.2	7.7	8.2	8.7	9.2	9.8	3:34
1400	5.5	6.1	6.6	7.2	7.7	8.3	8.8	9.4	9.9	10.5	3:51
1500	5.9	6.5	7.1	7.7	8.3	8.9	9.4	10.0	10.6	11.2	4:07
1600	6.3	6.9	7.5	8.2	8.8	9.4	10.0	10.7	11.3	12.0	4:24
1700	6.6	7.3	8.0	8.6	9.3	10.0	10.6	11.3	12.0	12.7	4:41
1800	7.0	7.7	8.4	9.1	9.8	10.5	11.2	11.9	12.6	13.4	4:57

Includes APU fuel burn.

Driftdown at optimum driftdown speed and cruise at long range cruise speed.

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Altitude Capability

100 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
85	15200	12600	9900
80	17200	15300	12500
75	19200	17400	15000
70	20900	19700	17300
65	22500	21300	19800
60	24100	23000	21600
55	26300	24800	23500
50	29000	27700	25800
45	31400	30500	29200
40	33800	33000	31800

With engine anti-ice on, decrease altitude capability by 1200 ft.
With engine and wing anti-ice on, decrease altitude capability by 5500 ft.

ENGINE INOP

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)									
		10	15	17	19	21	23	25	27	29	31
85	%N1	91.8	95.5	97.9							
	MACH	.561	.600	.616							
	KIAS	311	303	300							
	FF/ENG	3067	3033	3052							
80	%N1	90.1	94.0	95.9	98.5						
	MACH	.545	.590	.603	.621						
	KIAS	302	299	294	291						
	FF/ENG	2875	2870	2846	2886						
75	%N1	88.4	92.5	94.0	96.1						
	MACH	.528	.579	.593	.607						
	KIAS	293	293	288	284						
	FF/ENG	2684	2709	2674	2662						
70	%N1	86.5	90.7	92.3	94.0	96.2					
	MACH	.510	.562	.582	.595	.610					
	KIAS	282	284	283	278	274					
	FF/ENG	2494	2518	2520	2481	2487					
65	%N1	84.5	88.7	90.4	92.2	93.9	96.4				
	MACH	.491	.542	.563	.584	.596	.612				
	KIAS	271	274	274	273	268	265				
	FF/ENG	2306	2327	2330	2330	2295	2317				
60	%N1	82.3	86.5	88.3	90.0	91.9	93.7	96.4			
	MACH	.471	.521	.543	.564	.585	.597	.614			
	KIAS	261	263	263	263	263	258	254			
	FF/ENG	2124	2137	2139	2140	2143	2114	2146			
55	%N1	80.2	84.2	85.9	87.7	89.5	91.4	93.3	96.2		
	MACH	.453	.498	.520	.541	.563	.585	.597	.614		
	KIAS	250	251	252	252	253	252	247	244		
	FF/ENG	1954	1948	1950	1950	1953	1958	1938	1971		
50	%N1	77.8	81.6	83.4	85.2	87.0	88.7	90.7	92.7	95.7	
	MACH	.434	.475	.495	.516	.538	.561	.583	.596	.613	
	KIAS	240	239	239	240	241	241	241	236	233	
	FF/ENG	1791	1764	1762	1762	1764	1767	1777	1765	1793	
45	%N1	75.5	79.1	80.6	82.3	84.1	85.9	87.7	89.7	91.8	94.8
	MACH	.415	.452	.469	.489	.511	.533	.556	.578	.593	.610
	KIAS	229	227	227	227	228	229	229	229	225	222
	FF/ENG	1636	1594	1582	1575	1577	1580	1586	1600	1593	1613
40	%N1	73.0	76.2	77.8	79.4	81.0	82.8	84.6	86.4	88.3	90.7
	MACH	.395	.429	.445	.462	.480	.502	.525	.548	.571	.589
	KIAS	218	215	215	214	214	215	216	216	216	214
	FF/ENG	1485	1434	1416	1402	1392	1394	1400	1410	1421	1424

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Diversion Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
298	272	249	230	214	200	190	180	172	164	158
600	547	501	462	429	400	379	361	344	328	315
903	823	753	694	644	600	570	542	517	494	473
1209	1100	1005	926	859	800	759	721	687	657	630
1516	1379	1259	1159	1075	1000	949	902	859	820	786
1825	1659	1513	1393	1290	1200	1139	1082	1031	984	943
2137	1940	1768	1626	1506	1400	1328	1262	1202	1147	1099
2450	2222	2024	1860	1722	1600	1518	1442	1373	1311	1256
2766	2507	2281	2095	1938	1800	1707	1622	1544	1474	1412
3083	2792	2539	2331	2155	2000	1896	1801	1715	1637	1568

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		18		22		26	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	1.4	0:43	1.2	0:41	1.1	0:39	1.0	0:38	0.9	0:37
400	2.8	1:23	2.6	1:19	2.4	1:14	2.2	1:11	2.1	1:09
600	4.3	2:04	3.9	1:57	3.6	1:50	3.4	1:45	3.2	1:42
800	5.7	2:46	5.2	2:36	4.9	2:26	4.5	2:19	4.4	2:14
1000	7.1	3:28	6.6	3:15	6.1	3:03	5.7	2:53	5.5	2:47
1200	8.5	4:10	7.9	3:55	7.3	3:40	6.8	3:28	6.6	3:21
1400	9.8	4:53	9.1	4:36	8.5	4:18	8.0	4:02	7.7	3:54
1600	11.2	5:36	10.4	5:16	9.7	4:55	9.1	4:38	8.7	4:28
1800	12.5	6:20	11.7	5:58	10.9	5:34	10.2	5:13	9.8	5:02
2000	13.9	7:05	12.9	6:39	12.0	6:13	11.3	5:49	10.8	5:36

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)								
	40	45	50	55	60	65	70	75	80
1	-0.1	-0.1	-0.1	0.0	0.0	0.1	0.1	0.2	0.3
2	-0.3	-0.2	-0.1	-0.1	0.0	0.2	0.3	0.6	0.8
3	-0.4	-0.3	-0.2	-0.1	0.0	0.3	0.5	0.9	1.2
4	-0.6	-0.4	-0.3	-0.1	0.0	0.3	0.7	1.2	1.6
5	-0.7	-0.5	-0.4	-0.2	0.0	0.4	0.9	1.4	2.0
6	-0.8	-0.6	-0.4	-0.2	0.0	0.5	1.1	1.7	2.4
7	-1.0	-0.8	-0.5	-0.3	0.0	0.6	1.2	2.0	2.8
8	-1.1	-0.9	-0.6	-0.3	0.0	0.6	1.4	2.2	3.2
9	-1.3	-1.0	-0.7	-0.3	0.0	0.7	1.5	2.4	3.5
10	-1.4	-1.1	-0.7	-0.4	0.0	0.7	1.6	2.6	3.8
11	-1.6	-1.2	-0.8	-0.4	0.0	0.8	1.7	2.8	4.1
12	-1.7	-1.3	-0.9	-0.4	0.0	0.8	1.9	3.0	4.4
13	-1.9	-1.4	-0.9	-0.5	0.0	0.9	2.0	3.2	4.7
14	-2.0	-1.5	-1.0	-0.5	0.0	0.9	2.0	3.4	4.9

Includes APU fuel burn.

ENGINE INOP

MAX CONTINUOUS THRUST

Holding

Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)							
		1500	5000	10000	15000	20000	25000	30000	35000
85	%N1	81.1	84.1	88.3	92.8				
	KIAS	250	251	252	253				
	FF/ENG	2740	2730	2750	2800				
80	%N1	79.5	82.4	86.5	91.0	98.3			
	KIAS	242	243	244	245	247			
	FF/ENG	2580	2570	2570	2610	2740			
75	%N1	77.8	80.5	84.7	89.1	95.0			
	KIAS	235	236	236	238	239			
	FF/ENG	2420	2400	2400	2420	2490			
70	%N1	76.0	78.6	82.8	87.1	92.1			
	KIAS	227	227	228	229	231			
	FF/ENG	2260	2240	2230	2250	2270			
65	%N1	74.0	76.7	80.8	85.0	89.7	97.7		
	KIAS	219	219	220	221	222	224		
	FF/ENG	2100	2090	2070	2070	2080	2230		
60	%N1	71.7	74.6	78.5	82.8	87.4	93.7		
	KIAS	210	210	211	212	213	214		
	FF/ENG	1950	1930	1910	1910	1910	1970		
55	%N1	69.4	72.3	76.3	80.5	84.9	90.0		
	KIAS	200	201	202	203	204	205		
	FF/ENG	1800	1770	1750	1740	1730	1760		
50	%N1	67.0	69.7	73.8	77.8	82.3	87.0	94.9	
	KIAS	191	191	192	193	194	195	196	
	FF/ENG	1650	1620	1600	1580	1570	1570	1680	
45	%N1	64.3	66.9	71.0	75.0	79.4	84.0	89.6	
	KIAS	184	184	184	184	184	185	186	
	FF/ENG	1500	1470	1440	1430	1400	1400	1450	
40	%N1	61.1	64.0	67.8	72.0	76.2	80.7	85.4	94.1
	KIAS	177	177	177	177	177	177	177	177
	FF/ENG	1350	1330	1300	1270	1250	1240	1260	1360

This table includes 5% additional fuel for holding in a racetrack pattern.

ENGINE INOP

ADVISORY INFORMATION

Gear Down Landing Rate of Climb Available

Flaps 15

TAT (°C)	RATE OF CLIMB (FT/MIN)					
	PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
52	50	-10				
50	80	20	-80			
48	110	40	-50			
46	140	70	-30	-130		
44	170	100	0	-100		
42	200	130	20	-80	-190	
40	220	160	50	-50	-170	
38	250	190	80	-20	-140	-280
36	270	220	110	0	-120	-250
34	270	250	140	20	-100	-230
32	270	270	160	40	-80	-210
30	280	270	180	60	-60	-190
20	290	280	200	90	-20	-130
10	300	290	200	100	-10	-120
0	310	300	210	100	-10	-120
-20	330	320	230	110	0	-120
-40	350	340	240	120	0	-120

Rate of climb capability shown is valid for 60000 kg, gear down at VREF15+5.
Decrease rate of climb 120 ft/min per 5000 kg greater than 60000 kg.
Increase rate of climb 160 ft/min per 5000 kg less than 60000 kg.

Flaps 30

TAT (°C)	RATE OF CLIMB (FT/MIN)					
	PRESSURE ALTITUDE (FT)					
	-2000	0	2000	4000	6000	8000
52	-250	-310				
50	-220	-290	-390			
48	-190	-260	-370			
46	-170	-240	-340	-450		
44	-140	-210	-320	-420		
42	-110	-180	-290	-400	-520	
40	-90	-160	-270	-370	-490	
38	-60	-130	-240	-350	-470	-610
36	-50	-100	-210	-320	-450	-580
34	-40	-70	-190	-300	-430	-560
32	-40	-60	-170	-290	-410	-540
30	-40	-50	-150	-270	-400	-520
20	-30	-50	-140	-240	-360	-470
10	-30	-40	-130	-240	-360	-470
0	-20	-40	-130	-240	-360	-470
-20	-20	-30	-130	-250	-370	-490
-40	-10	-30	-130	-250	-380	-500

Rate of climb capability shown is valid for 60000 kg, gear down at VREF30+5.
Decrease rate of climb 130 ft/min per 5000 kg greater than 60000 kg.
Increase rate of climb 160 ft/min per 5000 kg less than 60000 kg.

ALTERNATE MODE EEC

Alternate Mode EEC Limit Weight

PERFORMANCE LIMIT	NORMAL MODE PERFORMANCE LIMIT WEIGHT (1000 KG)										
	46	50	54	58	62	66	70	74	78	82	86
FIELD	43.4	47.3	51.1	54.9	58.7	62.6	66.4	70.2	74.0	77.9	81.7
CLIMB	42.9	46.6	50.4	54.1	57.8	61.6	65.3	69.1	72.8	76.6	80.3
OBSTACLE	43.1	46.8	50.6	54.3	58.0	61.7	65.4	69.1	72.8	76.5	80.2
TIRE	46.0	50.0	54.0	58.0	62.0	65.7	69.7	73.6	77.6	81.6	85.6
BRAKE	46.0	50.0	54.0	58.0	62.0	65.5	69.4	73.4	77.3	81.3	85.2

Alternate Mode EEC Takeoff Speed Adjustment

TAKEOFF SPEEDS	TAKEOFF SPEED ADJUSTMENT (KTS)
DRY V1	+1
WET V1	+2
VR	+1
V2	0

Alternate Mode EEC Max Takeoff %N1

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

AIRPORT OAT (°C)	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
60	92.6	93.2	93.6	93.7	93.8	93.9	94.0	94.1	94.0	93.7	93.6	93.5	93.5
55	93.2	93.8	94.3	94.4	94.5	94.6	94.7	94.9	94.7	94.4	94.1	93.5	92.8
50	93.8	94.4	94.9	95.1	95.2	95.4	95.5	95.6	95.5	95.2	94.9	94.4	93.9
45	94.6	95.2	95.6	95.8	95.9	96.1	96.2	96.3	96.2	95.9	95.6	95.3	94.9
40	95.2	95.9	96.4	96.5	96.6	96.7	96.8	97.0	96.9	96.6	96.3	96.2	95.9
35	95.8	96.5	97.2	97.3	97.4	97.5	97.6	97.7	97.6	97.3	97.0	96.9	96.8
30	95.4	96.6	98.1	98.1	98.2	98.2	98.3	98.3	98.2	98.1	97.8	97.7	97.7
25	94.6	95.9	97.3	97.9	98.5	98.6	98.5	98.5	98.5	98.5	98.4	98.4	98.5
20	93.8	95.1	96.6	97.1	97.7	98.0	98.3	98.6	98.6	98.7	98.6	98.6	98.6
15	93.0	94.3	95.8	96.4	97.0	97.3	97.6	97.9	98.3	98.7	98.9	98.9	98.9
10	92.3	93.6	95.0	95.6	96.2	96.5	96.8	97.2	97.5	97.9	98.3	98.8	99.3
5	91.5	92.8	94.2	94.8	95.4	95.8	96.1	96.4	96.8	97.2	97.6	98.1	98.5
0	90.7	92.0	93.4	94.1	94.7	95.0	95.3	95.7	96.0	96.4	96.8	97.3	97.8
-5	89.8	91.2	92.6	93.3	93.9	94.2	94.5	94.9	95.3	95.7	96.1	96.5	97.0
-10	89.0	90.4	91.8	92.5	93.1	93.4	93.8	94.1	94.5	94.9	95.3	95.8	96.2
-15	88.2	89.5	91.0	91.7	92.3	92.6	93.0	93.4	93.7	94.1	94.5	95.0	95.4
-20	87.4	88.7	90.2	90.8	91.5	91.8	92.2	92.6	93.0	93.4	93.7	94.2	94.6
-25	86.5	87.9	89.4	90.0	90.7	91.0	91.4	91.8	92.2	92.6	93.0	93.4	93.8
-30	85.7	87.0	88.5	89.2	89.8	90.2	90.6	91.0	91.4	91.8	92.1	92.6	93.0
-35	84.8	86.2	87.7	88.3	89.0	89.4	89.7	90.2	90.6	90.9	91.3	91.8	92.2
-40	83.9	85.3	86.8	87.5	88.1	88.5	88.9	89.3	89.7	90.1	90.5	90.9	91.4
-45	83.1	84.4	86.0	86.6	87.3	87.7	88.1	88.5	88.9	89.3	89.7	90.1	90.5
-50	82.2	83.5	85.1	85.7	86.4	86.8	87.2	87.7	88.1	88.4	88.8	89.3	89.7

%N1 Adjustments for Engine Bleed

BLEED CONFIGURATION	AIRPORT PRESSURE ALTITUDE (FT)												
	-2000	-1000	0	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
PACKS OFF	0.7	0.8	0.8	0.9	0.9	0.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Intentionally
Blank

Performance Inflight — Chapter PI

Gear Down — Section 65

GEAR DOWN

Long Range Cruise Altitude Capability

Max Cruise Thrust, 100 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
85	15600	12500	9400
80	18400	15500	12600
75	21100	18500	15700
70	23600	21400	18600
65	26100	24400	21800
60	28600	27100	25300
55	30800	29600	28100
50	32900	31900	30700
45	35100	34100	33000
40	37500	36500	35400

GEAR DOWN

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)								
		10	21	23	25	27	29	31	33	35
85	%N1	85.9								
	MACH	.482								
	KIAS	267								
	FF/ENG	2421								
80	%N1	84.2								
	MACH	.468								
	KIAS	259								
	FF/ENG	2271								
75	%N1	82.5	91.7							
	MACH	.454	.554							
	KIAS	251	248							
	FF/ENG	2123	2101							
70	%N1	80.6	89.8	91.7						
	MACH	.440	.541	.557						
	KIAS	243	242	240						
	FF/ENG	1977	1960	1950						
65	%N1	78.6	87.9	89.5	91.6	94.5				
	MACH	.425	.524	.543	.560	.578				
	KIAS	235	234	233	231	229				
	FF/ENG	1835	1812	1806	1805	1836				
60	%N1	76.5	85.6	87.4	89.1	91.3	94.5			
	MACH	.409	.504	.525	.544	.562	.580			
	KIAS	226	225	225	224	222	220			
	FF/ENG	1696	1661	1661	1658	1664	1696			
55	%N1	74.4	83.3	85.0	86.8	88.5	90.9	94.1		
	MACH	.393	.484	.504	.525	.545	.562	.581		
	KIAS	217	216	216	216	215	213	211		
	FF/ENG	1559	1515	1512	1515	1517	1523	1555		
50	%N1	71.9	80.7	82.5	84.2	86.0	87.8	90.2	93.5	
	MACH	.376	.463	.482	.502	.523	.544	.561	.580	
	KIAS	207	206	206	206	206	205	203	201	
	FF/ENG	1424	1371	1367	1368	1374	1377	1381	1411	
45	%N1	69.1	78.0	79.7	81.4	83.1	85.0	86.8	89.1	92.5
	MACH	.358	.441	.458	.477	.498	.520	.541	.559	.578
	KIAS	197	196	196	196	196	196	195	193	191
	FF/ENG	1294	1231	1224	1224	1230	1235	1237	1239	1265
40	%N1	66.2	74.9	76.6	78.3	80.0	81.8	83.6	85.5	87.7
	MACH	.340	.417	.434	.452	.471	.491	.513	.535	.554
	KIAS	187	185	185	185	185	185	185	185	183
	FF/ENG	1170	1098	1085	1083	1089	1092	1094	1096	1097

GEAR DOWN

Long Range Cruise Enroute Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
324	290	260	236	217	200	188	178	168	160	153
654	583	523	474	435	400	377	357	338	321	307
989	880	787	713	653	600	566	535	507	483	461
1329	1181	1054	953	871	800	754	713	676	643	614
1674	1484	1322	1194	1090	1000	943	891	844	803	766
2024	1791	1593	1436	1310	1200	1131	1069	1013	962	918
2381	2103	1865	1680	1530	1400	1320	1247	1181	1122	1070
2743	2417	2140	1924	1751	1600	1508	1424	1348	1280	1221
3113	2737	2418	2171	1972	1800	1695	1600	1514	1438	1371

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)									
	10		14		20		24		28	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
200	2.4	0:49	2.2	0:47	1.9	0:44	1.7	0:42	1.6	0:41
400	4.9	1:36	4.5	1:31	4.0	1:25	3.7	1:20	3.5	1:17
600	7.4	2:25	6.8	2:17	6.1	2:06	5.7	1:59	5.4	1:54
800	9.8	3:14	9.1	3:03	8.1	2:48	7.6	2:38	7.2	2:31
1000	12.1	4:04	11.3	3:50	10.1	3:30	9.5	3:18	9.0	3:08
1200	14.4	4:56	13.5	4:39	12.1	4:14	11.3	3:58	10.7	3:46
1400	16.7	5:49	15.6	5:28	14.0	4:58	13.1	4:40	12.4	4:24
1600	18.9	6:43	17.7	6:18	15.9	5:44	14.9	5:22	14.1	5:03
1800	21.1	7:38	19.7	7:10	17.7	6:30	16.6	6:05	15.7	5:43

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	40	50	60	70	80
2	-0.3	-0.2	0.0	0.3	0.7
4	-0.7	-0.3	0.0	0.6	1.3
6	-1.0	-0.5	0.0	0.9	2.0
8	-1.3	-0.7	0.0	1.2	2.6
10	-1.7	-0.8	0.0	1.4	3.2
12	-2.0	-1.0	0.0	1.6	3.7
14	-2.4	-1.2	0.0	1.8	4.2
16	-2.7	-1.3	0.0	2.0	4.6
18	-3.0	-1.5	0.0	2.2	5.0
20	-3.4	-1.7	0.0	2.4	5.3
22	-3.7	-1.8	0.0	2.5	5.6

GEAR DOWN

Descent

VREF40 + 70 KIAS

PRESSURE ALTITUDE (FT)	TIME (MIN)	FUEL (KG)	DISTANCE (NM)
41000	21	280	91
39000	20	270	86
37000	19	270	81
35000	19	260	77
33000	18	260	72
31000	17	250	68
29000	17	250	64
27000	16	240	60
25000	15	230	56
23000	14	230	52
21000	13	220	48
19000	13	210	44
17000	12	200	40
15000	11	190	36
10000	8	170	26
5000	6	140	16
1500	4	110	9

Allowances for a straight-in approach are included.

GEAR DOWN

Holding

Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)							
		1500	5000	10000	15000	20000	25000	30000	35000
85	%N1	75.7	78.4	82.7	86.9	91.9			
	KIAS	229	229	229	229	229			
	FF/ENG	2240	2220	2220	2230	2250			
80	%N1	74.1	76.9	81.0	85.3	89.9			
	KIAS	224	224	224	224	224			
	FF/ENG	2110	2100	2090	2090	2100			
75	%N1	72.3	75.3	79.2	83.6	88.1			
	KIAS	218	218	218	218	218			
	FF/ENG	1990	1970	1960	1960	1960			
70	%N1	70.6	73.5	77.5	81.8	86.2	91.7		
	KIAS	213	213	213	213	213	213		
	FF/ENG	1870	1850	1840	1830	1830	1860		
65	%N1	68.8	71.7	75.8	80.0	84.4	89.1		
	KIAS	209	209	209	209	209	209		
	FF/ENG	1760	1740	1720	1710	1700	1720		
60	%N1	66.9	69.7	73.9	77.9	82.3	86.9	94.1	
	KIAS	203	203	203	203	203	203	203	
	FF/ENG	1650	1620	1600	1590	1580	1580	1660	
55	%N1	65.0	67.6	71.8	75.8	80.2	84.7	90.2	
	KIAS	197	197	197	197	197	197	197	
	FF/ENG	1530	1510	1490	1470	1450	1450	1490	
50	%N1	62.7	65.5	69.4	73.6	77.8	82.3	87.0	
	KIAS	191	191	191	191	191	191	191	
	FF/ENG	1420	1400	1370	1350	1330	1320	1350	
45	%N1	60.2	63.1	67.0	71.2	75.3	79.8	84.4	91.3
	KIAS	184	184	184	184	184	184	184	184
	FF/ENG	1310	1290	1260	1240	1210	1200	1220	1260
40	%N1	57.7	60.4	64.5	68.5	72.8	77.1	81.5	86.6
	KIAS	177	177	177	177	177	177	177	177
	FF/ENG	1200	1170	1150	1130	1100	1080	1090	1110

This table includes 5% additional fuel for holding in a racetrack pattern.

Intentionally
Blank

Performance Inflight — Chapter PI

Gear Down, Engine Inop — Section 66

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Driftdown Speed/Level Off Altitude

100 ft/min residual rate of climb

WEIGHT (1000 KG)		OPTIMUM DRIFTDOWN SPEED (KIAS)	LEVEL OFF ALTITUDE (FT)		
START DRIFTDOWN	LEVEL OFF		ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
85	80	227	1700		
80	76	223	4000	2300	200
75	71	218	6300	4900	2800
70	66	213	8600	7300	5300
65	62	208	10900	9800	8000
60	57	202	13200	12300	10900
55	52	196	15600	14800	13900
50	47	190	18100	17300	16500
45	43	183	20600	19800	18900
40	38	176	23100	22300	21400

Includes APU fuel burn.

Long Range Cruise Altitude Capability

100 ft/min residual rate of climb

WEIGHT (1000 KG)	PRESSURE ALTITUDE (FT)		
	ISA + 10°C & BELOW	ISA + 15°C	ISA + 20°C
75	1500		
70	4500	2500	
65	7500	5900	3400
60	10600	9200	6900
55	13300	12300	10600
50	16200	15400	14500
45	19300	18300	17500
40	22200	21400	20500

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Control

WEIGHT (1000 KG)		PRESSURE ALTITUDE (1000 FT)									
		5	7	9	11	13	15	17	19	21	23
70	%N1	94.8									
	MACH	.389									
	KIAS	235									
	FF/ENG	3774									
65	%N1	92.6	94.3	96.9							
	MACH	.376	.389	.402							
	KIAS	228	227	226							
	FF/ENG	3477	3485	3527							
60	%N1	90.2	91.9	93.7	96.3						
	MACH	.364	.375	.388	.402						
	KIAS	220	219	218	218						
	FF/ENG	3192	3191	3198	3240						
55	%N1	87.8	89.3	91.0	92.8	95.4					
	MACH	.351	.362	.374	.387	.400					
	KIAS	212	211	210	209	209					
	FF/ENG	2924	2909	2906	2913	2951					
50	%N1	85.3	86.7	88.2	89.9	91.7	94.2	98.2			
	MACH	.338	.348	.359	.371	.384	.398	.412			
	KIAS	204	203	202	201	200	199	198			
	FF/ENG	2672	2647	2630	2626	2633	2657	2737			
45	%N1	82.7	84.0	85.4	86.9	88.6	90.4	92.7	96.6		
	MACH	.325	.334	.344	.355	.367	.380	.393	.408		
	KIAS	196	195	193	192	191	190	189	189		
	FF/ENG	2432	2400	2374	2356	2351	2352	2359	2417		
40	%N1	79.8	81.1	82.5	83.9	85.4	87.0	88.8	90.8	94.1	98.4
	MACH	.311	.320	.329	.339	.349	.361	.374	.387	.402	.418
	KIAS	188	186	184	183	182	181	180	179	179	178
	FF/ENG	2206	2166	2133	2107	2088	2076	2069	2065	2101	2201

GEAR DOWN

ENGINE INOP

MAX CONTINUOUS THRUST

Long Range Cruise Diversion Fuel and Time

Ground to Air Miles Conversion

AIR DISTANCE (NM)					GROUND DISTANCE (NM)	AIR DISTANCE (NM)				
HEADWIND COMPONENT (KTS)						TAILWIND COMPONENT (KTS)				
100	80	60	40	20		20	40	60	80	100
172	151	134	120	109	100	93	88	83	78	75
352	308	270	242	219	200	187	175	165	156	148
533	465	408	364	330	300	280	262	246	232	220
716	623	545	486	440	400	373	349	328	309	293
900	783	684	609	551	500	466	436	409	385	365
1086	943	823	733	661	600	559	523	490	462	438
1273	1105	964	856	772	700	652	610	572	538	510
1462	1267	1103	980	883	800	745	696	652	614	581
1653	1431	1245	1104	994	900	838	782	733	690	653
1845	1595	1386	1228	1105	1000	931	868	813	765	724

Reference Fuel and Time Required at Check Point

AIR DIST (NM)	PRESSURE ALTITUDE (1000 FT)					
	6		10		14	
	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)	FUEL (1000 KG)	TIME (HR:MIN)
100	1.3	0:27	1.1	0:26	1.0	0:26
200	2.6	0:53	2.4	0:50	2.3	0:48
300	3.9	1:18	3.7	1:15	3.6	1:11
400	5.2	1:44	4.9	1:39	4.8	1:35
500	6.5	2:10	6.1	2:04	6.0	1:58
600	7.8	2:37	7.3	2:29	7.1	2:22
700	9.1	3:03	8.5	2:55	8.3	2:46
800	10.3	3:30	9.7	3:20	9.4	3:10
900	11.6	3:58	10.9	3:46	10.5	3:35
1000	12.8	4:25	12.0	4:12	11.6	3:59

Fuel Required Adjustments (1000 KG)

REFERENCE FUEL REQUIRED (1000 KG)	WEIGHT AT CHECK POINT (1000 KG)				
	40	50	60	70	80
1	-0.2	-0.1	0.0	0.1	0.3
2	-0.3	-0.2	0.0	0.3	0.6
3	-0.5	-0.3	0.0	0.5	1.0
4	-0.6	-0.3	0.0	0.7	1.3
5	-0.8	-0.4	0.0	0.9	1.7
6	-1.0	-0.5	0.0	1.0	2.0
7	-1.1	-0.6	0.0	1.2	2.4
8	-1.3	-0.7	0.0	1.4	2.7
9	-1.5	-0.7	0.0	1.6	3.1
10	-1.6	-0.8	0.0	1.8	3.5
11	-1.8	-0.9	0.0	1.9	3.8
12	-1.9	-1.0	0.0	2.1	4.2
13	-2.1	-1.1	0.0	2.3	4.5
14	-2.3	-1.1	0.0	2.5	4.9

Includes APU fuel burn.

GEAR DOWN
ENGINE INOP

MAX CONTINUOUS THRUST

Holding

Flaps Up

WEIGHT (1000 KG)		PRESSURE ALTITUDE (FT)			
		1500	5000	10000	15000
80	%N1	93.2			
	KIAS	224			
	FF/ENG	4120			
75	%N1	91.2	94.5		
	KIAS	218	218		
	FF/ENG	3840	3890		
70	%N1	89.2	92.4		
	KIAS	213	213		
	FF/ENG	3580	3610		
65	%N1	87.3	90.3	95.7	
	KIAS	209	209	209	
	FF/ENG	3340	3360	3430	
60	%N1	85.1	88.1	92.7	
	KIAS	203	203	203	
	FF/ENG	3090	3090	3130	
55	%N1	82.8	85.7	90.2	97.0
	KIAS	197	197	197	197
	FF/ENG	2850	2840	2860	2990
50	%N1	80.2	83.2	87.6	92.6
	KIAS	191	191	191	191
	FF/ENG	2610	2600	2610	2650
45	%N1	77.7	80.5	84.9	89.5
	KIAS	184	184	184	184
	FF/ENG	2390	2370	2360	2380
40	%N1	75.0	77.7	82.0	86.4
	KIAS	177	177	177	177
	FF/ENG	2170	2140	2120	2130

This table includes 5% additional fuel for holding in a racetrack pattern.

Introduction

This chapter contains information to supplement performance data from the Flight Management Computer (FMC). In addition, sufficient inflight data is provided to complete a flight with the FMC inoperative. In the event of conflict between data presented in this chapter and that contained in the approved Airplane Flight Manual, the Flight Manual shall always take precedence.

General

Takeoff Speeds

The speeds presented in the Takeoff Speeds table as well as FMC computed takeoff speeds can be used for all performance conditions except where adjustments must be made to V1 for clearway, stopway, anti-skid inoperative, thrust reversers inoperative, improved climb, contaminated runway situations or brake energy limits. 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 will not help this condition as the minimum control speeds are determined at the actual temperature and therefore are not reduced.

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

V1(MCG)

Regulations prohibit scheduling takeoff with a V1 less than minimum V1 for control on the ground, V1(MCG). It is therefore necessary to compare the adjusted V1 to V1(MCG). The V1(MCG) presented in this manual is conservative for all weight and bleed configurations.

To find V1(MCG) enter the V1(MCG) table with the airport pressure altitude and actual OAT. If the adjusted V1 is less than V1(MCG), set V1 equal to V1(MCG). If the adjusted VR is less than V1(MCG), set VR equal to V1(MCG), and determine a new V2 by adding the difference between the normal VR and V1(MCG) to the normal V2. No takeoff weight adjustment is necessary provided that the actual field length exceeds the minimum field length shown in the Field and Climb Limit Weight table in chapter Performance Dispatch.

Clearway and Stopway V1 Adjustments

Maximum allowable clearway limits are provided for guidance when more precise data is not available. Use of clearway is not allowed on wet runways.

Takeoff speed adjustments are to be applied to V1 speed when using takeoff weights based on the use of clearway and stopway.

Adjust V1 speed by the amount shown in the table. The adjusted V1 speed must not exceed VR. If the adjusted V1 speed is greater than VR, reduce V1 to equal VR.

Stab Trim

To find takeoff stabilizer trim setting, enter Stab Trim Setting table with anticipated brake release weight and center of gravity (C.G. % MAC) and read required stabilizer trim units.

VREF

This table contains flaps 40, 30 and 15 reference speeds for a given weight.

With autothrottles disengaged an approach speed wind correction (max 20 knots) of 1/2 steady headwind component + gust increment above steady wind is recommended. Do not apply a wind correction for tailwinds. The maximum command speed should not exceed landing flap placard speed minus 5 knots.

Flap Maneuver Speeds

This table provides flap maneuver speeds for various flap settings. During flap retraction, selection of the next flap position is initiated when reaching the maneuver speed for the existing flap position. During flap retraction, at least adequate maneuver capability or 30° of bank (15° of bank and 15° overshoot) to stick shaker is provided at the flap retraction speed. Full maneuver capability or at least 40° of bank (25° of bank and 15° overshoot) is provided when the airplane has accelerated to the recommended maneuver speed for the selected flap position.

During flap extension, selection of the flaps to the next flap position should be made when approaching, and before decelerating below, the maneuver speed for the existing flap position. The flap extension speed schedule varies with airplane weight and provides full maneuver capability or at least 40° of bank (25° of bank and 15° overshoot) to stick shaker at all weights.

Slush/Standing Water Takeoff

Experience has shown that aircraft performance may deteriorate significantly on runways covered with snow, slush, standing water or ice. Therefore, reductions in field/obstacle limited takeoff weight and revised takeoff speeds are necessary. The tables are intended for guidance in accordance with advisory material and assume an engine failure at the critical point during the takeoff.

The entire runway is assumed to be completely covered by a contaminant of uniform thickness and density. Therefore this information is conservative when operating under typical cold weather conditions where patches of slush exist and some degree of sanding is common. Takeoffs in slush depths greater than 13 mm (0.5 inches) are not recommended because of possible airplane damage as a result of slush impingement on the airplane structure. The use of assumed temperature for reduced thrust is not allowed on contaminated runways. Interpolation for slush/standing water depths between the values shown is permitted.

Takeoff weight determination:

1. Enter the Weight Adjustment table with the dry field/obstacle limit weight to obtain the weight reduction for the slush/standing water depth and airport pressure altitude.
2. Adjust field length available for temperature by amount shown beneath V1(MCG) limit weight table.
3. Enter the V1(MCG) Limit Weight table with the adjusted field length and pressure altitude to obtain the slush/standing water limit weight with respect to minimum field length required for V1(MCG) speed.

4. The maximum allowable takeoff weight in slush/standing water is the lesser of the limit weights found in steps 1 and 3.

Takeoff speed determination:

1. Determine takeoff speeds V1, VR and V2 for actual brake release weight using the Dry Runway Takeoff Speeds table for the appropriate flap setting and thrust rating.
2. If V1(MCG) limited, set V1=V1(MCG). If not limited by V1(MCG) considerations, enter the V1 Adjustment table with actual brake release weight to determine the V1 reduction to apply to V1 speed. If the adjusted V1 is less than V1(MCG), set V1=V1(MCG).

Slippery Runway Takeoff

Airplane braking action is reported as good, medium or poor, depending on existing runway conditions. If braking action is reported as good, conditions should not be expected to be as good as on clean, dry runways. The value “good” is comparative and is intended to mean that airplanes should not experience braking or directional control difficulties when stopping. The performance level used to calculate the “good” data is consistent with wet runway testing done on early Boeing jets. The performance level used to calculate the “poor” data reflects a runway covered with wet ice. Performance is based on a 15 ft screen height at the end of the runway. The tables provided are used in the same manner as the Slush/Standing Water tables.

Anti-Skid Inoperative

When operating with anti-skid inoperative, the field limit weight and V1 must be reduced to account for the effect on accelerate-stop performance. Anti-skid inoperative is only allowed on a dry runway. A simplified method which conservatively accounts for the effects of anti-skid inoperative is to reduce the normal dry field/obstacle limited weight by 7950 kg and the V1 associated with the reduced weight by the amount shown in the table below.

ANTI-SKID INOPERATIVE V1 ADJUSTMENTS

FIELD LENGTH (M)	V1 ADJUSTMENT (KIAS)
2000	-19
2500	-16
3000	-13
3500	-11
4000	-10

If the resulting V1 is less than V1(MCG), takeoff is permitted with V1 set equal to V1(MCG) provided the dry accelerate-stop distance adjusted for wind and slope exceeds approximately 1800 m.

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

Thrust Reverser Inoperative

When dispatching on a wet runway with both thrust reversers operative, an operative anti-skid system, and all brakes operating, regulations allow deceleration credit for one thrust reverser in the engine failure case and two thrust reversers in the all engine stop case.

When dispatching on a wet runway with one thrust reverser inoperative, the runway/obstacle limited weight and V1 must be reduced to account for the effect on accelerate-stop performance. A simplified method, which conservatively accounts for this, is to reduce the normal wet runway/obstacle limited weight by 850 kg and the V1 associated with the reduced weight by 2 knots.

If the resulting V1 is less than minimum V1, takeoff is permitted with V1 set equal to V1(MCG) provided the accelerate-stop distance available adjusted for wind and slope exceeds approximately 1200 m.

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

Takeoff %N1

To find Max Takeoff %N1 based on normal engine bleed for air conditioning packs on, enter Takeoff %N1 Table with airport pressure altitude and airport OAT and read %N1. Apply %N1 adjustments as provided when applicable.

Assumed Temperature Reduced Thrust

Regulations permit the use of up to 25% takeoff thrust reduction for operation with assumed temperature reduced thrust. Use of assumed temperature reduced thrust is not allowed with anti-skid inoperative or on runways contaminated with standing water, ice, slush, or snow. Use of assumed temperature reduced thrust is not recommended if potential windshear conditions exist.

To find the maximum allowable assumed temperature enter the Maximum Assumed Temperature table with airport pressure altitude and OAT. Compare this temperature to that at which the airplane is performance limited as determined from available takeoff performance data. Next, enter the Maximum Takeoff %N1 table with airport pressure altitude and the lower of the two temperatures previously determined, to obtain a maximum takeoff %N1. Do not use an assumed temperature less than the minimum assumed temperature shown. Enter the %N1 Adjustment table with OAT and the difference between the assumed and actual OAT to obtain a %N1 adjustment. Subtract the %N1 adjustment from the maximum takeoff %N1 found previously to determine the assumed temperature reduced thrust %N1.

Apply %N1 adjustments as provided when applicable.

Max Climb %N1

This table shows Max Climb %N1 for a 280/.78 climb speed schedule, normal engine bleed for packs on or off and anti-ice off. Enter the table with airport pressure altitude and TAT and read %N1. %N1 adjustments are shown for anti-ice operation.

Go-around %N1

To find Max Go-around %N1 based on normal engine bleed for packs on (AUTO) and anti-ice on or off, enter the Go-around %N1 table with airport pressure altitude and reported OAT or TAT and read %N1. For packs OFF or HIGH operation, apply the %N1 adjustment shown below the table.

Flight with Unreliable Airspeed / Turbulent Air Penetration

Pitch attitude and average %N1 information is provided for use in all phases of flight in the event of unreliable airspeed/Mach indications resulting from blocking or freezing of the pitot system. Loss of radome or turbulent air may also cause unreliable airspeed/Mach indications. The cruise table in this section may also be used for turbulent air penetration.

Pitch attitude is shown in bold type for emphasis since altitude and/or vertical speed indications may also be unreliable.

All Engines

Long Range Cruise Maximum Operating Altitude

These tables provide the maximum operating altitude in the same manner as the FMC. Maximum altitudes are shown for a given cruise weight and maneuver capability. This table considers both thrust and buffet limits, providing the more limiting of the two. Any data that is thrust limited is denoted by an asterisk and represents only a thrust limited condition in level flight with 100 ft/min residual rate of climb. Flying above these altitudes with sustained banks in excess of approximately 15° may cause the airplane to lose speed and/or altitude. The altitudes shown in the table are limited to the maximum certified altitude of 41000 ft.

Long Range Cruise Control

These tables provide target %N1, Long Range Cruise Mach number, IAS and standard day fuel flow per engine for the airplane weight and pressure altitude. As indicated by the shaded area, at optimum altitude .79M approximates the Long Range Cruise Mach schedule.

Long Range Cruise Enroute Fuel and Time

Long Range Cruise Enroute Fuel and Time tables are provided to determine remaining time and fuel required to destination. The data is based on Long Range Cruise and .78/280/250 descent. Tables are presented for low altitudes and high altitudes.

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

APU Operation During Flight

For APU operation during flight, increase fuel flow according to the table in the Engine Inoperative text section.

Long Range Cruise Wind-Altitude Trade

Wind is a factor which may justify operations considerably below optimum altitude. For example, a favorable wind component may have an effect on ground speed which more than compensates for the loss in air range.

Using this table, it is possible to determine the break-even wind (advantage necessary or disadvantage that can be tolerated) to maintain the same range at another altitude and long range cruise speed. The tables make no allowance for climb or descent time, fuel or distance, and are based on comparing ground fuel mileage.

Descent

Time, fuel, and distance for descent are shown for a .78/280/250 descent speed schedule. Enter the table with top of descent pressure altitude and read distance, time and fuel. Data is based on flight idle thrust descent in zero wind. Allowances are included for a straight-in approach with gear down and landing flaps at the outer marker.

Holding

Target %N1, indicated airspeed and fuel flow per engine information is tabulated for holding with flaps up based on the FMC optimum holding speed schedule. This is the higher of the maximum endurance speed and the maneuvering speed. Small variations in airspeed will not appreciably affect the overall endurance time. Enter the table with weight and pressure altitude to read %N1, IAS and fuel flow per engine.

Advisory Information

Normal Configuration Landing Distance

The normal configuration distance tables are provided as advisory information to help determine the actual landing distance performance of the airplane for different runway surface conditions and brake configurations.

Flaps 15, 30, and 40 landing distances and adjustments are provided for dry runways as well as runways with good, medium, and poor reported braking action, which are commonly referred to as slippery runway conditions.

If the surface is affected by water, snow or ice, and the braking action is reported as "good", conditions should not be expected to be as good as on clean, dry runways. The value "good" is comparative and is intended to mean that airplanes should not experience braking or directional control difficulties when landing. The performance level used to calculate the "good" data is consistent with wet runway testing done on early Boeing jets. The performance level used to calculate "poor" data reflects runways covered with wet ice.

Dry runway landing performance is shown for max manual braking configuration and autobrake settings max, 3, 2, and 1. The autobrake performance may be used to assist in the selection of the most desirable autobrake setting for a given field length. Selection of an autobrake setting results in a constant rate of deceleration. Maximum effort manual braking should achieve shorter landing distance than the max autobrake setting. The reference landing distance is a reference distance from 50 ft above the threshold to stop based on a reference landing weight and normal approach speed for the selected landing flap at sea level, zero wind, zero slope, and two engine detent reverse thrust. Subsequent columns provide adjustments for off-reference landing weight, altitude, wind, slope, temperature, speed, and reverse thrust. Each adjustment is independently added to the reference landing distance.

Non-normal Configuration Landing Distance

Advisory information is provided to support non-normal configurations that affect the landing performance of the airplane. Landing distances and adjustments are provided for dry runways and runways with good, medium, and poor reported braking action.

Enter the table with the applicable non-normal configuration and read the normal approach speed. The reference landing distance is a reference distance from 50 ft above the threshold to stop based on a reference landing weight and speed at sea level, zero wind, and zero slope. Subsequent columns provide adjustments for off-reference landing weight, altitude, wind, slope, and speed conditions. Each adjustment is independently added to the reference landing distance. Landing distance includes the effect of reverse thrust.

Recommended Brake Cooling Schedule

Advisory information is provided to assist in avoiding the problems associated with hot brakes. For normal operation, most landings are at weights below the AFM quick turnaround limit weight.

Use of the recommended cooling schedule will help avoid brake overheat and fuse plug problems that could result from repeated landings at short time intervals or a rejected takeoff.

Enter the Recommended Brake Cooling Schedule table with the airplane weight and brakes on speed, adjusted for wind at the appropriate temperature and altitude condition. Instructions for applying wind adjustments are included below the table. Linear interpolation may be used to obtain intermediate values. The resulting number is the reference brake energy per brake in millions of foot-pounds, and represents the amount of energy absorbed by each brake during a rejected takeoff. Notes providing adjustments for wind are included below the table.

To determine the energy per brake absorbed during landing, enter the appropriate Adjusted Brake Energy Per Brake table (No Reverse Thrust or 2 Engine Reverse) with the reference brake energy per brake and the type of braking used during landing (Max Manual, Max Auto, or Autobrake). The resulting number is the adjusted brake energy per brake and represents the energy absorbed in each brake during the landing.

The recommended cooling time is found in the appropriate (steel or carbon brakes) final table by entering with the adjusted brake energy per brake. Times are provided for ground cooling and inflight gear down cooling.

Brake Temperature Monitor System (BTMS) indications are also shown. If brake cooling is determined from the BTMS, use the hottest brake indication 10 to 15 minutes after the airplane has come to a complete stop, or inflight with gear retracted to determine recommended cooling schedule.

Engine Inoperative

Initial Max Continuous %N1

The Initial Max Continuous %N1 setting for use following an engine failure is shown. The table is based on the typical all engine cruise speed of .79M to provide a target %N1 setting at the start of driftdown. Once driftdown is established, the Max Continuous %N1 table should be used to determine %N1 for the given conditions.

Max Continuous %N1

Power setting is based on one engine operating with one A/C pack operating and all anti-ice bleeds off. Enter the table with pressure altitude, TAT, and IAS or Mach to read %N1.

It is desirable to maintain engine thrust level within the limits of the Max Cruise thrust rating. However, where thrust level in excess of Max Cruise rating is required, such as for meeting terrain clearance, ATC altitude assignments, or to attain maximum range capability, it is permissible to use the thrust needed up to the Max Continuous thrust rating. The Max Continuous thrust rating is intended primarily for emergency use at the discretion of the pilot and is the maximum thrust that may be used continuously.

Driftdown Speed/Level Off Altitude

The table shows optimum driftdown speed as a function of cruise weight at start of driftdown. Also shown are the approximate weight and pressure altitude at which the airplane will level off considering 100 ft/min residual rate of climb.

The level off altitude is dependent on air temperature (ISA deviation).

Driftdown/LRC Range Capability

This table shows the range capability from the start of driftdown. Driftdown is continued to level off altitude. As weight decreases due to fuel burn, the airplane is accelerated to Long Range Cruise speed. Cruise is continued at level off altitude and Long Range Cruise speed.

To determine fuel required, enter the Ground to Air Miles Conversion table with the desired ground distance and adjust for anticipated winds to obtain air distance to destination. Then enter the Driftdown/Cruise Fuel and Time table with air distance and weight at start of driftdown to determine fuel and time required. If altitudes other than the level off altitude is used, fuel and time required may be obtained by using the Engine Inoperative Long Range Cruise Enroute Fuel and Time table.

Long Range Cruise Altitude Capability

The table shows the maximum altitude that can be maintained at a given weight and air temperature (ISA deviation), based on Long Range Cruise speed, Max Continuous thrust, and 100 ft/min residual rate of climb.

Long Range Cruise Control

The table provides target %N1, engine inoperative Long Range Cruise Mach number, IAS and fuel flow for the airplane weight and pressure altitude. The fuel flow values in this table reflect single engine fuel burn.

APU Operation During Flight

For APU operation during flight, increase fuel flow according to the following table. These increments include the APU fuel flow and the effect of increased drag from the APU door.

PRESSURE ALTITUDE (1000 FT)	APU FUEL FLOW (KG/HR)
39	45
35	45
31	50
25	60
20	65
15	75
10	85
5	95

Long Range Cruise Diversion Fuel and Time

Tables are provided for crews to determine the fuel and time required to proceed to an alternate airfield with one engine inoperative. The data is based on single engine Long Range Cruise speed and .78/280/250 descent. Enter with Air Distance as determined from the Ground to Air Miles Conversion table and read Fuel and Time required at the cruise pressure altitude. Adjust the fuel obtained for deviation from the reference weight at checkpoint as required by entering the off reference fuel adjustments table with the fuel required for the reference weight and the actual weight at checkpoint. Read fuel required and time for the actual weight.

Holding

Single engine holding data is provided in the same format as the all engine holding data and is based on the same assumptions.

Gear Down Landing Rate of Climb Available

Rate of climb data is provided as guidance information in the event an engine inoperative landing (manual or autoland) is planned. The tables show gear down rate of climb available for Flaps 15 and Flaps 30. Enter the table with TAT and pressure altitude to read rate of climb available. Apply adjustments shown to correct for weight.

Alternate Mode EEC

Introduction

This section contains performance data for airplane operation with the Electronic Engine Control (EEC) in the alternate mode (ALTN EEC switch illuminated) for applicable thrust ratings. The data includes engine bleed effects for normal air conditioning operation i.e., two packs on at normal flow all engines operating.

Operation with derate and/or assumed temperature reduced thrust is not permitted with the EEC in alternate mode.

Limit Weight

A simplified method which conservatively accounts for the effects of EEC in alternate mode is to reduce the normal mode (ON EEC switch illuminated) performance limited weights. The Limit Weight table provides takeoff field, climb, obstacle, tire speed and brake energy limit weights. To determine limit weights for operations with the EEC in the alternate mode, enter the table with the limit weights for normal mode EEC operation and read the associated limit weight for each performance condition. The most limiting of the takeoff weights must be used. Analysis from the Airplane Flight Manual - Digital Performance Information may yield less restrictive limit weights.

Takeoff Speed Adjustment

Takeoff speeds for the reduced weight should be increased by the amount shown in the Takeoff Speeds Adjustment table. The adjusted V1 should not exceed the adjusted VR.

Note: The FMC does not incorporate alternate mode EEC performance in its takeoff speeds calculations.

Max Takeoff %N1

The alternate mode EEC thrust schedule provides equal or greater thrust than the normal mode thrust for the same thrust lever position. Thrust limit protection is not provided in alternate mode EEC and maximum rated thrust may be reached at thrust lever position less than full forward. As a result, thrust overboost may occur if the target alternate mode EEC Max Takeoff %N1 settings are not observed.

To find alternate mode EEC Max Takeoff %N1 based on normal engine bleed for air conditioning packs on, enter the Alternate Mode EEC Max Takeoff %N1 table with airport pressure altitude and airport OAT and read %N1. For packs off apply the %N1 adjustment provided below the table. No %N1 adjustment is required for engine or wing anti-ice.

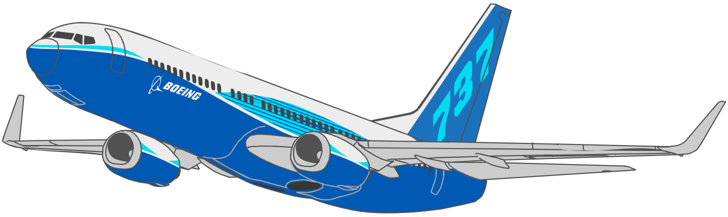
Gear Down

This section contains performance for airplane operation with the landing gear extended. The data is based on engine bleeds for normal air conditioning.

Note: The Flight Management Computer System (FMCS) does not contain special provisions for operation with landing gear extended. As a result, the FMCS may generate inappropriate enroute speed schedules, display non-conservative predictions of fuel burn, estimated time of arrival (ETA), maximum altitude, and compute overly shallow descent path. An accurate estimated time of arrival (ETA) is available if current speed or Mach is entered into the VNAV cruise page.

Tables for gear down performance in this section are identical in format and used in the same manner as tables for the gear up configuration previously described.

Control Number:
(受控号)



737-700/-800

Flight Crew
Operations Manual

Xiamen Airlines

Volume 2
（第二册）

Document Number D6-27370-75C-XIA
Revision Number: 40b
Revision Date: March 20, 2018

Airplane General, Emergency Equipment, Doors, Windows

Chapter 1

Table of Contents

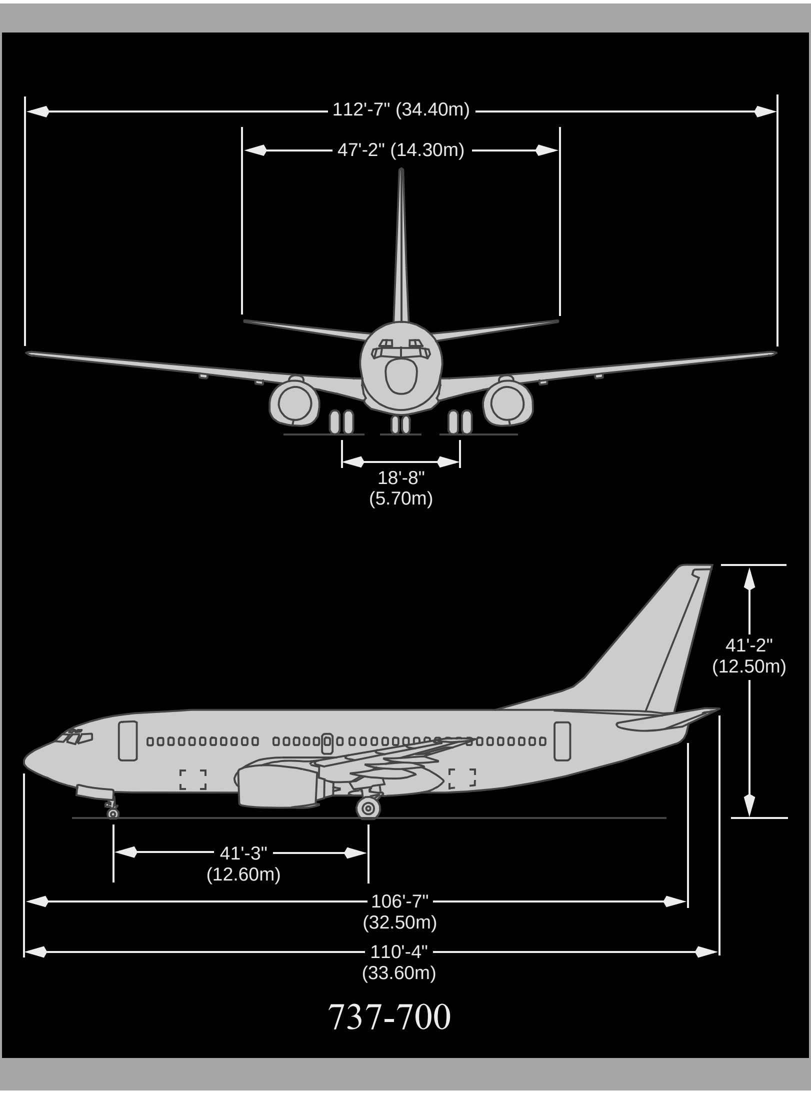
Section TOC

Airplane General, Emergency Equipment, Doors, Windows

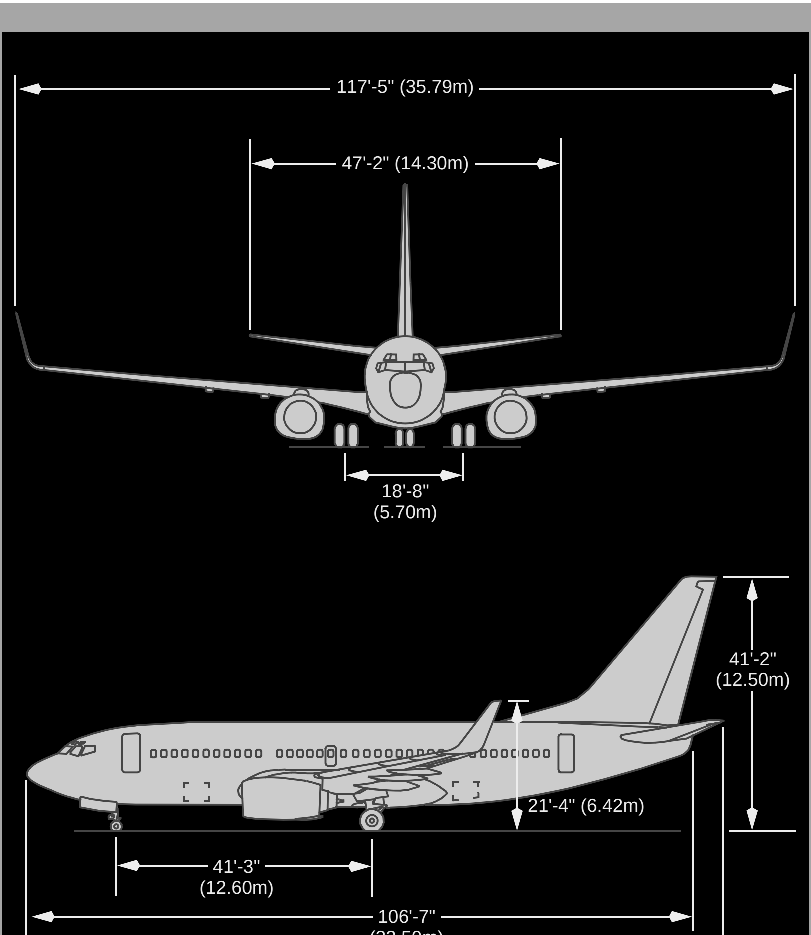
Dimensions

Principal Dimensions

YA701 - YA710

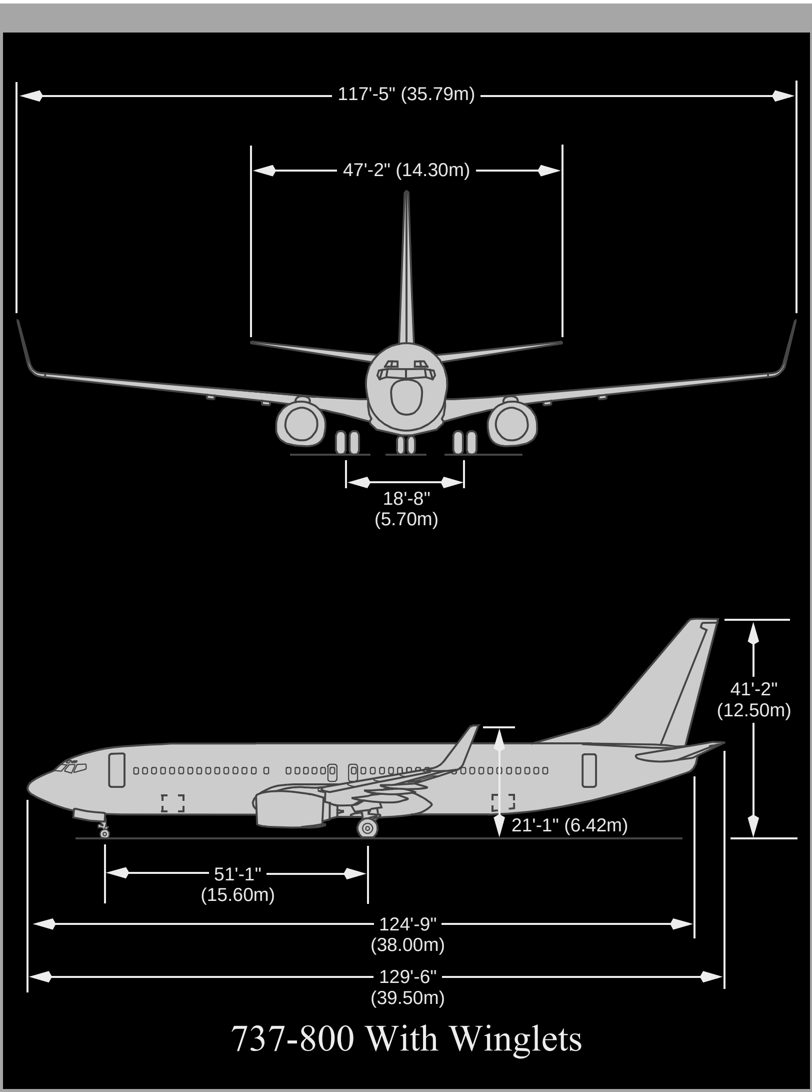


YM482 - YN534



737-700 With Winglets

YF048 - YL551, YS151 - YV754



737-800 With Winglets

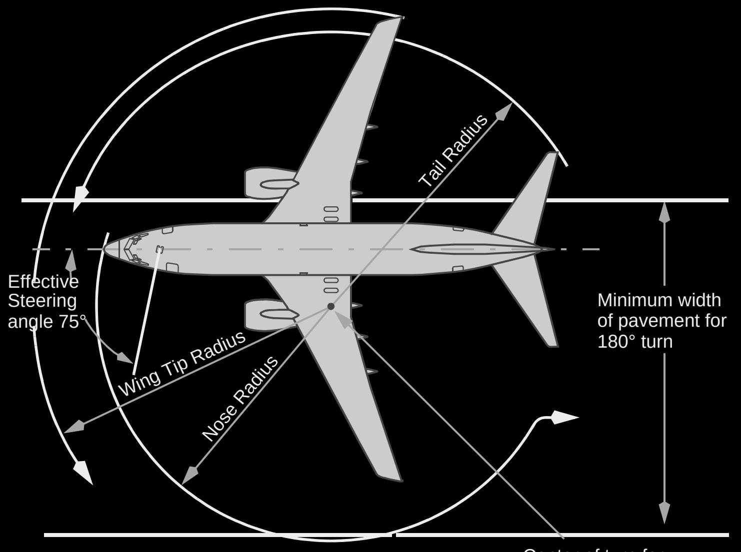
Turning Radius

The wingtip swings the largest arc while turning and determines the minimum obstruction clearance path. All other portions of the airplane structure remain within this arc.

YA701 - YA710

Nose radius
55.9 Feet (17.0 Meters)

Tail radius
65.5 Feet (20.0 Meters)



Center of turn for minimum turning radius. (Slow continuous turning with minimum thrust on all engines. No differential braking.)

Wing tip radius
69.6 Feet (21.2 Meters)

Note: Minimum width of pavement for 180° turn:
66.9 Feet (20.4 Meters)

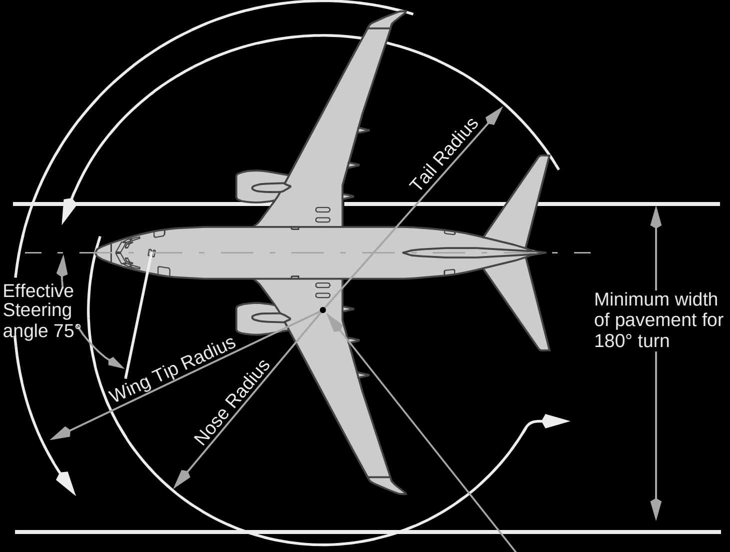
CAUTION: Do not attempt to make a turn away from an obstacle within (17.2 feet/5.2m) of the wing tip or within (29.0feet/8.8m)of the nose.

737-700

YM482 - YN534

Nose radius
55.9 Feet (17.0 Meters)

Tail radius
65.5 Feet (20.0 Meters)



Wing tip radius
72.8 Feet (22.2 Meters)

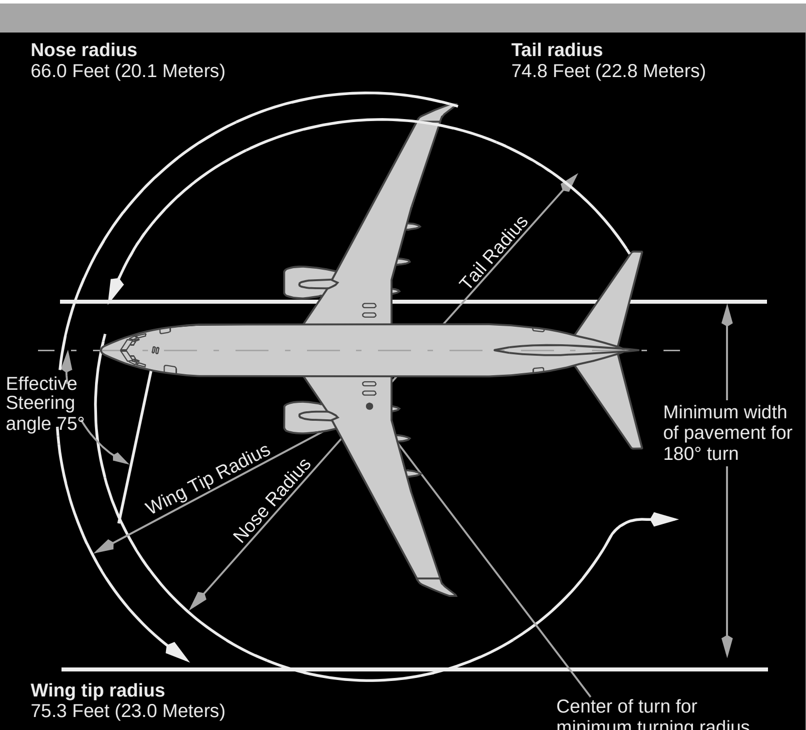
Center of turn for minimum turning radius. (Slow continuous turning with minimum thrust on all engines. No differential braking.)

Note: Minimum width of pavement for 180° turn:
66.9 Feet (20.4 Meters)

CAUTION: Do not attempt to make a turn away from an obstacle within (17.8 feet/5.4m) of the wing tip or within (32.0feet/9.8m)of the nose.

737-700 With Winglets

YF048 - YL551, YS151 - YV754



Note: Minimum width of pavement for 180° turn: 79.7 Feet (24.3 Meters)

CAUTION: Do not attempt to make a turn away from an obstacle within (17.8 feet/5.4m) of the wing tip or within (24.3feet/7.4m)of the nose.

737-800 With Winglets

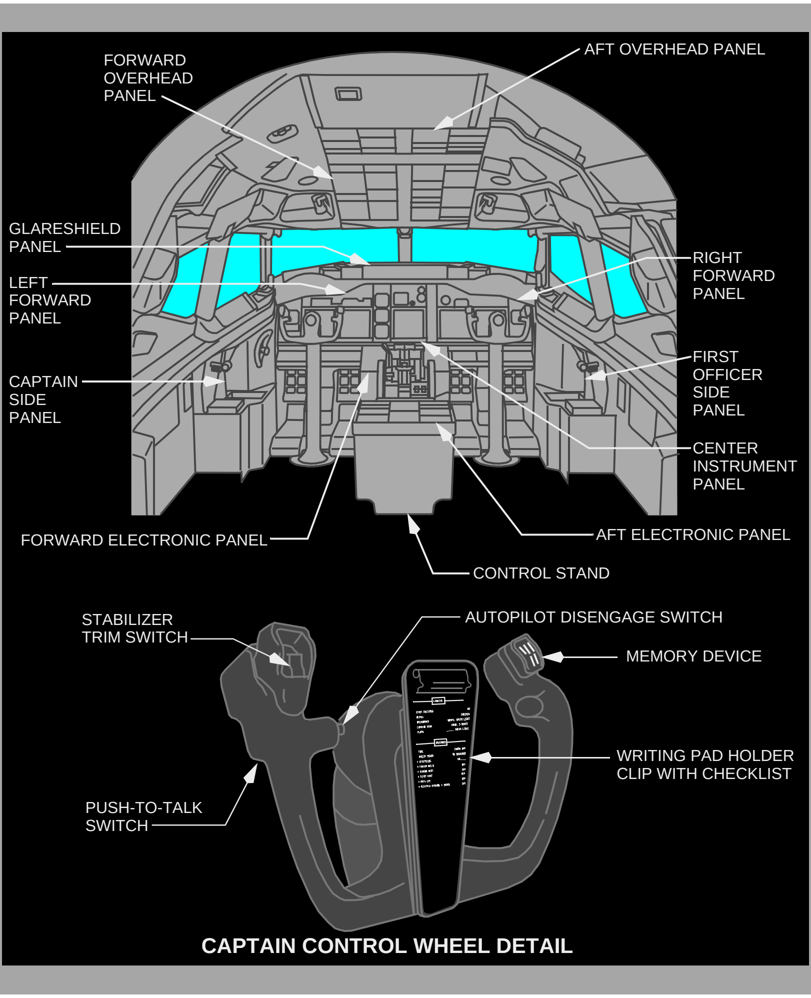
Airplane General, Emergency Equipment, Doors, Windows

Chapter 1

Instrument Panels

Section 20

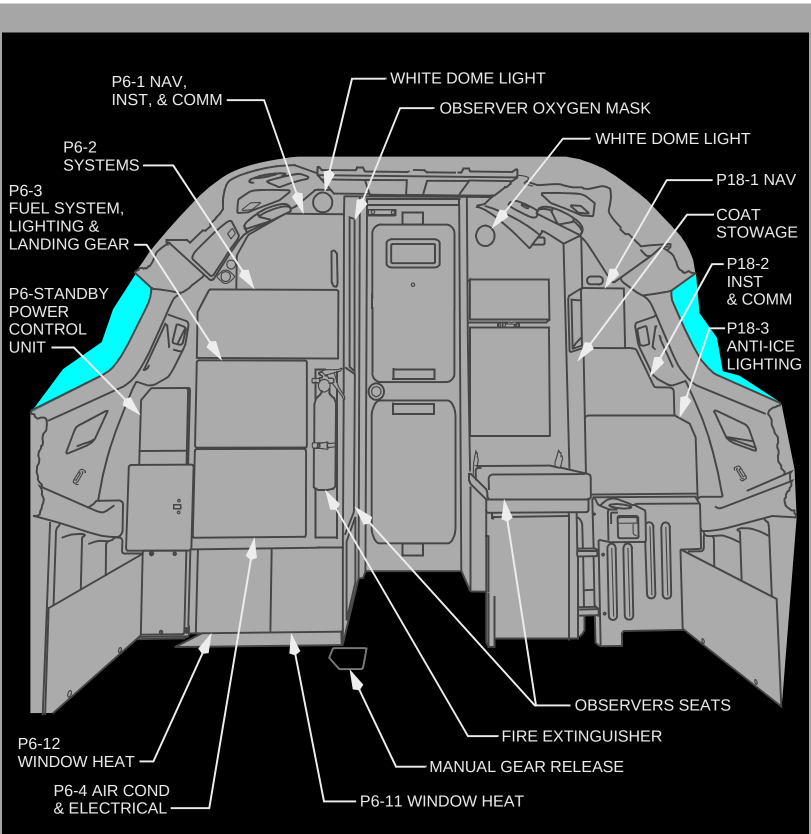
Panel Arrangement



On the following pages, circled numbers refer to chapters where information on the item may be found.

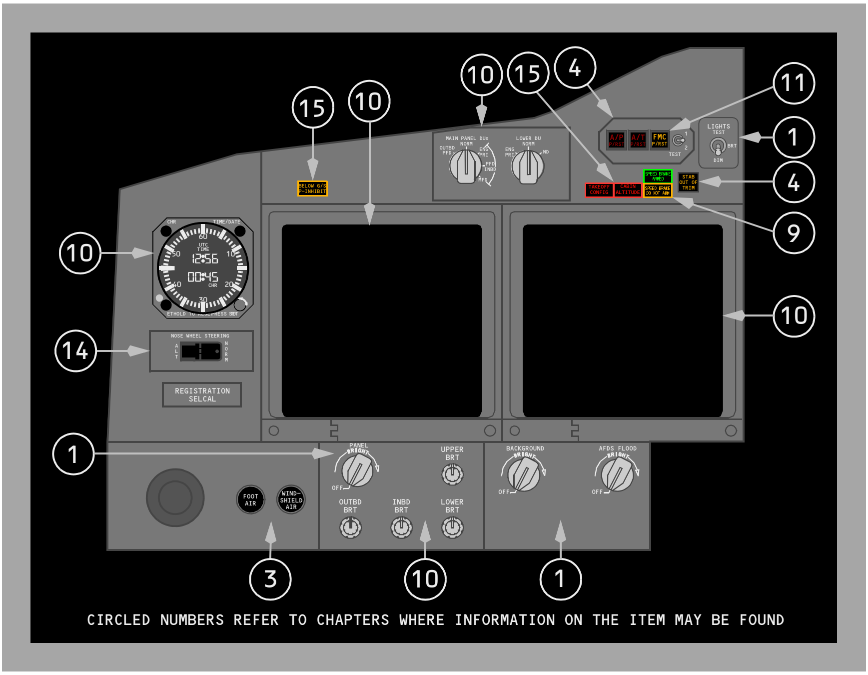
The panels, controls, and indicators shown in this chapter are representative of installed units and may not exactly match the latest configuration. Refer to the appropriate chapter system descriptions for current information.

Aft Flight Deck Overview



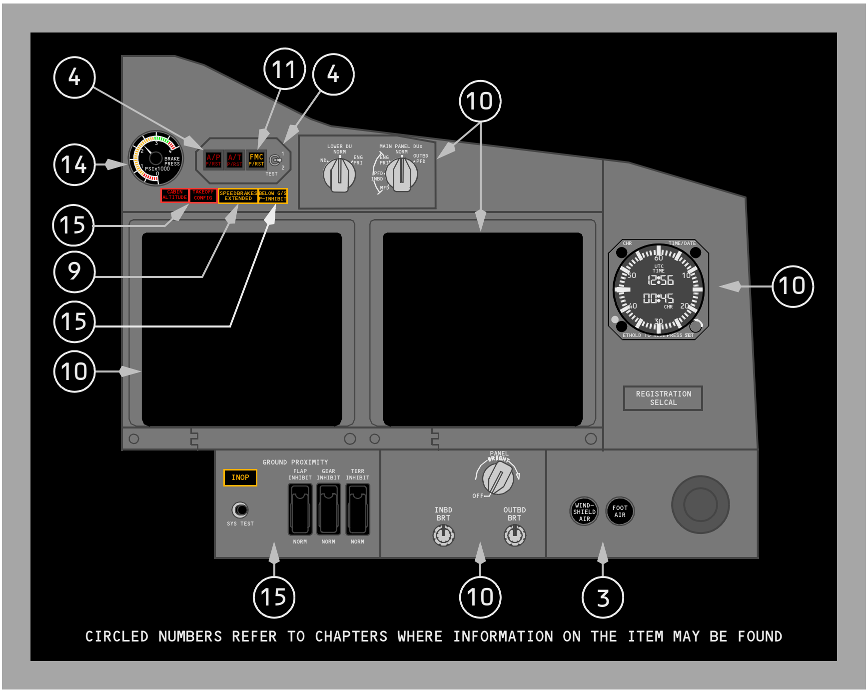
AFT FLIGHT DECK OVERVIEW

Left Forward Panel

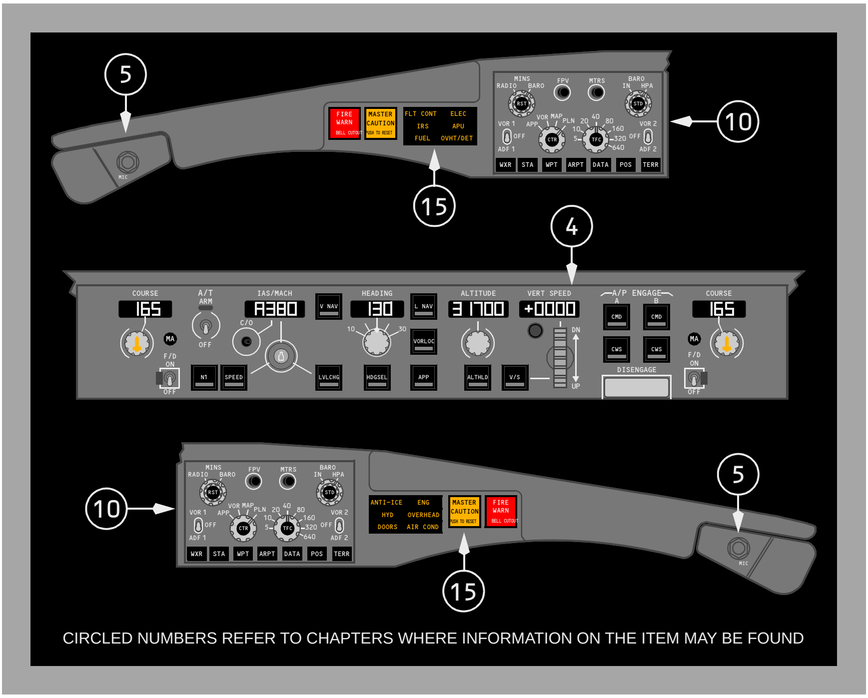


CIRCLED NUMBERS REFER TO CHAPTERS WHERE INFORMATION ON THE ITEM MAY BE FOUND

Right Forward Panel

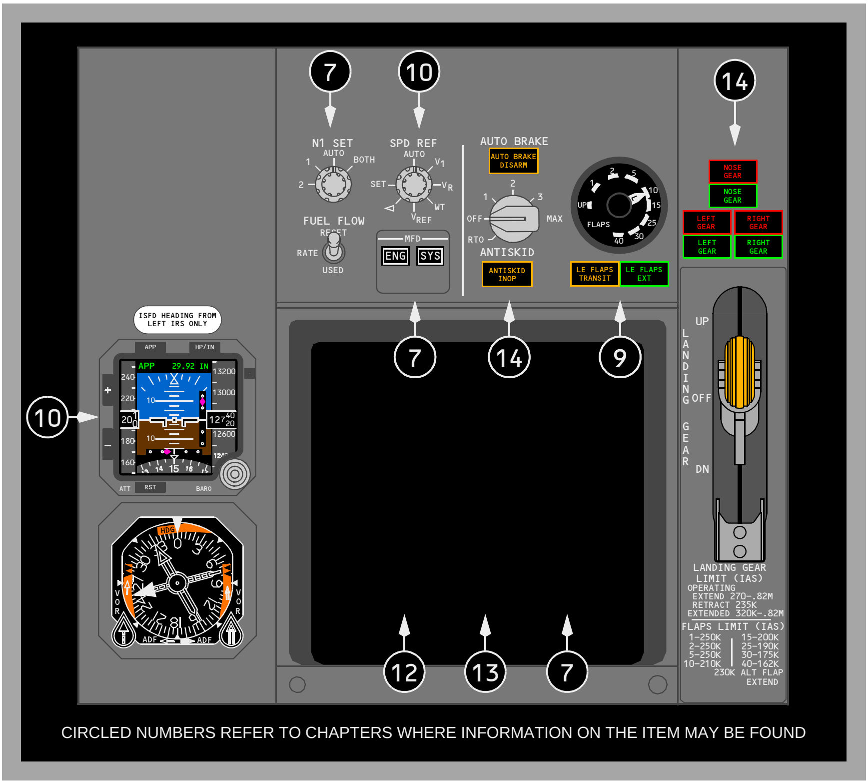


Glareshield Panel



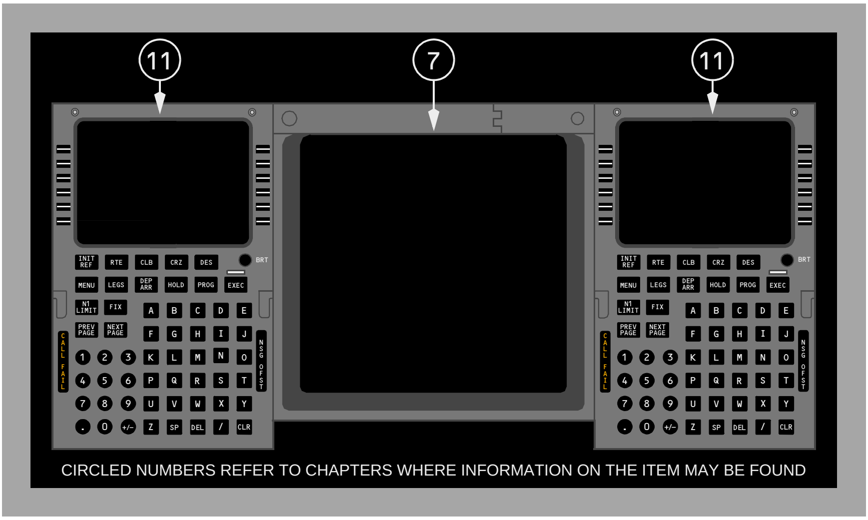
CIRCLED NUMBERS REFER TO CHAPTERS WHERE INFORMATION ON THE ITEM MAY BE FOUND

Center Forward Panel



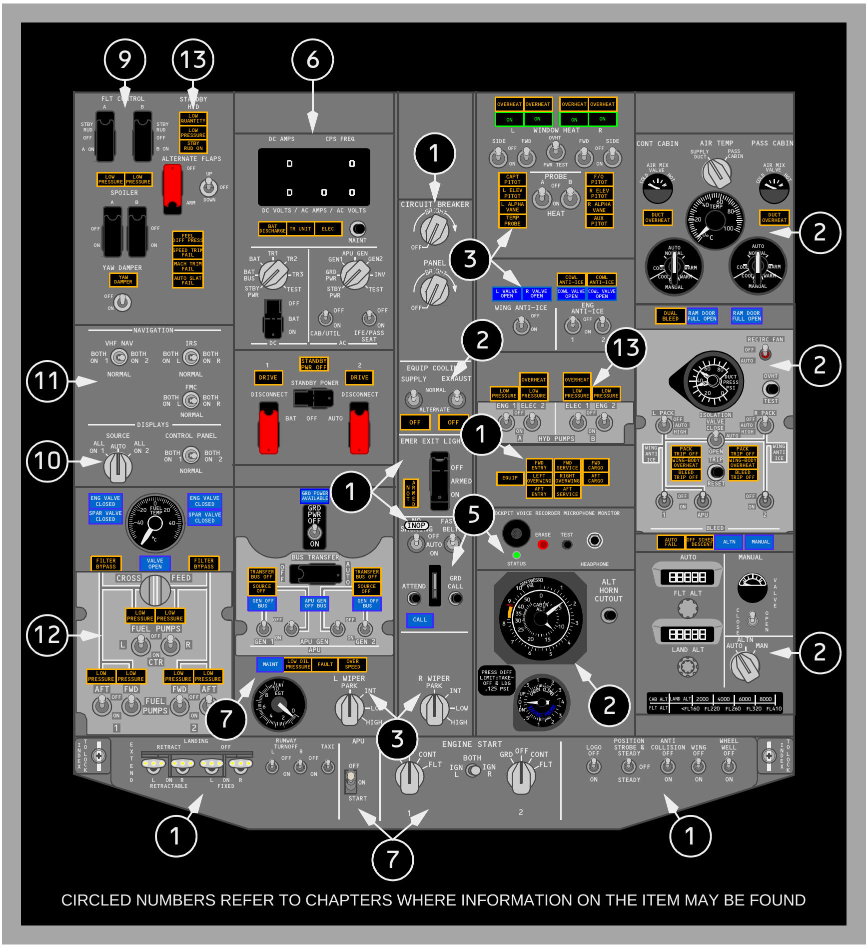
CIRCLED NUMBERS REFER TO CHAPTERS WHERE INFORMATION ON THE ITEM MAY BE FOUND

Forward Aisle Stand



Intentionally
Blank

Forward Overhead Panel



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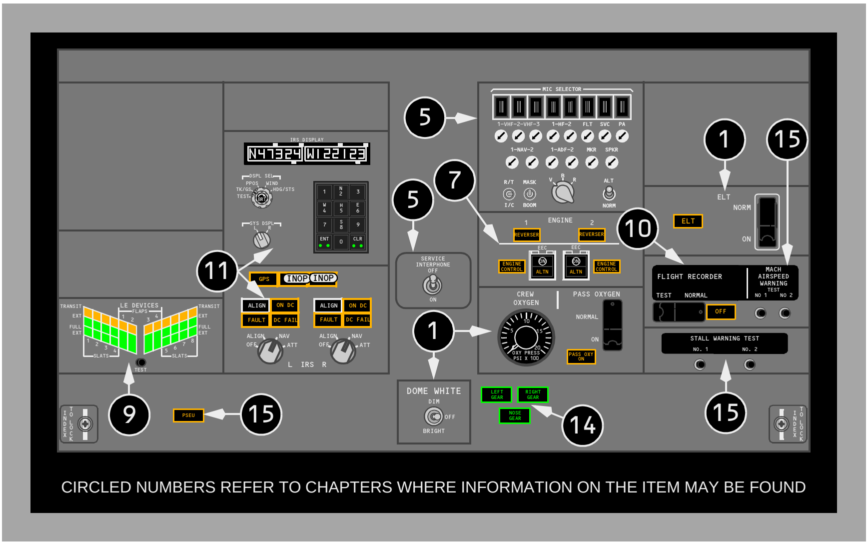
Aft Overhead Panel



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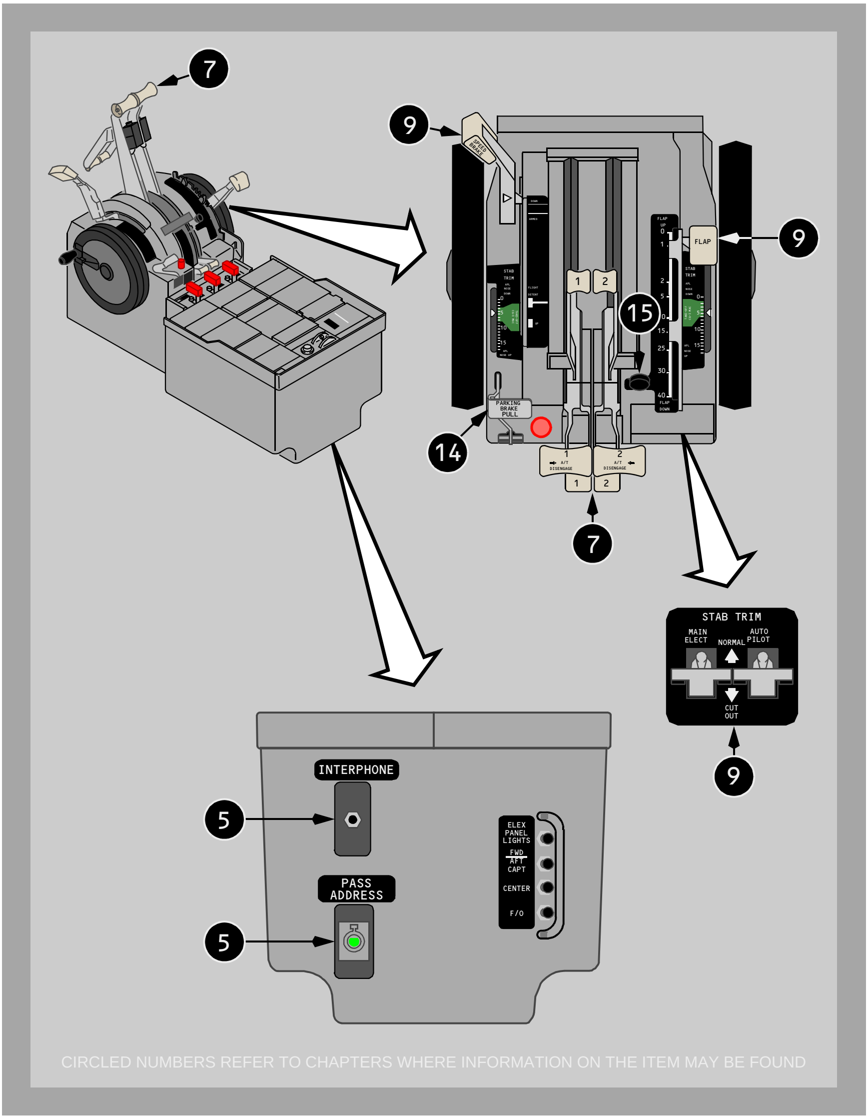
Control Stand

YA701 - YT511



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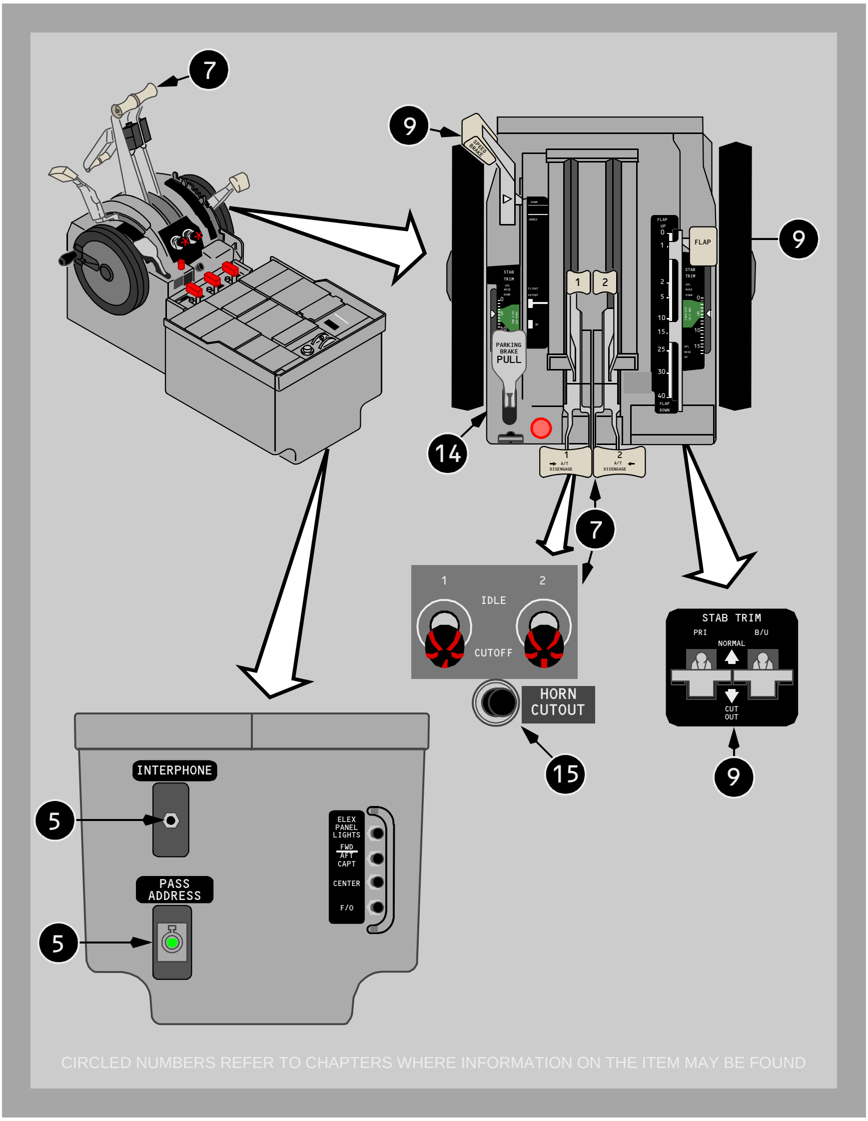
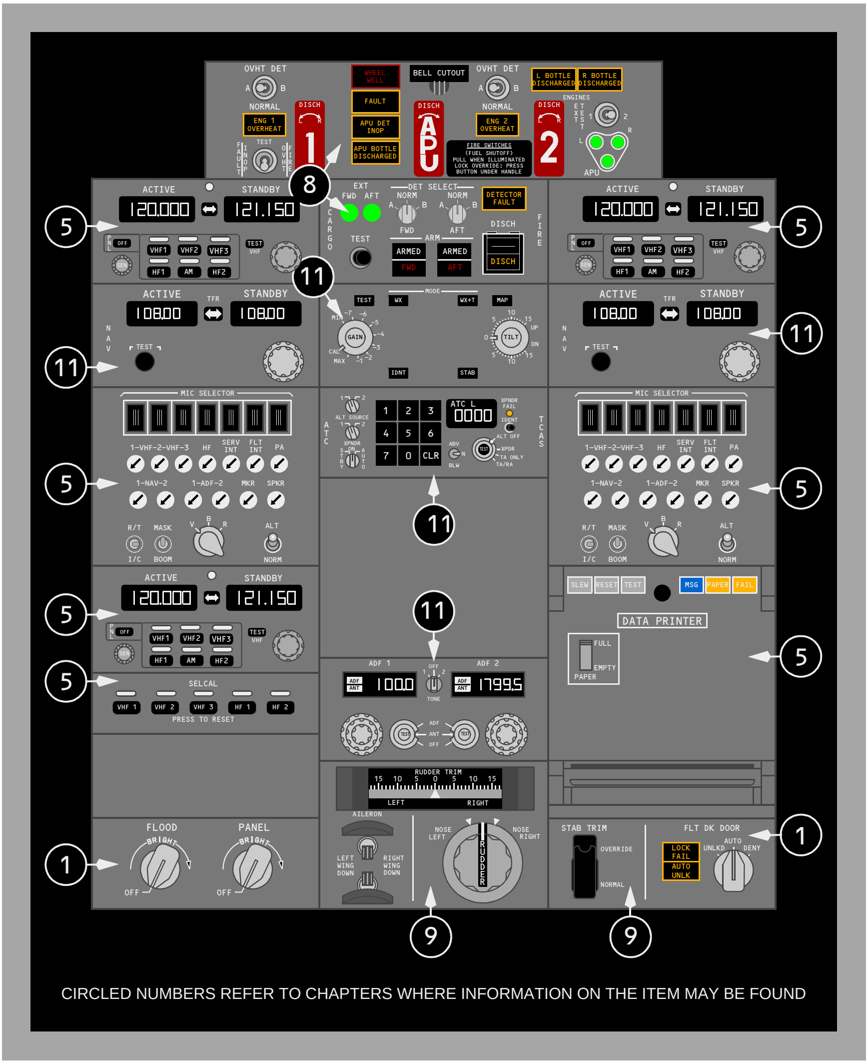
YT512 - YV754



CIRCLED NUMBERS REFER TO CHAPTERS WHERE INFORMATION ON THE ITEM MAY BE FOUND

Aft Electronic Panel



CIRCLED NUMBERS REFER TO CHAPTERS WHERE INFORMATION ON THE ITEM MAY BE FOUND

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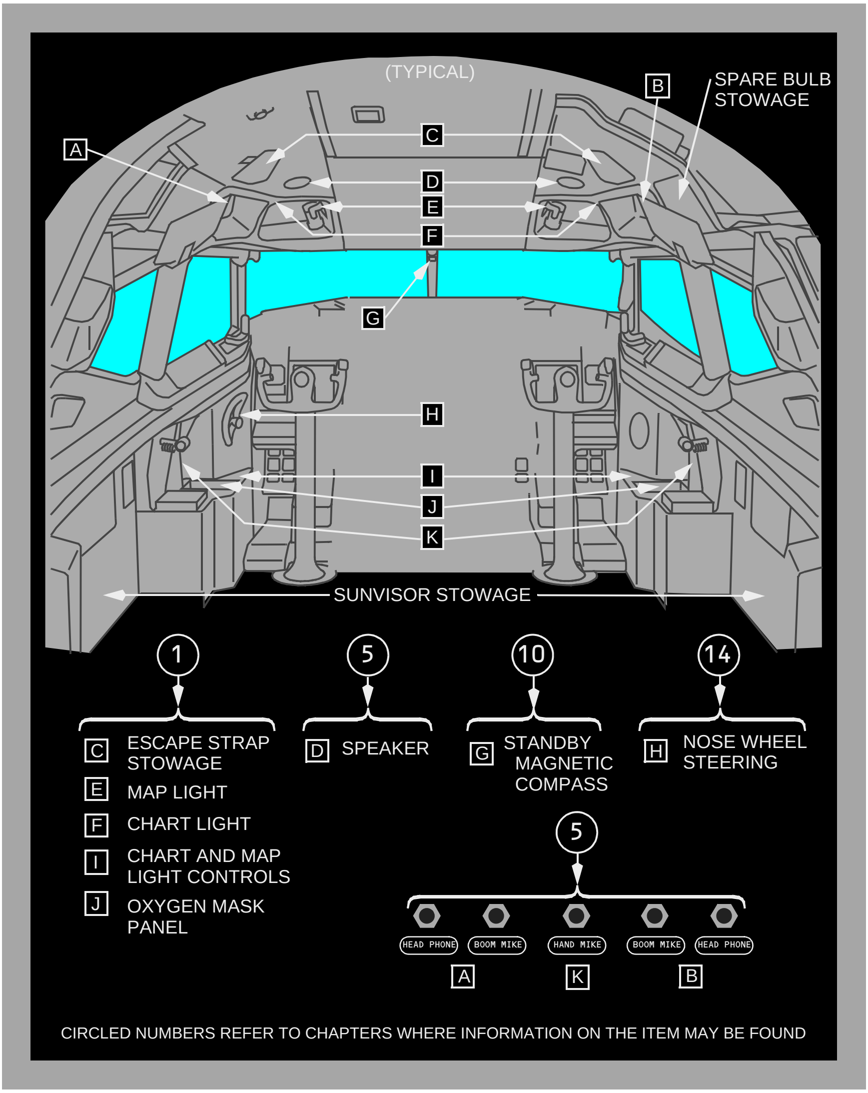
Auxiliary Panels

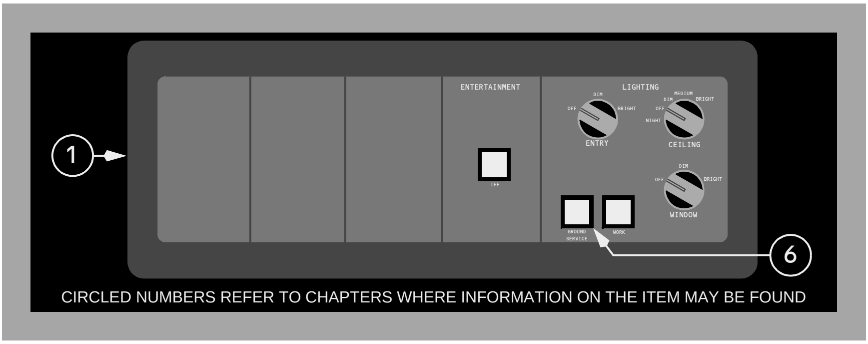


CIRCLED NUMBERS REFER TO CHAPTERS WHERE INFORMATION ON THE ITEM MAY BE FOUND

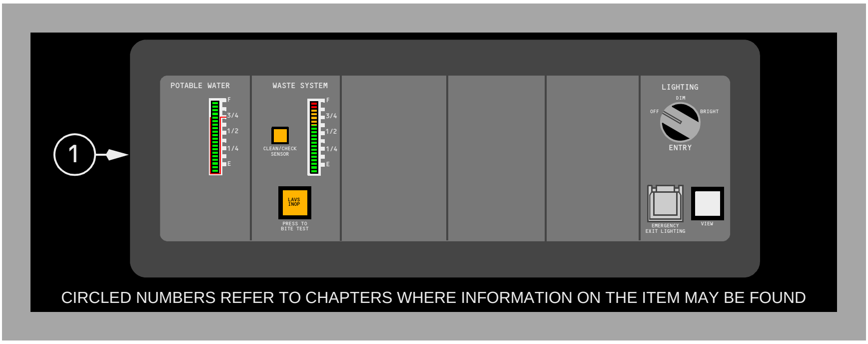
Attendant Panels

YA701 - YM484

Forward Attendant Panel



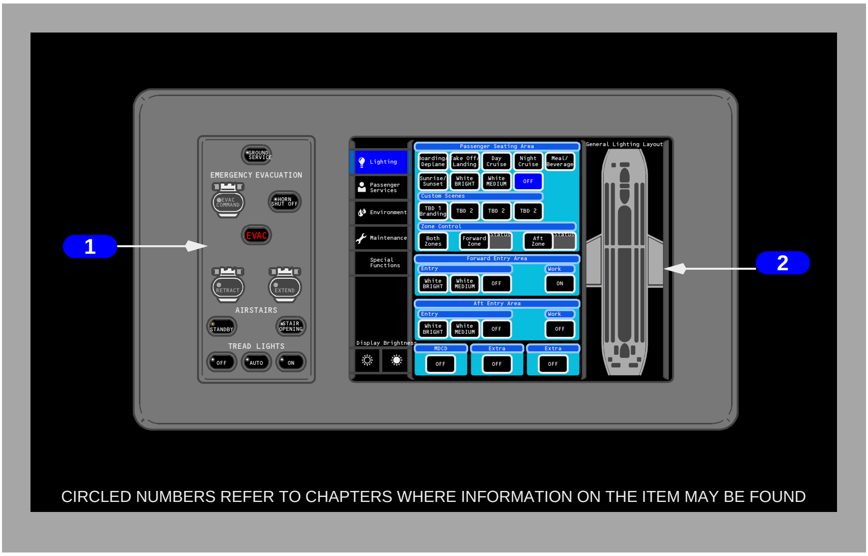
Aft Attendant Panel



Attendant Control Panels

YN531 - YV754

Forward Attendant Control Panel



CIRCLED NUMBERS REFER TO CHAPTERS WHERE INFORMATION ON THE ITEM MAY BE FOUND

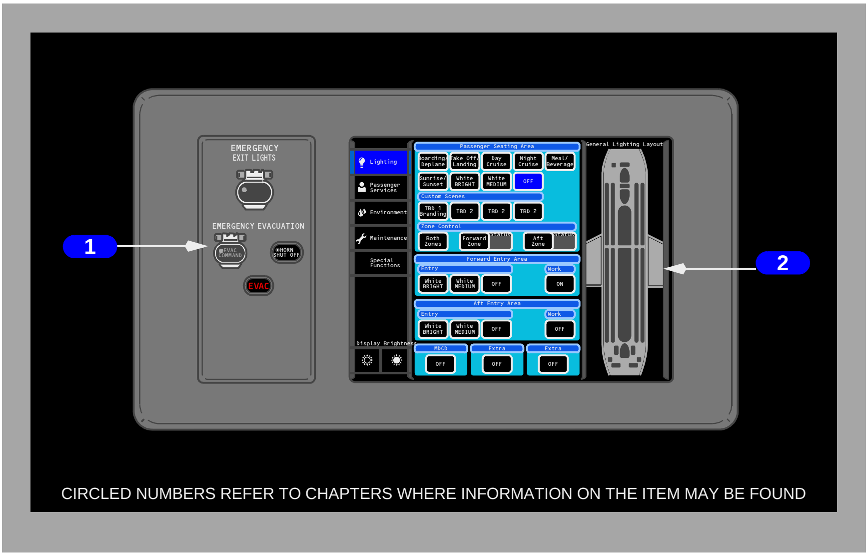
① Pushbutton Panel Controls

This is a typical grouping of pushbutton cabin controls.

② Touch Screen

Touch screen controls various functions such as Lighting, Passenger Services, Environment, Maintenance and Special Functions. A typical Lighting menu is depicted.

Aft Attendant Control Panel



CIRCLED NUMBERS REFER TO CHAPTERS WHERE INFORMATION ON THE ITEM MAY BE FOUND

1 Pushbutton Panel Controls

This is a typical grouping of pushbutton cabin controls.

2 Touch Screen

Touch screen controls various functions such as Lighting, Passenger Services, Environment, Maintenance and Special Functions. A typical Lighting menu is depicted.

Attendant Handset

CIRCLED NUMBERS REFER TO CHAPTERS WHERE INFORMATION ON THE ITEM MAY BE FOUND

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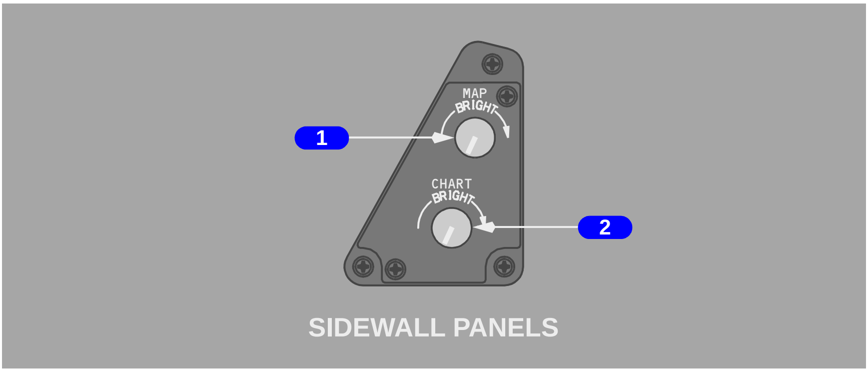
Flight Deck Lighting

Map and Chart Light Controls



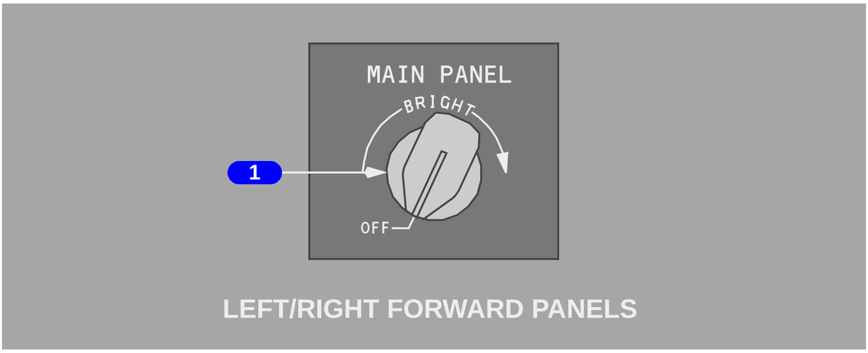
1 MAP Light Control

Rotate – adjusts brightness of Captain/First Officer map lights

2 CHART Light Control

Rotate – adjusts brightness of Captain/First Officer chart lights

Main Panel Lighting

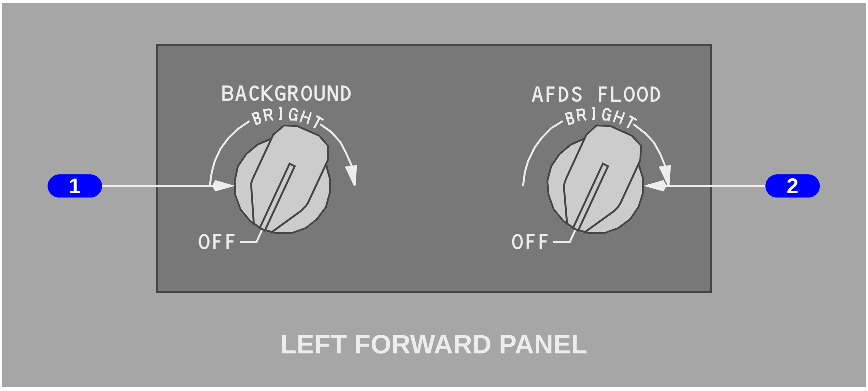


1 MAIN PANEL Light Control

Rotate –

- Captain – controls brightness of Captain’s panel and instrument lighting, center instrument panel, and AFDS panel displays and edge lighting
- First Officer – controls brightness of First Officer’s panel and instrument lighting.

Background and AFDS Flood Light Control



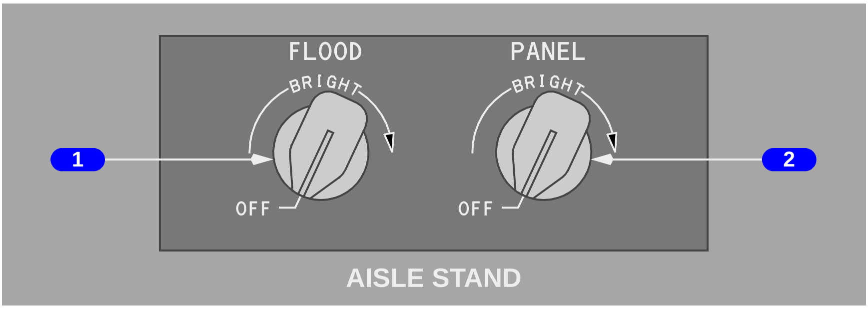
1 BACKGROUND Light Control

Rotate – controls incandescent lighting brightness for Captain’s panel, First Officer’s panel, and center panel.

2 AFDS FLOOD Light Control

Rotate – controls brightness of lighting directed at AFDS panel.

Flood and Aft Electronics Lights Controls



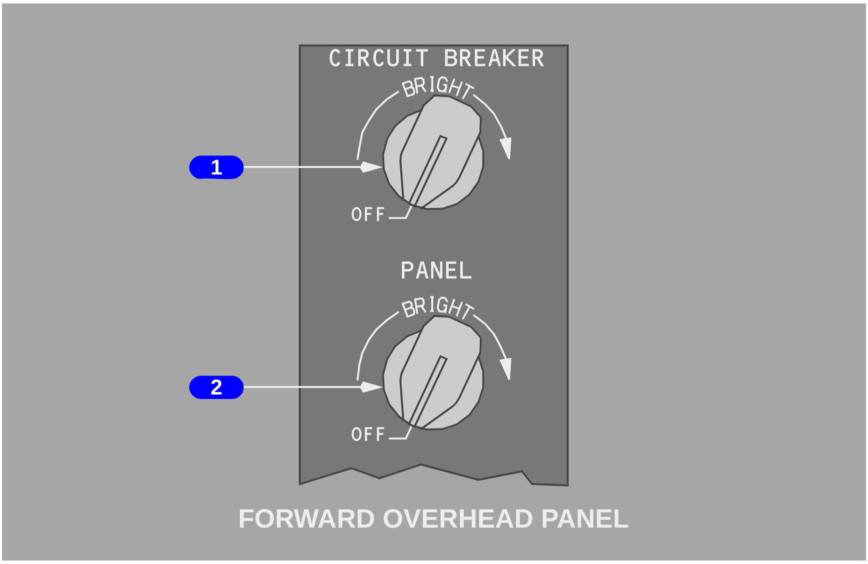
1 **FLOOD Light Control**

Rotate – controls overhead spotlight brightness directed at thrust lever quadrant.

2 **PANEL Light Control**

Rotate – controls forward and aft electronic control panel lights brightness.

Overhead/Circuit Breaker Panel Light Controls



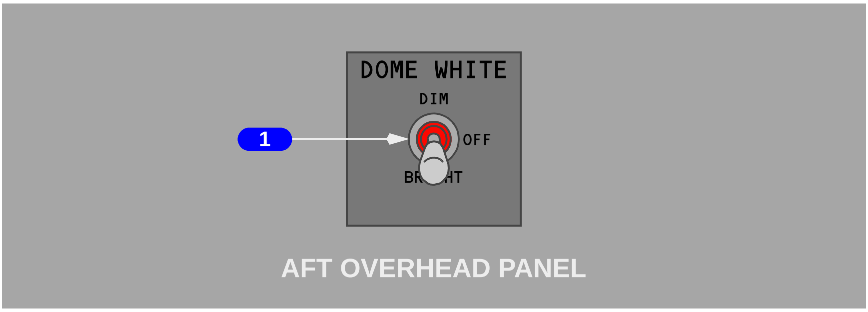
1 **CIRCUIT BREAKER Light Control**

Rotate – controls P–6 and P–18 circuit breaker panels light brightness.

2 **PANEL Light Control**

Rotate – controls forward and aft overhead panel lights brightness.

Dome Light Control



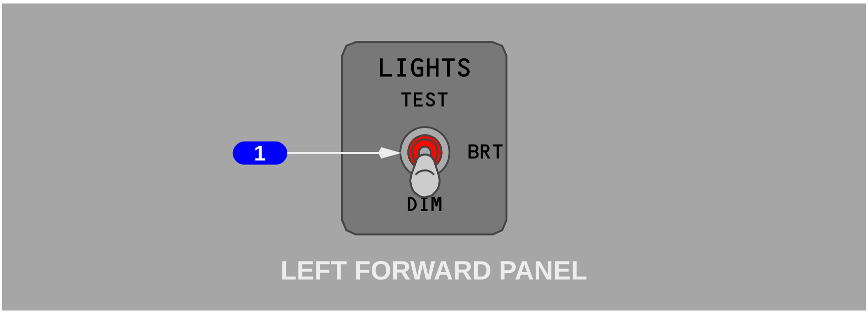
1 **DOME Light Control**

DIM – sets overhead dome lights to low brightness.

OFF – overhead dome lights are extinguished.

BRIGHT – sets overhead dome lights to full brightness.

Master Lights Test and Dim Switch



1 **Master LIGHTS TEST and DIM SWITCH**

TEST – illuminates all system lights on forward and aft overhead panels, and some lights on Captain and First Officer instrument panels to full brightness.

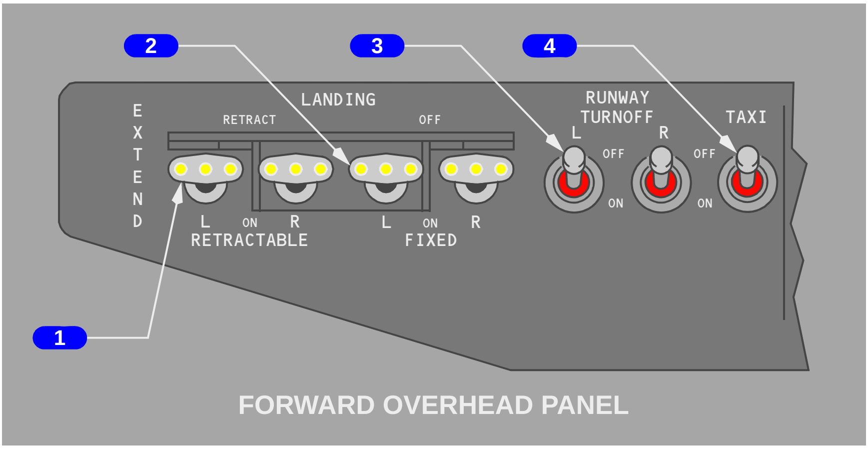
BRT (bright) – sets all system lights on forward and aft overhead panels, and some lights on Captain and First Officer panels to full brightness.

DIM – sets all system lights on forward and aft overhead panels, and some lights on Captain and First Officer panels to low brightness.

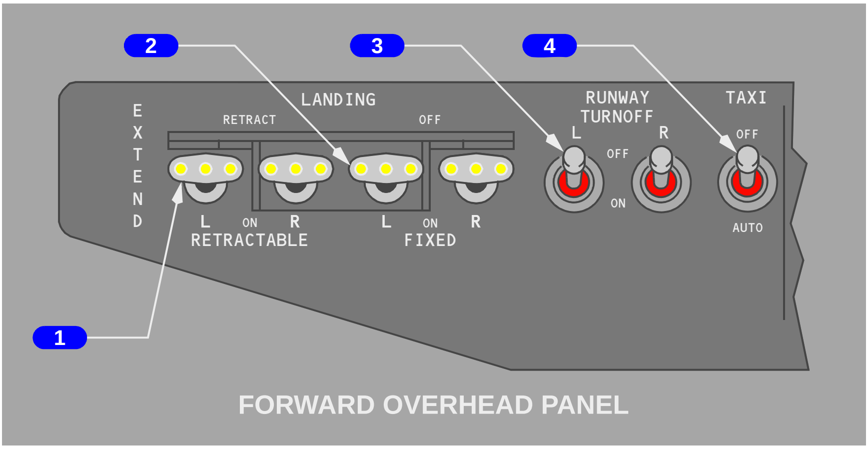
Note: Placing the Master Lights Test and Dim Switch in the TEST position will result in a master caution recall and any stored fault will cause the associated light to remain illuminated when the switch is released.

Exterior Lighting
Landing, Runway Turnoff and Taxi Lights

YA701 - YF049



YF921 - YT508



YA701 - YT508

1 RETRACTABLE LANDING Light Switch

RETRACT – retractable landing lights are retracted and extinguished

EXTEND – retractable landing lights are extended and extinguished

ON – retractable landing lights are extended and illuminated.

YA701 - YT508

2 FIXED LANDING Light Switch

OFF – fixed landing lights are extinguished.

ON – fixed landing lights are illuminated.

YA701 - YT508

3 RUNWAY TURNOFF Light Switch

OFF – runway turnoff lights located in leading edge of wing root are extinguished.

ON – runway turnoff lights are illuminated.

YA701 - YF049

4 TAXI Light Switch

OFF – nose wheel well taxi light extinguished.

ON – nose wheel well taxi light illuminated.

YF921 - YT508

4 TAXI Light Switch

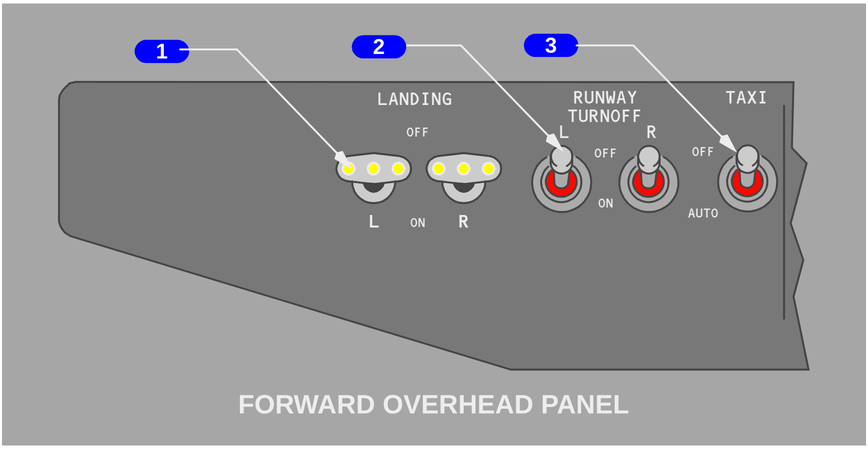
OFF – nose wheel well taxi light extinguished.

AUTO – nose landing gear taxi light automatically extinguishes when the nose landing gear retracts.

LED - Landing, Taxi and Runway Turnoff Lights

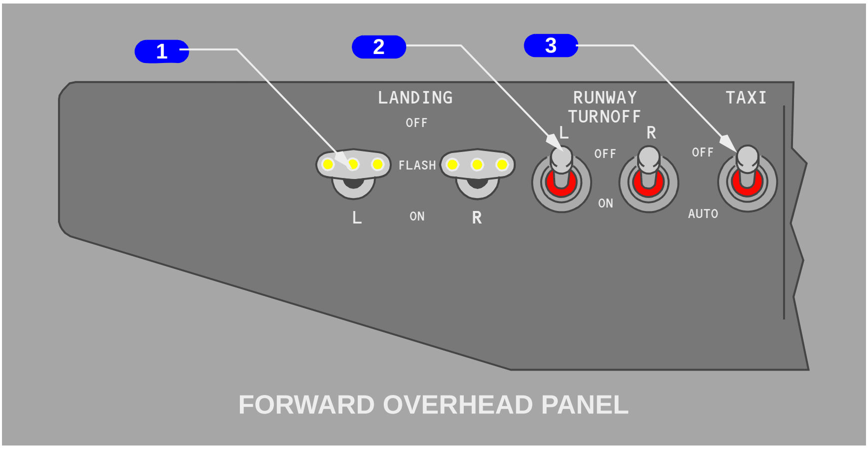
YT509 - YV754

The Landing, Taxi and Runway Turnoff Lights are located in each wing root strakelet and provide the lighting necessary for airplane operation.



FORWARD OVERHEAD PANEL

YV751 - YV754



YT509 - YV750

1 LANDING Light Switch

OFF – fixed landing lights are extinguished.

ON – fixed landing lights are illuminated.

YV751 - YV754

1 LANDING Light Switch

OFF – fixed landing lights are extinguished.

FLASH – fixed landing lights alternately illuminate at 45 (+/-2) flashes per minute.

ON – fixed landing lights are illuminated.

2 RUNWAY TURNOFF Light Switch

OFF – runway turnoff lights are extinguished.

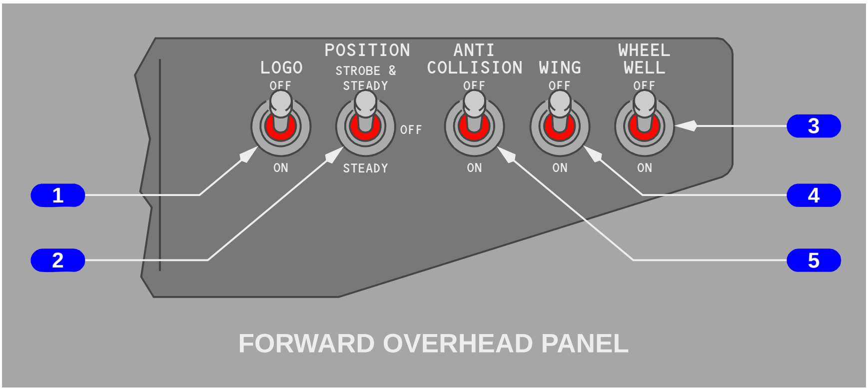
ON – runway turnoff lights are illuminated.

3 TAXI Light Switch

OFF – LED wing strakelet taxi light extinguished.

AUTO – LED wing strakelet taxi lights are illuminated when the nose landing gear is fully extended and are extinguished when the nose landing gear retracts.

Miscellaneous Exterior Lights



1 LOGO Light Switch

OFF – logo lights on each side of vertical fin extinguished.

ON – logo lights illuminated.

2 POSITION Light Switch

STROBE & STEADY – red and green wing–tip position lights, white trailing edge wing–tip lights and wing–tip and tail strobe lights illuminated.

OFF – red and green wing–tip position lights, white trailing edge wing–tip lights and wing–tip and tail strobe lights extinguished.

STEADY – red and green wing–tip position lights and white trailing edge wing–tip lights illuminated.

3 WHEEL WELL Light Switch

OFF – three wheel well lights extinguished.

ON – wheel well lights illuminated.

4 WING Illumination Switch

OFF – wing leading edge lights on fuselage forward of wing extinguished.

ON – wing leading edge lights illuminated.

5 ANTI–COLLISION Light Switch

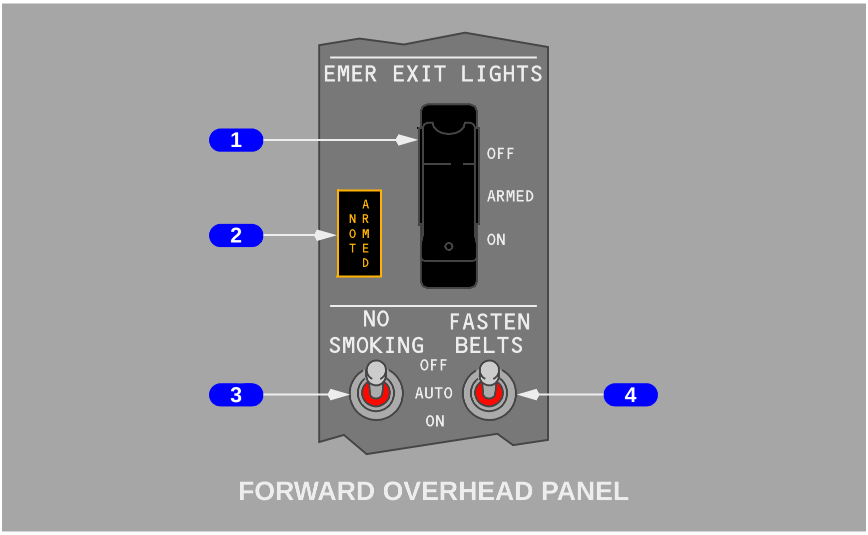
OFF – red strobe/rotating beacon lights on upper and lower fuselage extinguished.

ON – red strobe/rotating beacon lights illuminated.

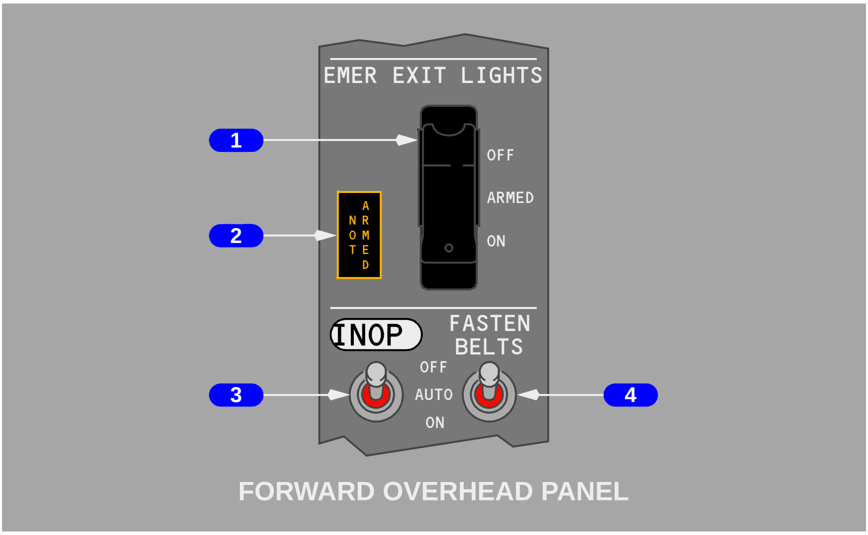
Emergency Lighting and Passenger Signs

Flight Deck

YA701 - YA704



YA705 - YV754



1 Emergency (EMER) EXIT LIGHTS Switch

OFF – prevents emergency lights system operation if airplane electrical power fails or is turned off.

ARMED – (guarded position) all emergency lights illuminate automatically if airplane electrical power to DC bus No. 1 fails or AC power is turned off.

ON – all emergency lights illuminate.

2 Emergency (EMER) EXIT LIGHTS NOT ARMED Light

Illuminated (amber) – EMER EXIT LIGHTS switch not in ARMED position.

YA701 - YA704

3 NO SMOKING Switch

OFF – the NO SMOKING signs are not illuminated.

AUTO – the NO SMOKING signs are illuminated or extinguished automatically with reference to airplane configuration (refer to the Lighting System Description section).

ON – the NO SMOKING signs are illuminated.

YA705 - YF049, YK622 - YK971, YL541, YM482 - YM484

3 NO SMOKING Switch

The No Smoking signs are permanently illuminated. The No Smoking switch is placarded INOP.

YF921 - YF928, YK973 - YL077, YL542 - YL551, YN531 - YV754

3 NO SMOKING Switch

The No Smoking signs are deactivated and placarded INOP.

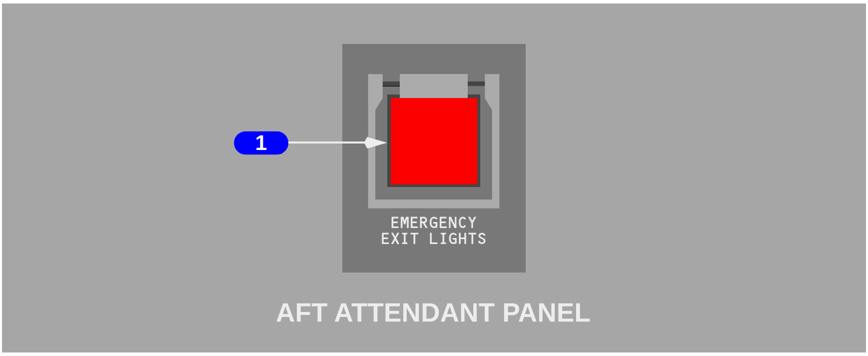
4 FASTEN BELTS Switch

OFF – the FASTEN SEAT BELTS and RETURN TO SEAT signs are not illuminated.

AUTO – the FASTEN SEAT BELTS and RETURN TO SEAT signs are illuminated or extinguished automatically with reference to airplane configuration (refer to the Lighting System Description section).

ON – the FASTEN SEAT BELTS and RETURN TO SEAT signs are illuminated.

Passenger Cabin



1 Passenger Cabin Emergency Lights Switch (guarded)

On – illuminates all emergency lights and bypasses flight deck control.

Emergency Locator Transmitter

1 Emergency Locator Transmitter Light

Illuminated (amber) – ELT has been activated and is simultaneously transmitting on 121.5, 243.0 and 406.0 MHz.

2 Emergency Locator Transmitter Switch

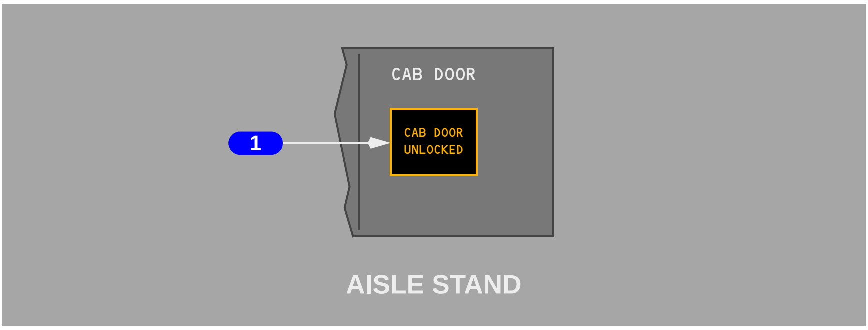
ARM – (guarded position) ELT transmits automatically when it reaches its preset G–Load limit.

ON – manually activates the ELT.

Doors

Cabin Door

YA701 - YA706

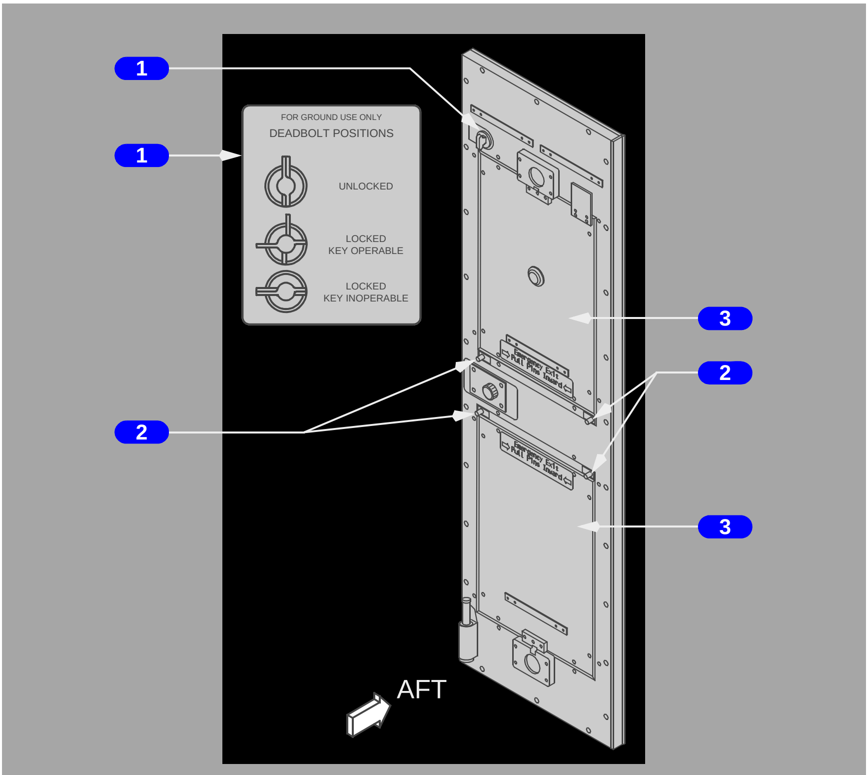


1 Cabin Door (CAB DOOR) Lock Switch

Illuminated (amber) – cabin door is unlocked.

Push – with DC power available, locks cabin door

Flight Deck Door
YA707 - YV754



FLIGHT DECK DOOR

1 Deadbolt and Deadbolt Placard

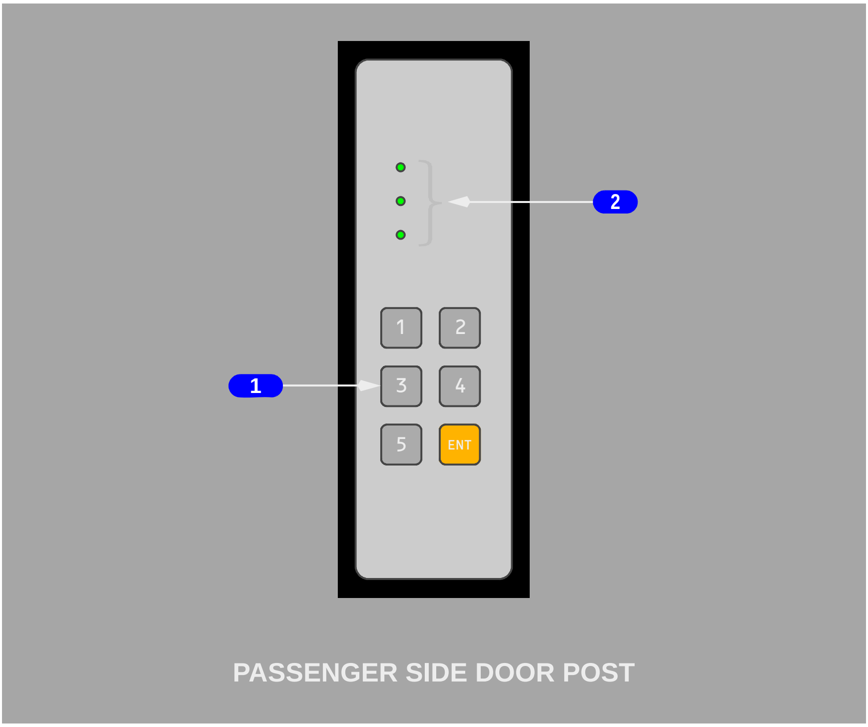
2 Release Pins

Pull pins inward - manually separates decompression panel from a jammed door to allow panel opening and egress.

3 Decompression Panel

Provides emergency egress path and automatically opens during airplane decompression.

Flight Deck Emergency Access Panel



1 Keypad

Push - enters 3 to 8 digit emergency access code by pressing numeric then "ENT" keys. Entry of correct emergency access code sounds flight deck chime.

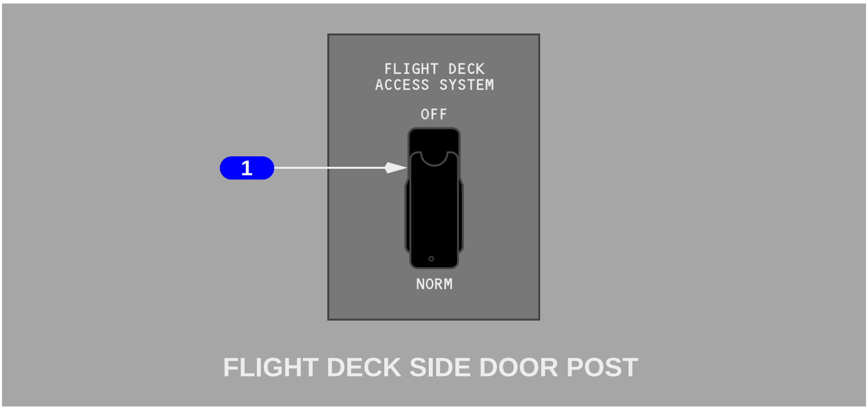
2 Access Lights

Illuminated (red) - door locked or Flight Deck Access System switch OFF.

Illuminated (amber) - correct emergency access code entered.

Illuminated (green) - door unlocked.

Flight Deck Access System Switch

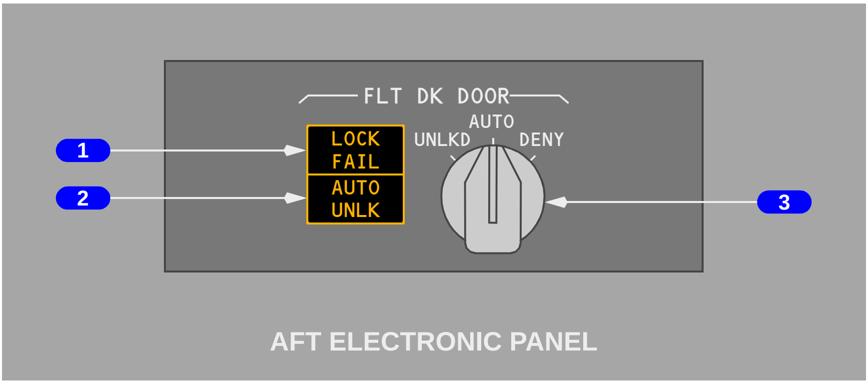


1 Flight Deck Access System Switch

OFF - removes electrical power from door lock.

NORM (Normal) - flight deck access system configured for flight.

Flight Deck Door Lock Panel



1 LOCK FAIL Light

Illuminated (amber) - Flight Deck Door Lock selector in AUTO and door lock has failed or Flight Deck Access System switch is OFF.

2 AUTO Unlock (UNLK) Light

Illuminated (amber) - correct emergency access code entered in keypad. AUTO UNLK light flashes and continuous chime sounds before timer expires and door unlocks.

3 Flight Deck (FLT DK) Door Lock Selector

Spring loaded to AUTO. Selector must be pushed in to rotate from AUTO to UNLKD. Selector must not be pushed in to rotate from AUTO to DENY.

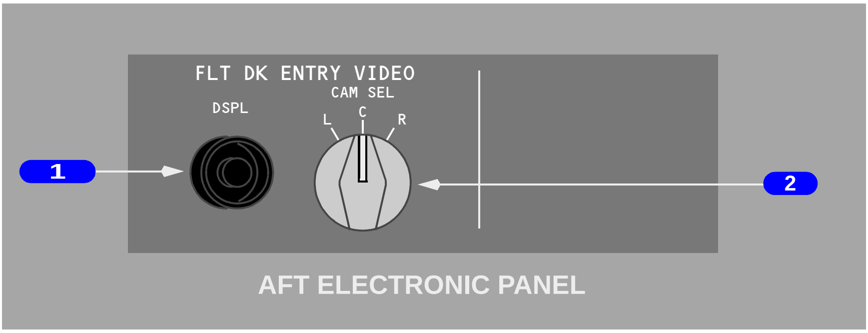
UNLKD - door unlocked while selector in UNLKD.

AUTO - door locked. Allows door to unlock after entry of emergency access code and expiration of timer, unless crew takes action.

DENY - rejects keypad entry request and prevents further emergency access code entry for a time period.

Flight Deck Entry Video Panel

YF048 - YF928, YK626 - YK630, YK973 - YK980, YL541 - YL551, YN531 - YV754



1 Display Switch (DSPL)

Push - displays surveillance in MFD.

Second Push - cancels display of video on MFD.

Note: The IFE/PASS switch must be in the ON position for the flight deck entry camera to be displayed on the MFD.

2 Camera Selector (CAM SEL)

Selects video surveillance camera view on MFD

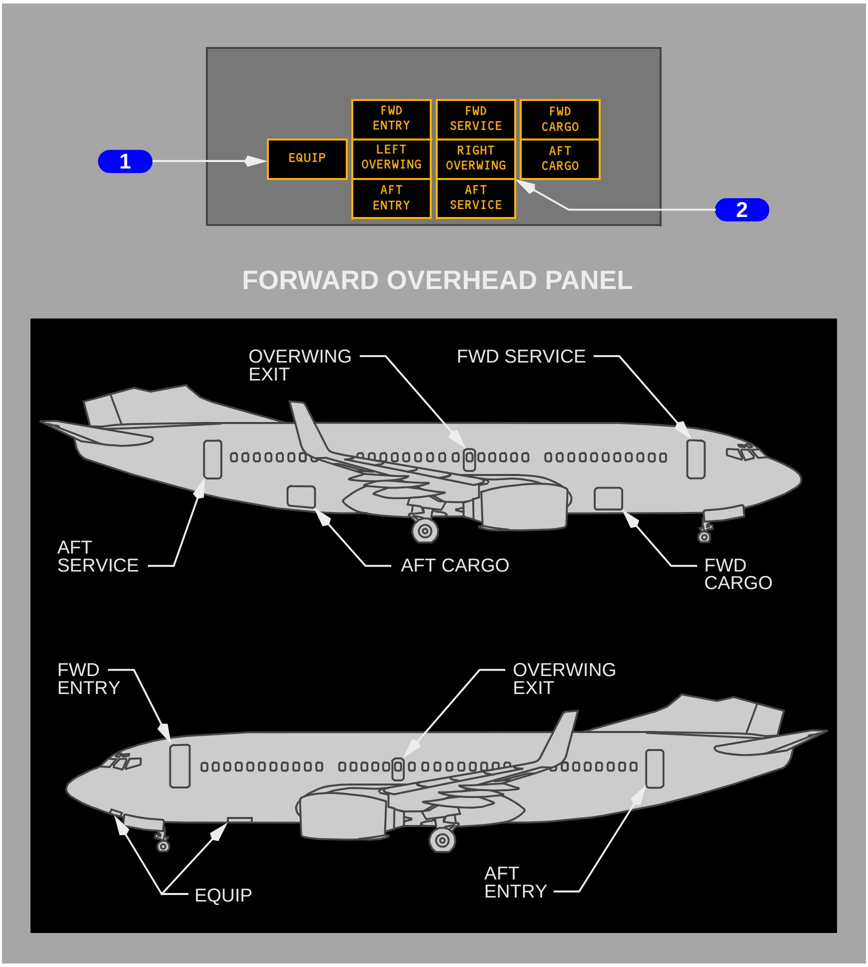
L - provides a view of the flight deck door with a back view of the person requesting entry.

C - provides a frontal view of the person requesting entrance (assuming the person is facing the flight deck door).

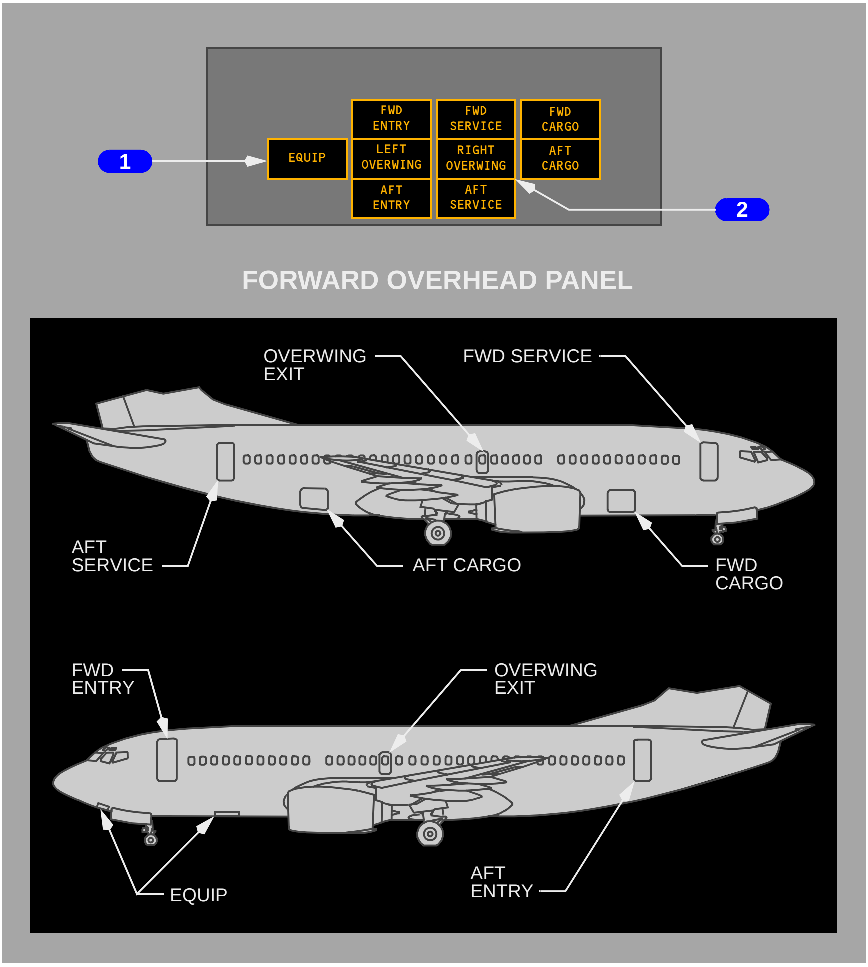
R - provides a general view of the Door 1 Galley area.

Exterior Door Annunciator Lights

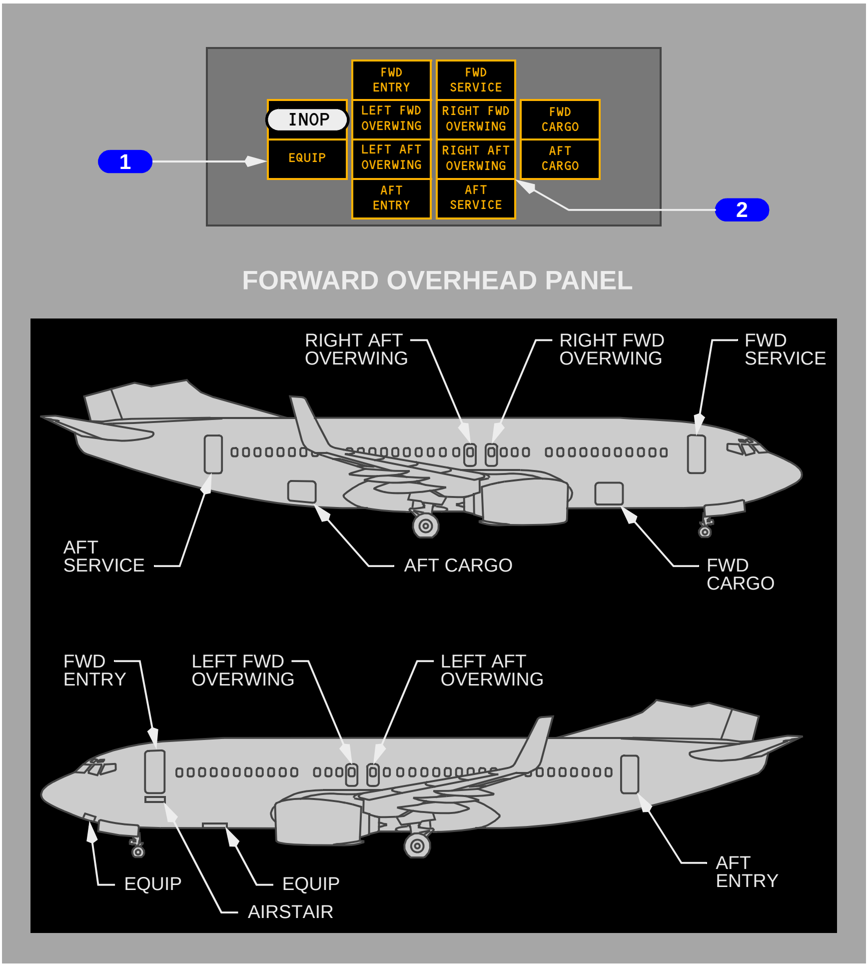
YM482 - YN534



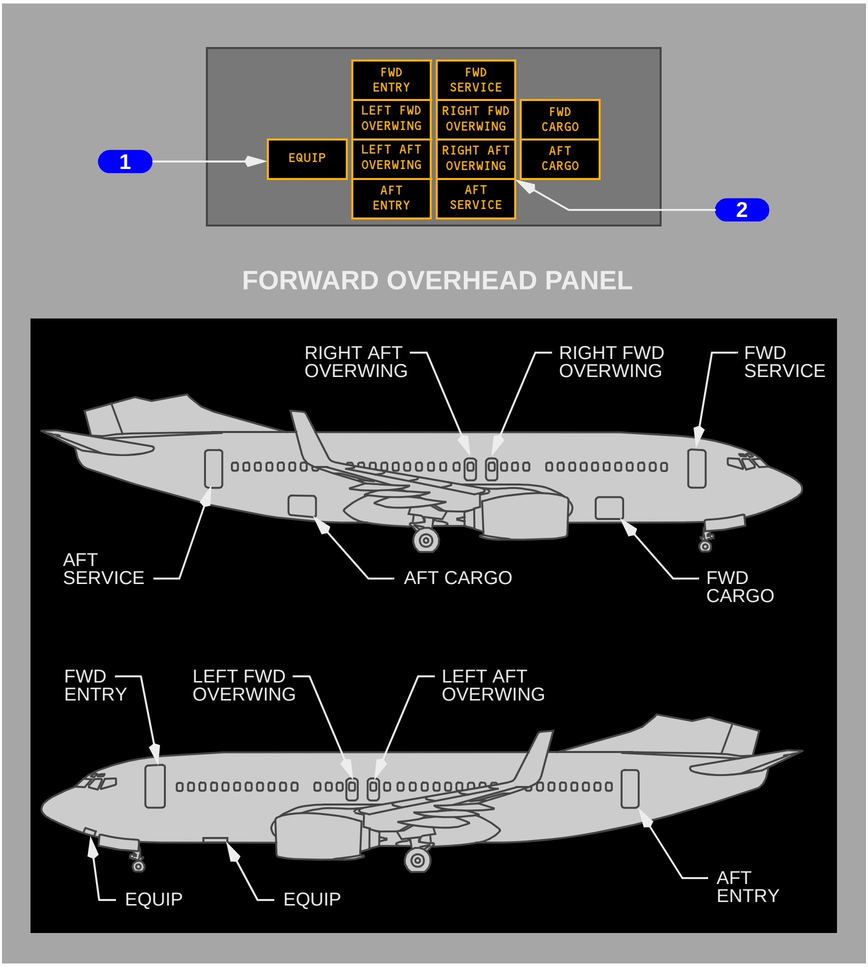
YA701 - YA710


1
EQUIP
FWD ENTRY
LEFT OVERWING
AFT ENTRY
FWD SERVICE
RIGHT OVERWING
AFT SERVICE
FWD CARGO
AFT CARGO
2
FORWARD OVERHEAD PANEL
OVERWING EXIT
FWD SERVICE
AFT SERVICE
AFT CARGO
FWD CARGO
FWD ENTRY
OVERWING EXIT
EQUIP
AFT ENTRY

YK624 - YK630, YL541



YF048 - YK623, YK961 - YL077, YL542 - YL551, YS151 - YV754



1 Exterior Door Annunciations

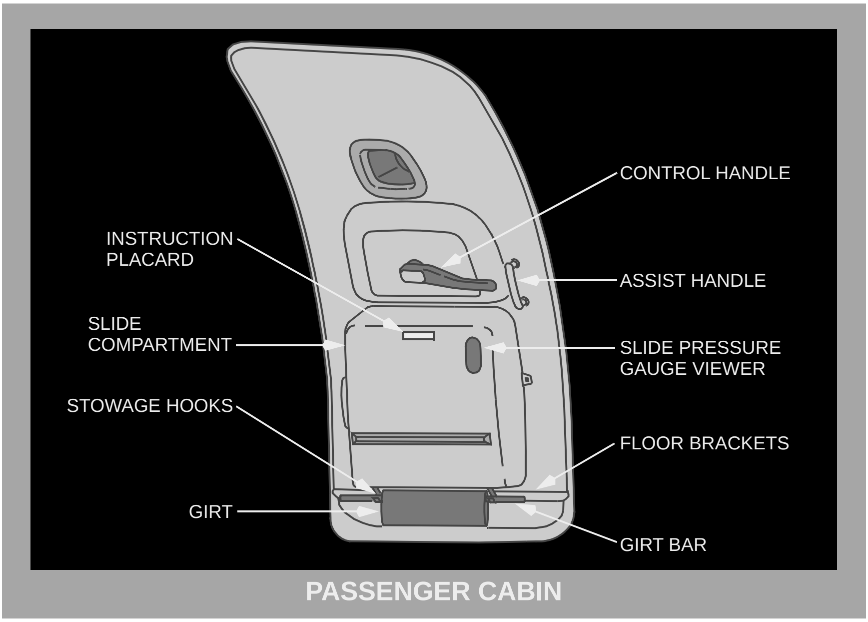
Illuminated (amber) – related door is not closed and locked.

2 Overwing Exit Annunciations

Illuminated (amber) –.

- related overwing exit is not closed and locked
- related flight lock failed to engage when commanded locked.

Passenger Entry/Galley Service Doors



Oxygen

Oxygen Panel

YA701 - YM484, YS151 - YV754

1 Flight CREW OXYGEN Pressure Indicator

Indicates pressure at the crew oxygen cylinder.

2 Passenger Oxygen (PASS OXYGEN) Switch

NORMAL – (guarded position) passenger masks drop and passenger oxygen system activated automatically if cabin altitude climbs to 14,000 feet

ON – activates system and drops masks if automatic function fails.

3 Passenger Oxygen On Light

Illuminated (amber) – passenger oxygen system is operating and masks have dropped.

Oxygen Panel

YN531 - YN534

1 Oxygen Pressure (OXY PRESS) Indicator

Indicates pressure at the crew or passenger oxygen cylinder.

2 Passenger Oxygen (PASS) Switch

RESET - flow control units are closed electrically if cabin altitude is below 14,650 ft.

NORM – (guarded position) passenger masks drop and passenger oxygen system automatically activated when cabin altitude is at or above 14,650 ft.

ON – activates system and drops the passenger cabin oxygen masks regardless of cabin altitude.

3 Indication Select (IND SEL) Switch

(spring-loaded to CREW)

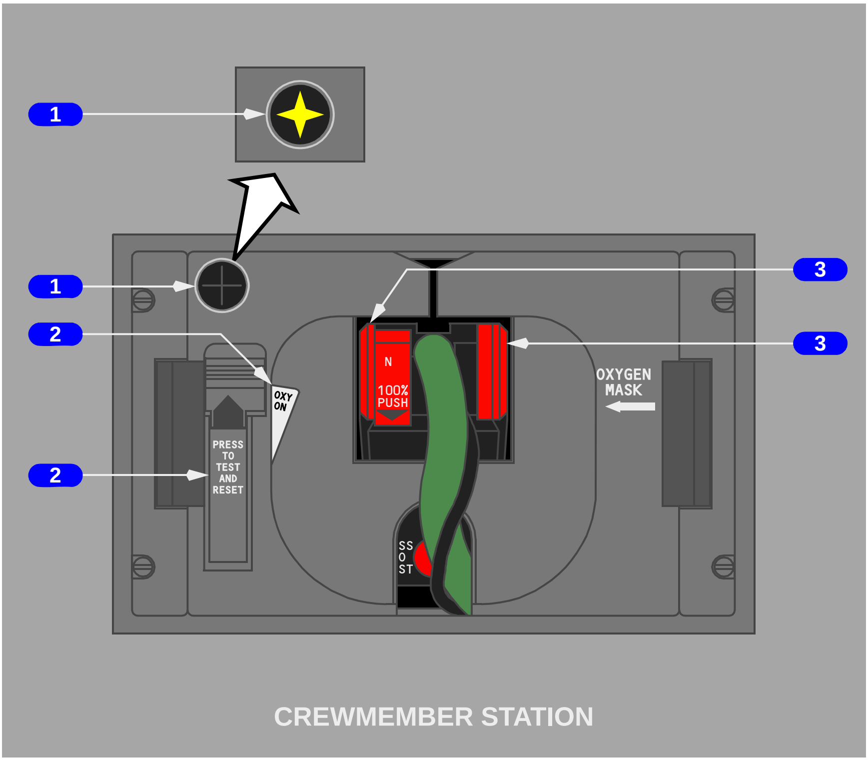
PASS - oxygen pressure indicator displays the passenger oxygen supply.

CREW - oxygen pressure indicator displays the flight crew oxygen supply.

4 Passenger Oxygen (PASS OXY) On Light

Illuminated (amber) – passenger oxygen system is operating and masks have dropped.

Oxygen Mask Panel



1 Oxygen Flow Indicator

Indicates a yellow cross when oxygen is flowing.

2 TEST/RESET Switch

YA701 - YA710, YF921 - YM484, YS151 - YS178, YS191 - YS194
Push –

- if mask is stowed, activates oxygen flow momentarily to test regulator
- if mask is not stowed and stowage box doors are closed, retracts OXY ON flag, shuts off oxygen, and shuts off microphone.

YF048, YF049, YN531 - YN534, YS179 - YS190, YT501 - YV754
Push –

- with the left oxygen mask panel door closed and the OXY ON flag not displayed, turns oxygen on momentarily to test the regulator
- with the left oxygen mask panel door closed and the OXY ON flag displayed will turn oxygen off and disable the mask microphone and enable the boom microphone.

3 Oxygen Mask Release Lever

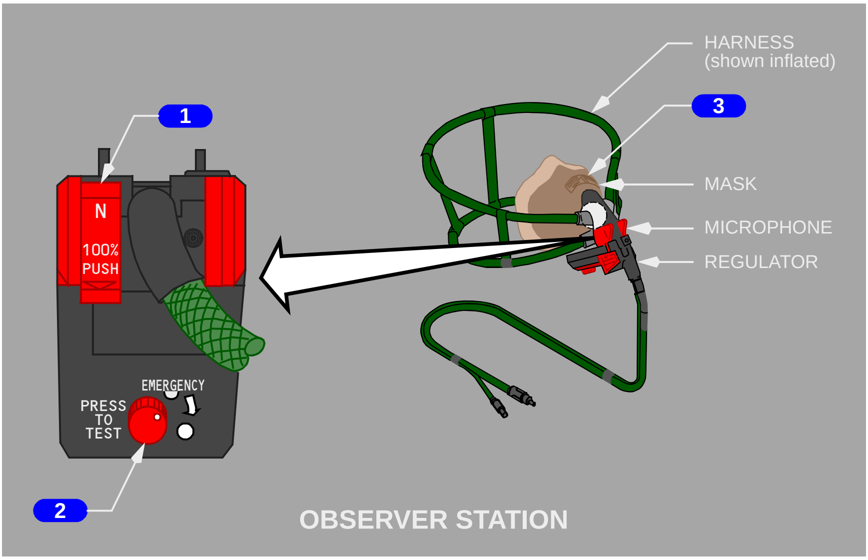
YA701 - YA710, YF921 - YM484, YS151 - YS178, YS191 - YS194
Squeeze and pull up –

- releases mask from stowage box
- releases OXY ON flag when stowage box doors open
- initiates oxygen flow
- inflates mask harness when inflation lever is squeezed
- flow indicator shows a yellow cross momentarily as harness inflates.

YF048, YF049, YN531 - YN534, YS179 - YS190, YT501 - YV754
Squeeze and pull up –

- releases mask from stowage box
- releases OXY ON flag when stowage box doors open
- activates oxygen and microphone
- inflates mask harness when inflation lever is squeezed
- flow indicator shows a yellow cross momentarily as harness inflates.

Oxygen Mask and Regulator



1 NORMAL/100% Switch

N (normal) – supplies air/oxygen mixture on demand (ratio depends on cabin altitude).

100% – supplies 100% oxygen on demand.

2 Oxygen Mask EMERGENCY/Test Selector (rotary)

Normal (non-emergency) position - supplies air/oxygen mixture or 100% oxygen on demand, depending upon the position of the 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).

CAUTION: Use of EMER mode depletes oxygen supply at higher rate than 100% or NORM mode. Use EMER mode only as conditions require.

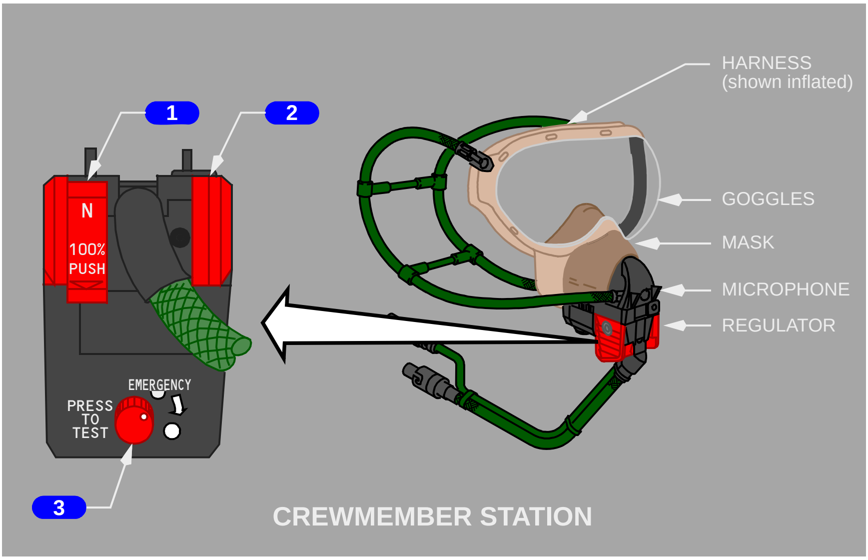
Note: Communications in EMER mode may be difficult. Switch to 100% or NORM if conditions allow.

PRESS TO TEST – tests positive pressure supply to regulator.

3 Smoke Vent Valve Selector

Up - vent valve closed.

Down - vent valve open, allowing oxygen flow to smoke goggles.



1 NORMAL/100% Switch

N (normal) – supplies air/oxygen mixture on demand (ratio depends on cabin altitude).

100% – supplies 100% oxygen on demand.

2 Oxygen Mask Release Lever

YA701 - YA710, YF921 - YM484, YS151 - YS178, YS191 - YS194
Squeeze –

- inflates mask harness when lever is squeezed
- flow indicator shows a colored cross momentarily as harness inflates.

YF048, YF049, YN531 - YN534, YS179 - YS190, YT501 - YV754
Squeeze and Pull –

- inflates mask harness when lever is squeezed
- flow indicator shows a colored cross momentarily as harness inflates
- enables the mask microphone when the left oxygen mask panel door is opened
- disables the boom microphone.

3 EMERGENCY/PRESS TO TEST Selector

Normal (non-emergency) position - supplies air/oxygen mixture or 100% oxygen on demand, depending upon the position of the Normal/100% switch. Automatically supplies 100% oxygen under positive pressure when cabin altitude is above a preset value.

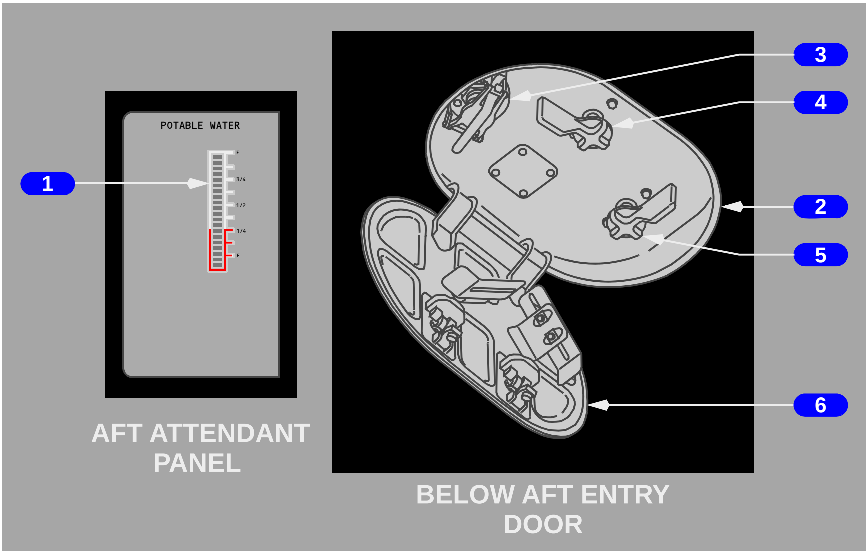
EMERGENCY position (rotate in the direction of the arrow) - supplies 100% oxygen under positive pressure at all cabin altitudes (protects against smoke and harmful vapors). Use to purge contaminants from mask and to remove condensation or fogging from interior of mask lens.

CAUTION: Use of EMER mode depletes oxygen supply at higher rate than 100% or NORM mode. Use EMER mode only as conditions require.

Note: Communications in EMER mode may be difficult. Switch to 100% or NORM if conditions allow.

PRESS TO TEST – tests positive pressure supply to regulator.

Water System Controls



1 Water Quantity Indicator

Indicates quantity of water in reservoir.

2 Water System Service Panel

3 Fill Fitting

Used to fill tank.

4 Fill and Overflow Valve Handle

Open - enables filling or gravity draining water tank.

Closed - normal position.

5 Tank Drain Valve Handle

Open - drains water from tank.

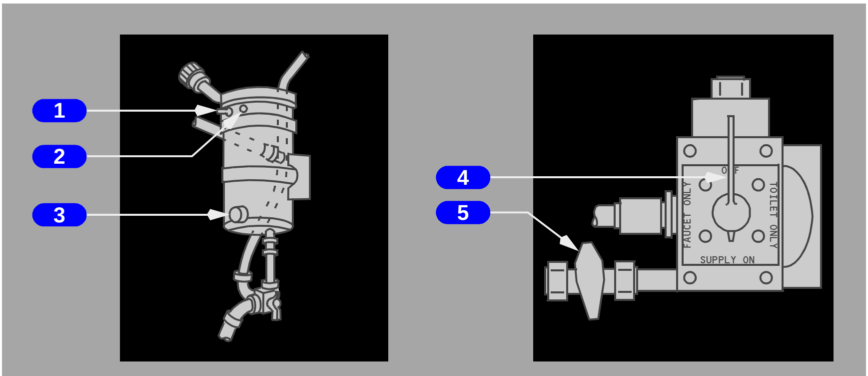
Closed - normal position.

6 Access Panel

Cannot be closed unless the Fill and Overflow Valve and Tank Drain Valve Handles are in the closed position.

Lavatory Controls

YA701 - YA710



LAVATORY SINK CABINET

1 Water Heater Switch

On – activates the water heater.

2 Water Heater Light

Illuminated - heater operating.

3 Temperature Control Switch

4 Water Supply Selector Valve

SUPPLY ON – provides water to lavatory sink faucets and water heater (normal position).

FAUCET ONLY– water is supplied to faucet only.

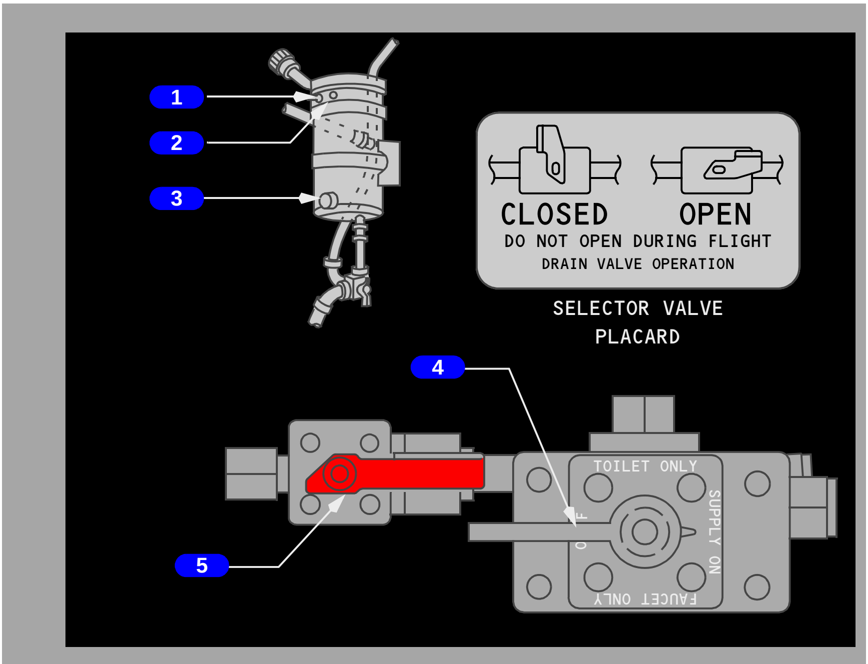
OFF – shuts off water to lavatory sink faucets and water heater.

TOILET ONLY– water is supplied to toilet only.

5 Drain Valve

Located in the forward lavatory.

YF048 - YV754



LAVATORY SINK CABINET

1 Water Heater Switch

On – activates the water heater.

2 Water Heater Light

Illuminated - heater operating.

3 Temperature Control Switch

4 Water Supply Selector Valve

Each lavatory has a Water Supply Selector Valve. The Water Supply Selector Valve has four positions, and is located in the cabinet below the sink.

SUPPLY ON – Normal operating position. When the water system is depressurized, all lavatories except “A” will drain. In this lavatory, the drain valve must be opened to drain the lavatory

FAUCET ONLY – In this position, water is supplied to the faucet, but not to the toilet

TOILET ONLY – In this position, water is supplied to the toilet, but not to the faucet

OFF – No water is supplied to the lavatory.

5 Drain Valve Handle (red)

Located in the forward lavatory only.

Airplane General, Emergency Equipment, Doors, Windows

Chapter 1

Systems Description

Section 40

Introduction

This chapter describes miscellaneous airplane systems, including:

- lighting systems
- oxygen systems
- fire extinguishers
- emergency equipment
- doors and windows
- cargo compartments
- emergency egress
- flight deck seats
- galleys
- water systems
- lavatories

Lighting Systems

Lighting systems described in this chapter include:

- exterior lighting
- flight deck lighting
- passenger cabin lighting
- emergency lighting.

Exterior Lighting

Exterior lighting consists of these lights:

- landing
- runway turnoff
- taxi
- logo
- position (navigation)
- strobe
- anti–collision
- wing illumination
- wheel well.

Retractable Landing Lights
YA701 - YT508

Retractable landing lights are installed in the lower airplane fuselage. The lights are designed to extend and shine forward, parallel to the waterline of the airplane. The lights may be extended at any speed.

Fixed Landing Lights
YA701 - YT508

Two fixed landing lights are in the wing leading edge. The lights shine forward and down in a fixed position.

Runway Turnoff Lights
YA701 - YT508

Runway turnoff lights are in each wing root. The lights illuminate the area in front of the main gear.

Taxi Lights
YA701 - YF049

The taxi light is mounted on the nose wheel strut and points in the same direction as the nose wheel.

Taxi Lights
YF921 - YT508

The taxi light is mounted on the nose wheel strut and points in the same direction as the nose wheel. The light extinguishes automatically when the nose gear is retracted.

Landing, Taxi, and Runway Turnoff Lights
YT509 - YV754

LED lights are mounted in the wing strakelets and provide all function capability of landing, taxi, and runway turnoff light applications for the airplane. When both the landing and taxi lights are in the ON postion, the taxi light function is overridden by the landing light function.

LED Landing Lights - Alternating Flash

YV751 - YV754

LED landing lights alternate flash the left and right landing lights by alternately flashing at approximately 45 (+/-2) flashes per minute (fpm) through a three-position OFF-FLASH-ON switch. When both landing light switches are in the FLASH positions, the left/right landing lights will alternately flash. When both switches are in the ON position, the landing lights operate normally (steady on). If one of the landing light switches (left or right) is in the FLASH position, only that landing light (left or right) will flash at approximately 22 (+/-1) flashes per minute.

Logo Lights

Logo lights are located on the top of each horizontal stabilizer surface to point light on both sides of the vertical stabilizer.

Position Lights

YA701 - YA710

The navigation lights are the standard red (left forward wingtip), green (right forward wingtip), and white (aft tip of both wings) position lights.

YF048 - YV754
The navigation lights are the standard red (left forward, at the base of the winglet), green (right forward, at the base of the winglet), and white (trailing edge, at the base of both winglets).

Strobe Lights

YA701 - YA710
Three high intensity white strobe lights are installed on the left forward wing tip, right forward wing tip, and tail cone.

YF048 - YV754
Three high intensity white strobe lights are installed on the left forward winglet, right forward winglet, and tail cone.

Anti–collision Lights

Two red anti–collision strobe lights are located on the top and bottom of the fuselage.

Wing Illumination Lights

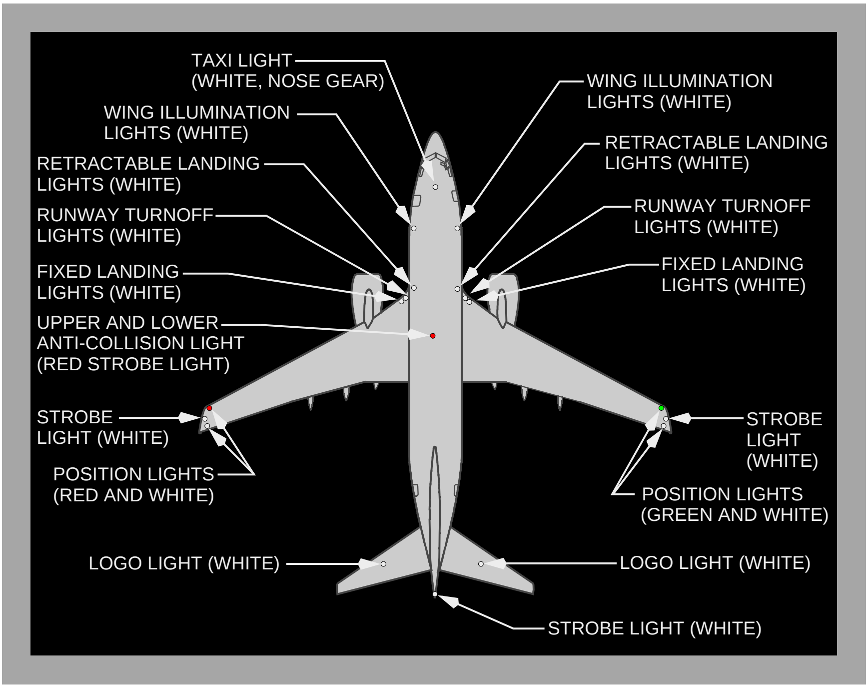
Wing lights are installed on the fuselage and illuminate the leading edge of the wing.

Wheel Well Lights

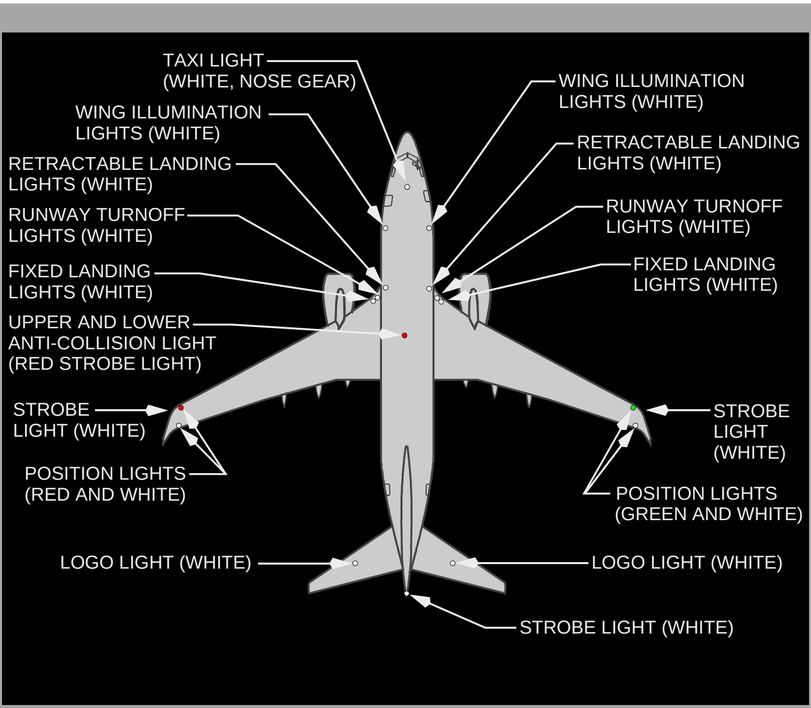
Lights are installed in the wheel well of the nose gear and each main gear.

Exterior Lighting Locations

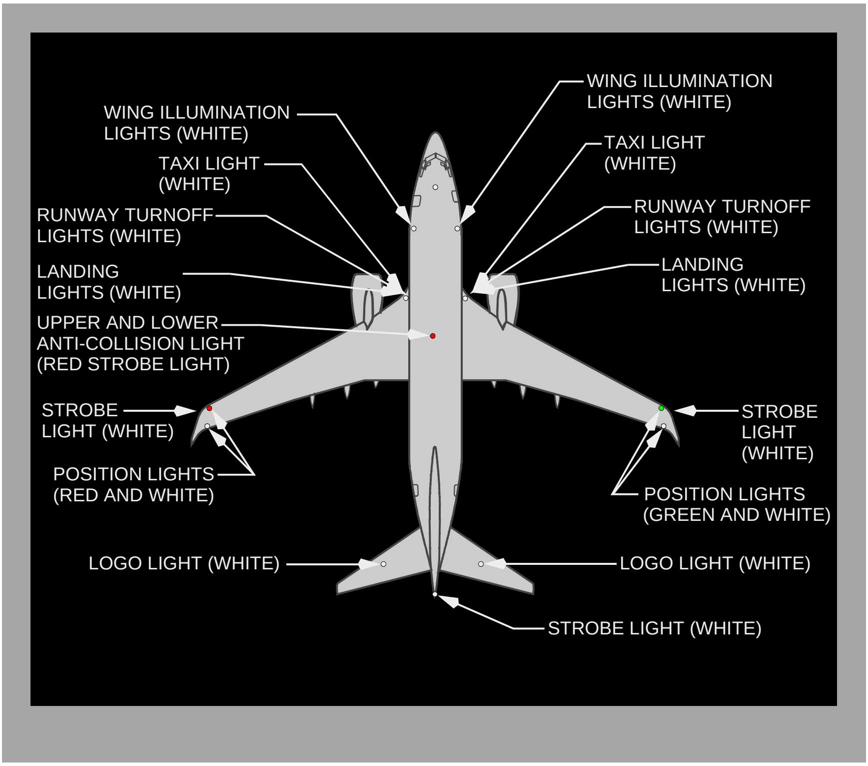
YA701 - YA710



YF048 - YT508


TAXI LIGHT (WHITE, NOSE GEAR)
WING ILLUMINATION LIGHTS (WHITE)
WING ILLUMINATION LIGHTS (WHITE)
RETRACTABLE LANDING LIGHTS (WHITE)
RETRACTABLE LANDING LIGHTS (WHITE)
RUNWAY TURNOFF LIGHTS (WHITE)
RUNWAY TURNOFF LIGHTS (WHITE)
FIXED LANDING LIGHTS (WHITE)
FIXED LANDING LIGHTS (WHITE)
UPPER AND LOWER ANTI-COLLISION LIGHT (RED STROBE LIGHT)
STROBE LIGHT (WHITE)
STROBE LIGHT (WHITE)
POSITION LIGHTS (RED AND WHITE)
POSITION LIGHTS (GREEN AND WHITE)
LOGO LIGHT (WHITE)
LOGO LIGHT (WHITE)
STROBE LIGHT (WHITE)

YT509 - YV754



Flight Deck Lighting

Flight deck lighting is provided for panel illumination, area lighting and localized illumination. Dome lights supply general flight deck flood lighting. The glareshield supplies background light for the main instrument panels. Each instrument and instrument panel has its own integral lights. Floodlights are installed for the MCP, aisle stand, and aft circuit breaker panel.

Map lights, chart lights and utility lights are available at the pilot stations, each with individual controls.

If normal electrical power is lost, standby electrical power is automatically provided to the standby compass light, dome lights, instrument flood lights and selected system information and warning lights.

Passenger Cabin Lighting

Passenger cabin lighting is supplied by incandescent and fluorescent lights. General cabin lighting is provided by window lights, ceiling lights, and entry lights. Reading lights are located above each passenger seat in the passenger service unit. Lights are also installed in the lavatories and galleys.

Passenger Cabin Signs

The passenger cabin signs are controlled by a switch on the forward overhead panel. With Auto selected, the signs are controlled automatically by reference to landing gear and flap positions:

FASTEN BELTS and RETURN TO SEAT signs:

- illuminate when flaps or gear are extended
- extinguish when flaps and gear are retracted.

YA701 - YA704
NO SMOKING signs:

- illuminate when gear is extended
- extinguish when gear is retracted.

YA705 - YF049, YK622 - YK971, YL541, YM482 - YM484
NO SMOKING signs:

- are illuminated at all times.

YA701 - YA704, YF921 - YF928, YK973 - YL077, YL542 - YL551, YN531 - YV754
All passenger signs can be controlled manually by positioning the respective switch to ON or OFF.

YA705 - YF049, YK622 - YK971, YL541, YM482 - YM484
The FASTEN BELTS and RETURN TO SEAT signs can be controlled manually by positioning the respective switch to ON or OFF.

When the passenger cabin signs illuminate or extinguish, a low tone sounds over the PA system.

Emergency Lighting

Exit lights are located throughout the passenger cabin to indicate the approved emergency exit routes. The system is controlled by a switch on the overhead panel. The switch has three positions, OFF, ARMED and ON and is guarded to the ARMED position. With the switch in the ARMED position, the emergency exit lights are normally extinguished. If electrical power to DC bus No. 1 fails or if AC power has been turned off, the emergency exit lights illuminate automatically.

The emergency exit lights may also be illuminated by a switch on the Aft Attendant Panel. Lifting the guard and pushing the switch ON overrides the flight deck control and illuminates the emergency exit lights. Control from this panel is available in the event of failure of the automatic control.

The flight deck aft DOME light contains a separate bulb that is powered by the emergency lighting system to provide for flight deck evacuation.

Interior Emergency Lighting
YA701 - YA710, YF921 - YM484

Interior emergency exit lights are located:

- in the lower inboard corner of stowage bins to illuminate the aisle
- over the entry/service and overwing emergency doors to indicate the door exits
- in the ceiling to locate the exits and provide general illumination in the area of the exits.

Self–illuminating exit locator signs are installed at the forward, middle, and aft end of the passenger cabin.

Floor proximity emergency escape path lighting consists of locator lights spaced at regular intervals down the aisle. Lighted EXIT indicators with arrows point to overwing exits. Lighted EXIT indicators without arrows are placed near each door. Escape path markings are provided for visual guidance for emergency cabin evacuation when other sources of cabin lighting are obscured.

Interior Emergency Lighting
YF048, YF049, YN531 - YV754

Interior emergency exit lights are located:

- in the lower inboard corner of stowage bins to illuminate the aisle
- over the entry/service and overwing emergency doors to indicate the door exits
- in the ceiling to locate the exits and provide general illumination in the area of the exits.

Self–illuminating exit locator signs are installed at the forward, middle, and aft end of the passenger cabin.

A photoluminescent floor path marking system is installed along the cabin aisle. The photoluminescent material, when excited by light, will glow and provide exit path guidance. At the exit, electrically operated lights and markers provide exit identification.

The photoluminescent strips need to be properly charged. The table below contains charging information and can be used to determine how long the strips remain illuminated. For charging, the cabin ceiling, and sidewall lights need to be on at full intensity, and the strips should not be covered or blocked.

Photoluminescent Lighting systems with strip colors other than blue. YF048, YF049

First Flight of the Day with Bin Doors Closed	Maximum Duration Allowed (Hours)	Additional Steps to Follow for charging credit
5 minute charge	4.25	a) Close overhead bin doors during charging. b) Cabin activity is limited to minor aisle traffic or crew and personnel. c) Passengers will shadow the system and are not allowed onboard during charging.
10 minute charge	8.0	
15 minute charge	9.5	
30 minute charge	14.0	
45 minute charge	16.0	

First Flight of the Day with Bin Doors Open No Passengers		
15 minute charge	5.75	a) Close overhead bin doors during charging. b) Cabin activity is limited to minor aisle traffic or crew and personnel. c) Passengers will shadow the system and are not allowed onboard during charging.
30 minute charge	7.5	

In-Flight Charging* - All Phases		
15 minute charge	8.0	Charging must begin prior to previous discharge duration ending. Strips are assumed to be shadowed during meal service by galley carts and flight attendants which are stationary for 5 minutes.
30 minute charge	11.25	

In-Flight Charging* - Descent		
10 minute charge	8.0	Charging must begin prior to previous discharge duration ending. Reduced charge time allowed because passengers are seated, meal service ended and little aisle traffic.

In-Flight Charging* - Double Charge at 4 Hours and 8 Hours		
15 minute charge	9.5	Charging must begin prior to previous discharge duration ending. Strips are assumed to be shadowed during meal service by galley carts and flight attendants which are stationary for 5 minutes. In order to get double charging credit, strips must be charged for the first time 4 hours +/- 15 minutes after prior charge. The second charge must take place before 8 hours has elapsed from initial charge.
30 minute charge	12.5	

Continuous Flight	**No limit if lights stay on**	**Flight duration can be extended continuously by having ceiling lights on dim.**
*Taxi Time can be used for charging credit.		

Quick Turn with Bin Doors Open and Passengers in Seats		
15 minute charge	6.75	a) Charging must begin prior to previous discharge duration ending b) Bin doors can be open during charging c) Passenger loading and unloading periods can not be included in the charge time. Passengers can be seated on the airplane.
30 minute charge	9.0	

Quick Turn with Bin Doors Open and No Passengers in Seats		
15 minute charge	7.5	a) Close overhead bin doors during charging b) Cabin activity is limited to minor aisle traffic or crew and personnel c) Passengers will shadow the system and are not allowed onboard during charging.
30 minute charge	10.0	

Photoluminescent Lighting systems with blue strips.
YF048, YF049

First Flight of the Day with Bin Doors Closed	Maximum Duration Allowed (Hours)	Additional Steps to Follow for charging credit
5 minute charge	4.0	a) Close overhead bin doors during charging. b) Cabin activity is limited to minor aisle traffic or crew and personnel. c) Passengers will shadow the system and are not allowed onboard during charging.
10 minute charge	6.0	
15 minute charge	8.0	
30 minute charge	10.0	
45 minute charge	11.5	

First Flight of the Day with Bin Doors Open No Passengers		
15 minute charge	5.0	a) Close overhead bin doors during charging. b) Cabin activity is limited to minor aisle traffic or crew and personnel. c) Passengers will shadow the system and are not allowed onboard during charging.
30 minute charge	6.0	

In-Flight Charging* - All Phases		
15 minute charge	8.0	Charging must begin prior to previous discharge duration ending. Strips are assumed to be shadowed during meal service by galley carts and flight attendants which are stationary for 5 minutes.
30 minute charge	11.5	

In-Flight Charging* - Descent		
10 minute charge	8.0	Charging must begin prior to previous discharge duration ending. Reduced charge time allowed because passengers are seated, meal service ended and little aisle traffic.

In-Flight Charging* - Double Charge at 4 Hours and 8 Hours		
15 minute charge	9.5	Charging must begin prior to previous discharge duration ending. Strips are assumed to be shadowed during meal service by galley carts and flight attendants which are stationary for 5 minutes. In order to get double charging credit, strips must be charged for the first time 4 hours +/- 15 minutes after prior charge. The second charge must take place before 8 hours has elapsed from initial charge.
30 minute charge	12.5	

Continuous Flight	**No limit if lights stay on**	**Flight duration can be extended continuously by having ceiling lights on dim.**
*Taxi Time can be used for charging credit.		

Quick Turn with Bin Doors Open and Passengers in Seats		
15 minute charge	6.75	a) Charging must begin prior to previous discharge duration ending b) Bin doors can be open during charging c) Passenger loading and unloading periods can not be included in the charge time. Passengers can be seated on the airplane.
30 minute charge	9.0	

Quick Turn with Bin Doors Open and No Passengers in Seats		
15 minute charge	7.5	a) Close overhead bin doors during charging b) Cabin activity is limited to minor aisle traffic or crew and personnel c) Passengers will shadow the system and are not allowed onboard during charging.
30 minute charge	10.0	

Sky Interior and Photoluminescent Lighting systems Standard Width and Narrow Strips (Blue only)

YN531 - YV754

First Flight of the Day with Bin Doors Closed (White BRIGHT)	**Maximum Duration Allowed (Hours)**	**Additional Steps to Follow for charging credit**
5 minute charge	3.5	a) Close overhead bin doors during charging. b) Cabin activity is limited to minor aisle traffic or crew and personnel.
10 minute charge	5	
15 minute charge	7.5	

First Flight of the Day with Bin Doors Open No Passengers (White BRIGHT)		
10 minute charge	5	a) Bin doors can be open during charging. b) Cabin activity is limited to minor aisle traffic or crew and personnel.
15 minute charge	7.5	

Quick Turn with Bin Doors Open and Passengers in Seats **(White BRIGHT)**		
10 minute charge	5	a) Charging must begin prior to previous discharge duration ending b) Bin doors can be open during charging c) Passenger loading and unloading periods can not be included in the charge time. Passengers can be seated on the airplane.
15 minute charge	7.5	

In-Flight Charging		
Taxi/Take off 10 minute charge	2.5	Charging must begin prior to previous discharge duration ending. Strips are assumed to be shadowed during meal service by galley cart and flight attendants which are stationary for 5 minutes.
Meal/Beverage 15 minute charge	3.5	
Day Cruise 15 minute charge	3.5	

Continuous Flight		
	No limit if ceiling and sidewall light stays on	If the Attendant Control Panel loses communication with the ceiling and sidewall lights these lights will change to a default medium white. Flight duration can be extended continuously.

Sky Interior and Photoluminescent Lighting systems with Standard Width Strips (except Blue)
YN531 - YV754

First Flight of the Day with Bin Doors Closed **(White BRIGHT)**	**Maximum Duration Allowed (Hours)**	**Additional Steps to Follow for charging credit**
5 minute charge	8	a) Close overhead bin doors during charging. b) Cabin activity is limited to minor aisle traffic or crew and personnel.
10 minute charge	9.5	
15 minute charge	12.5	

First Flight of the Day with Bin Doors Open No Passengers **(White BRIGHT)**		
10 minute charge	9.5	a) Close overhead bin doors during charging. b) Cabin activity is limited to minor aisle traffic or crew and personnel.
15 minute charge	12.5	

Quick Turn with Bin Doors Open and Passengers in Seats **(White BRIGHT)**		
10 minute charge	9.5	a) Charging must begin prior to previous discharge duration ending b) Bin doors can be open during charging c) Passenger loading and unloading periods can not be included in the charge time. Passengers can be seated on the airplane.
15 minute charge	12.5	

In-Flight Charging		
Taxi/Take off 10 minute charge	3.5	Charging must begin prior to previous discharge duration ending. Strips are assumed to be shadowed during meal service by galley cart and flight attendants which are stationary for 5 minutes.
Meal/Beverage 15 minute charge	5	
Day Cruise 15 minute charge	5	

In-Flight Charging* - Double Charge at 3 Hours and 6.5 Hours		
Meal/Beverage 15 minute charge	7.5	Charging must begin prior to previous discharge duration ending. Strips are assumed to be shadowed during meal service by galley carts and flight attendants which are stationary for 5 minutes. In order to get double charging credit, strips must be charged for the first time 4 hours +/- 15 minutes after prior charge. The second charge must take place before 8 hours has elapsed from initial charge.
Day Cruise 15 minute charge	7.5	

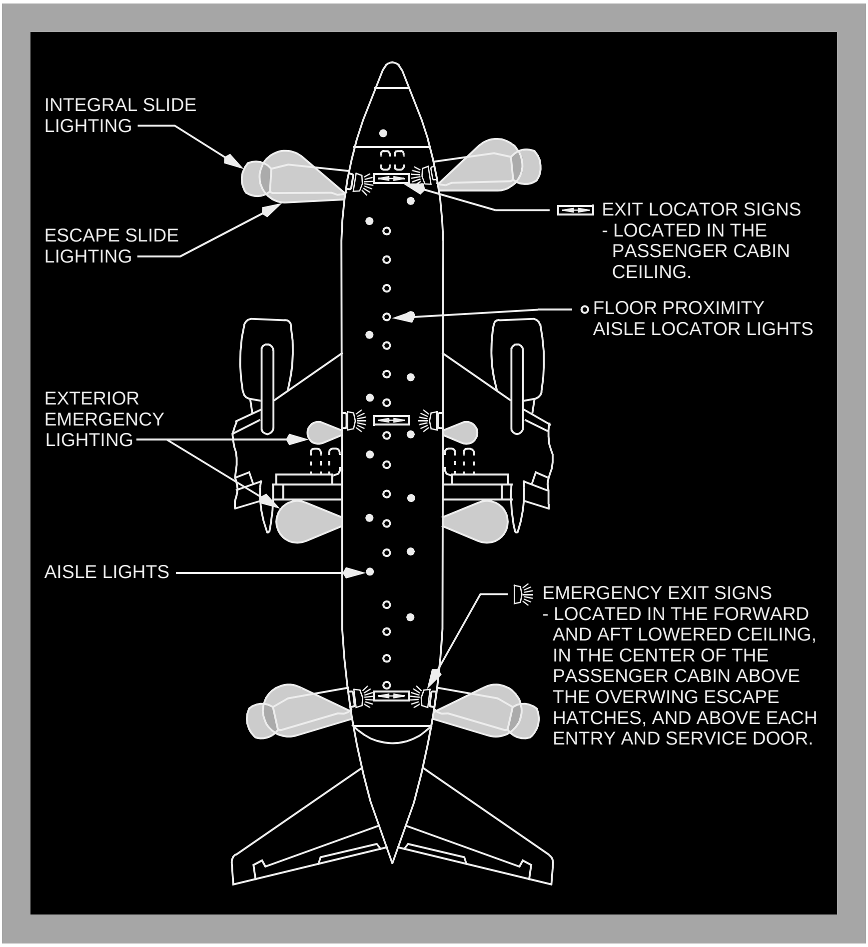
Continuous Flight		
	No limit if ceiling and sidewall light stays on	If the Attendant Control Panel loses communication with the ceiling and sidewall lights these lights will change to a default medium white. Flight duration can be extended continuously.

Exterior Emergency Lighting

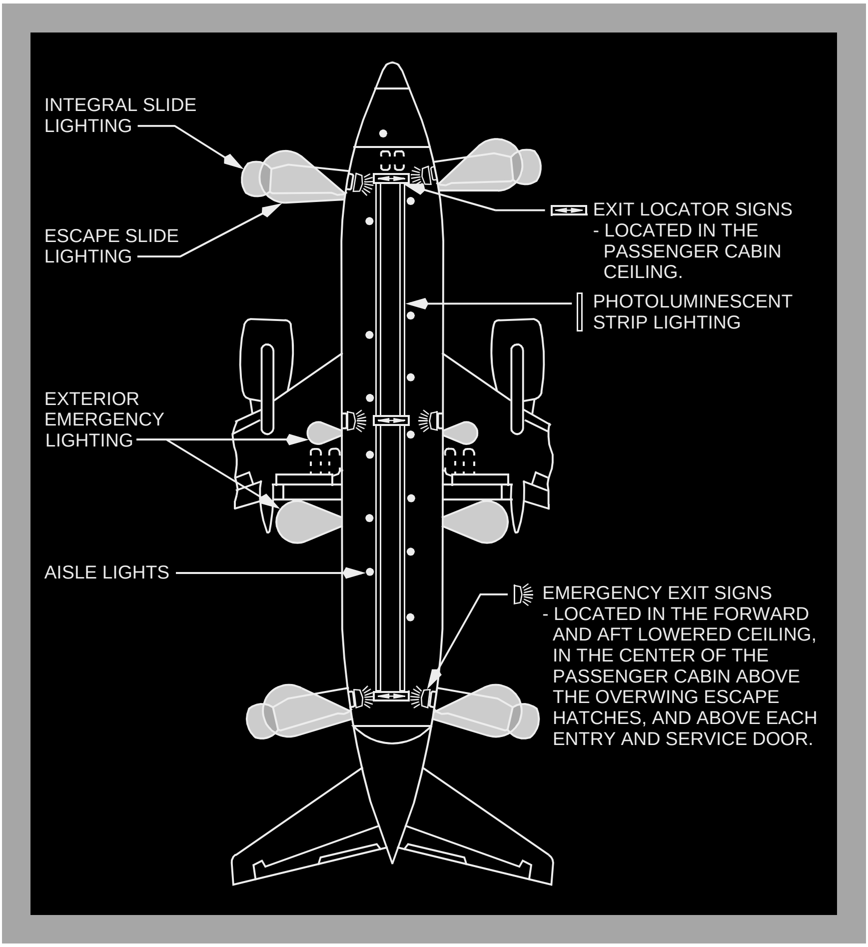
Exterior emergency lights illuminate the escape slides. The fuselage installed escape slide lights are adjacent to the forward and aft service and entry doors. Lights are also installed on the fuselage to illuminate the overwing escape routes and ground contact area.

Emergency Exit Lighting

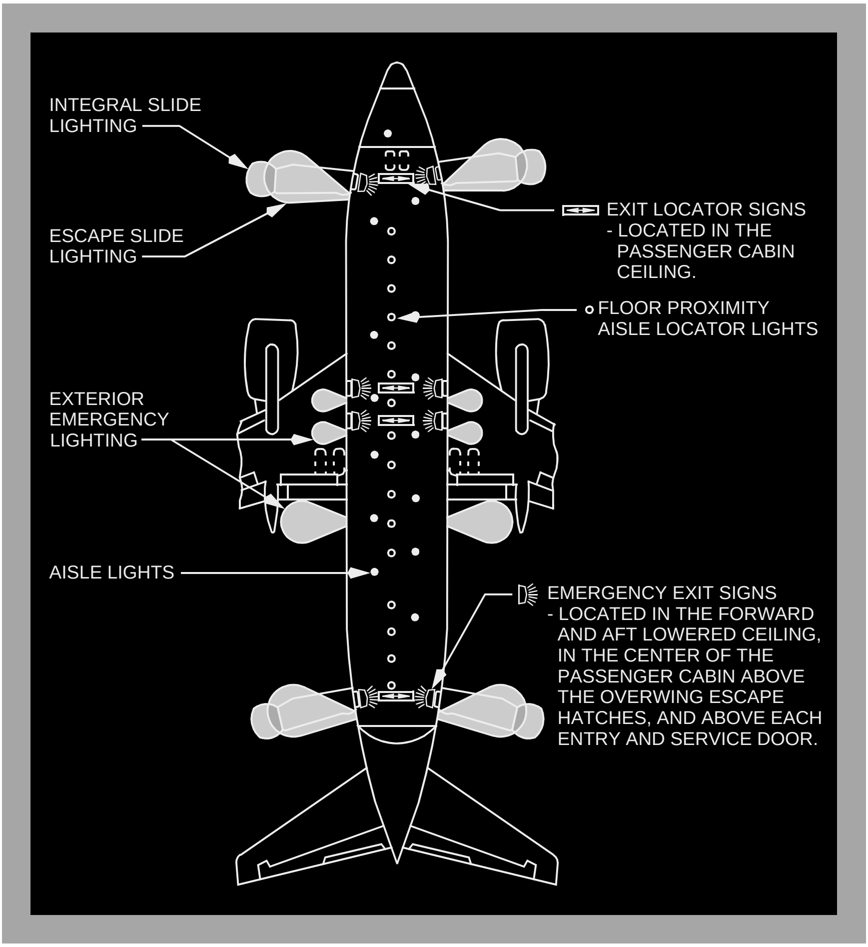
YA701 - YA710, YM482 - YM484



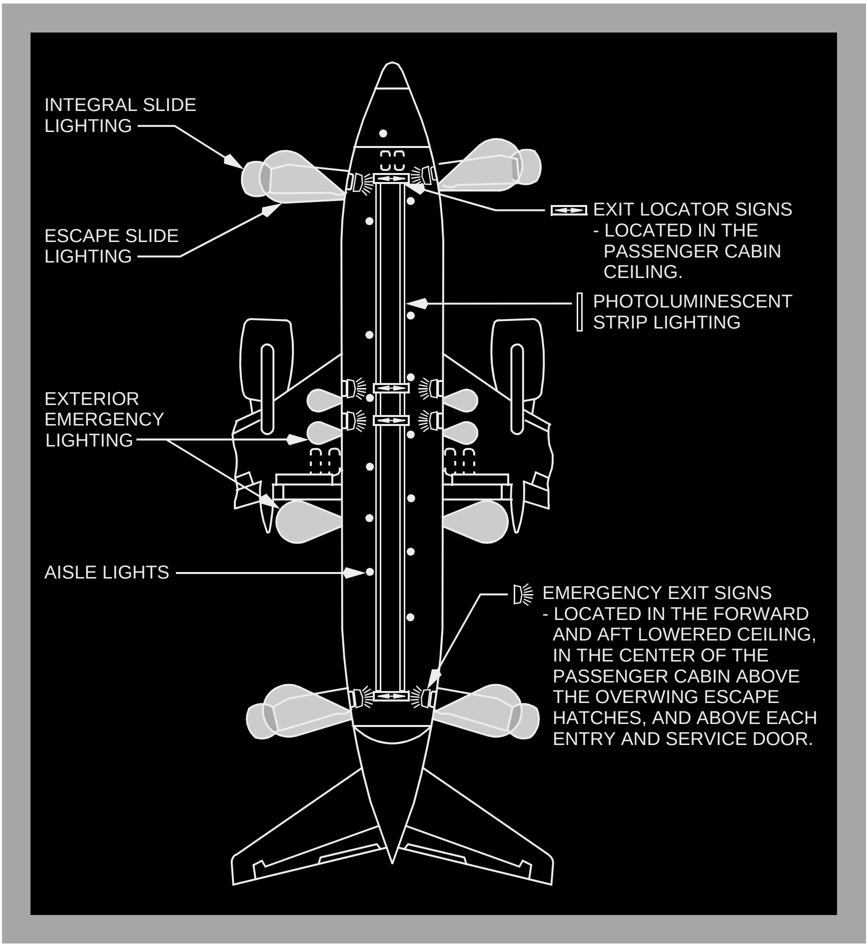
YN531 - YN534


INTEGRAL SLIDE LIGHTING
ESCAPE SLIDE LIGHTING
EXIT LOCATOR SIGNS - LOCATED IN THE PASSENGER CABIN CEILING.
PHOTOLUMINESCENT STRIP LIGHTING
EXTERIOR EMERGENCY LIGHTING
AISLE LIGHTS
EMERGENCY EXIT SIGNS - LOCATED IN THE FORWARD AND AFT LOWERED CEILING, IN THE CENTER OF THE PASSENGER CABIN ABOVE THE OVERWING ESCAPE HATCHES, AND ABOVE EACH ENTRY AND SERVICE DOOR.

YF921 - YL551


INTEGRAL SLIDE LIGHTING
ESCAPE SLIDE LIGHTING
EXIT LOCATOR SIGNS
- LOCATED IN THE PASSENGER CABIN CEILING.
FLOOR PROXIMITY AISLE LOCATOR LIGHTS
EXTERIOR EMERGENCY LIGHTING
AISLE LIGHTS
EMERGENCY EXIT SIGNS
- LOCATED IN THE FORWARD AND AFT LOWERED CEILING, IN THE CENTER OF THE PASSENGER CABIN ABOVE THE OVERWING ESCAPE HATCHES, AND ABOVE EACH ENTRY AND SERVICE DOOR.

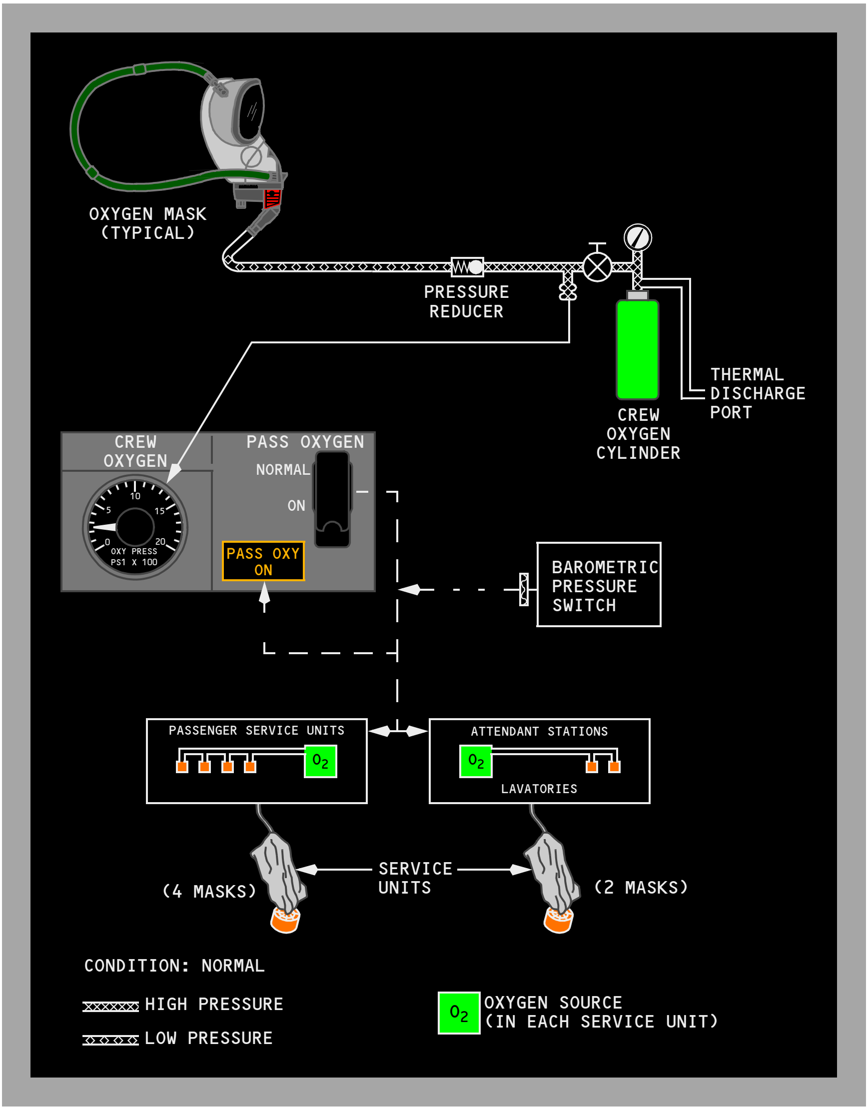
YF048, YF049, YS151 - YV754



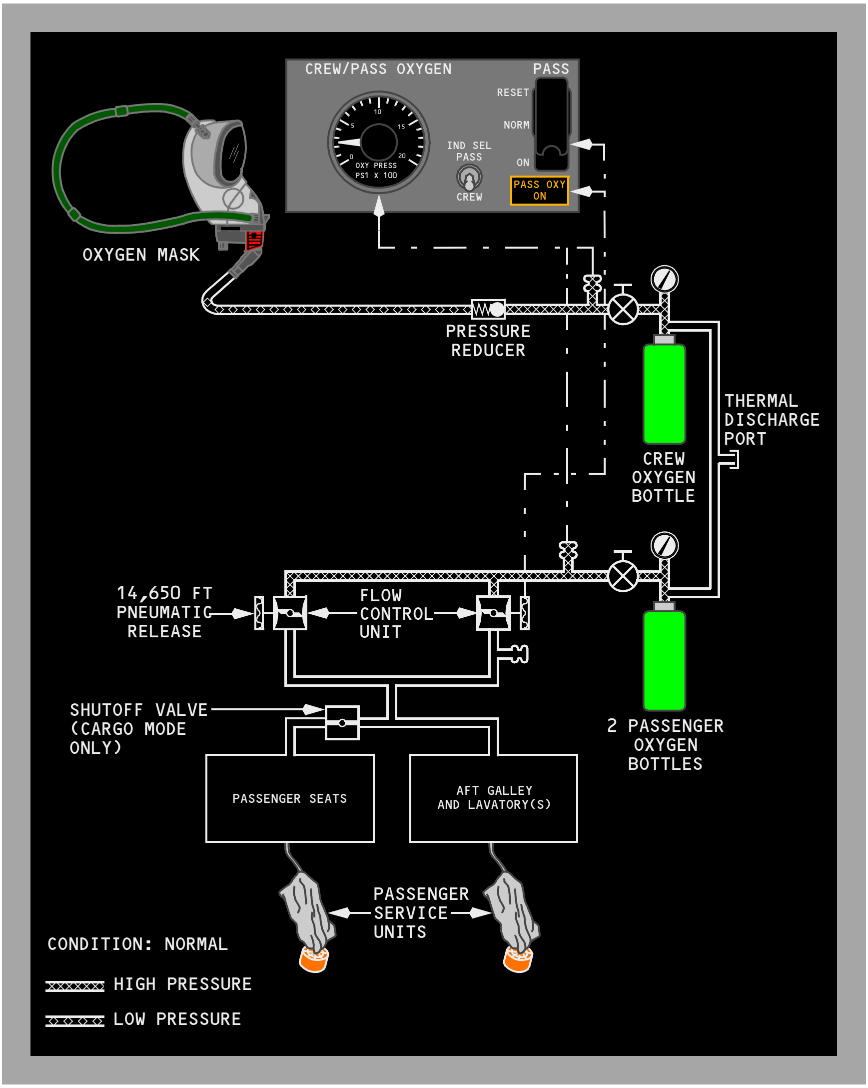
Oxygen Systems

Two independent oxygen systems are provided, one for the flight crew and one for the passengers. Portable oxygen cylinders can be located throughout the airplane for emergency use. These cylinders are normally found in the forward and aft areas of the passenger cabin.

Oxygen System Schematic



YN531 - YN534



Flight Crew Oxygen System

The flight crew oxygen system uses quick-donning, diluter-demand masks/ regulators located at each crew station. Oxygen is supplied by a single cylinder. Oxygen pressure is displayed on the Oxygen Pressure indicator located on the aft overhead panel when the battery switch is ON. Oxygen flow is controlled through an in-line, pressure-reducing regulator to supply low-pressure oxygen to the regulator on the mask. System pressure may be as high as 1850 psi.

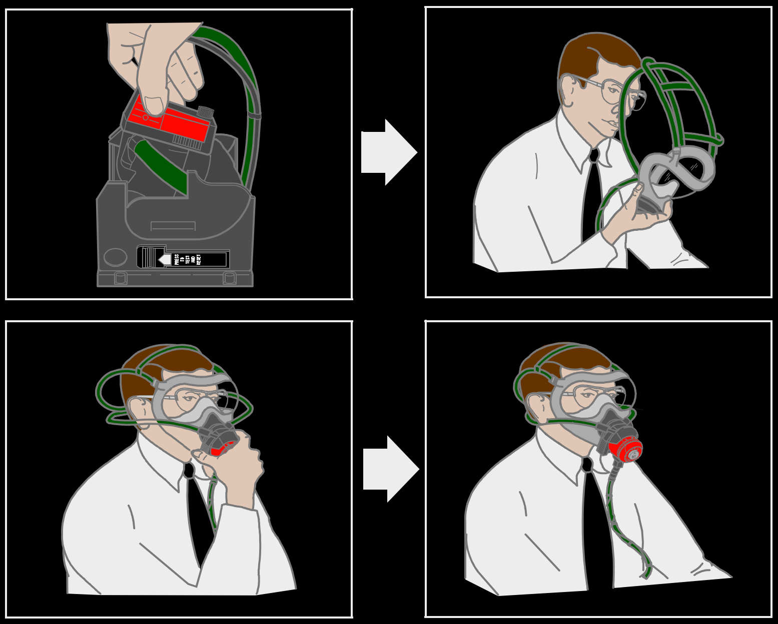
Oxygen flow is controlled by a regulator mounted on the oxygen mask. By pushing the NORMAL/100% control lever, the regulator is adjusted from the air/oxygen mixture to 100% oxygen. By rotating the EMERGENCY/TEST selector, the regulator is adjusted to supply oxygen under pressure.

Flight Crew Oxygen Mask Usage

Donning Instructions

To don the oxygen mask accomplish the following:

- Grasp the regulator by the red inflation levers with the hand nearest the stowage box.
- Squeeze the inflation levers while pulling the mask from the box.
- Pull the mask across in front of you, toward the center of the airplane (to ensure ample hose extension) while rolling the mask face-up.
- Lean slightly toward the center of the airplane and bring the mask toward your face so that the lower portion of the mask contacts your chin first. Roll the top of the mask toward your forehead so the harness goes over and behind your head.
- Release the inflation levers so the harness holds the mask in place.



MASK DONNING

Stowing Instructions

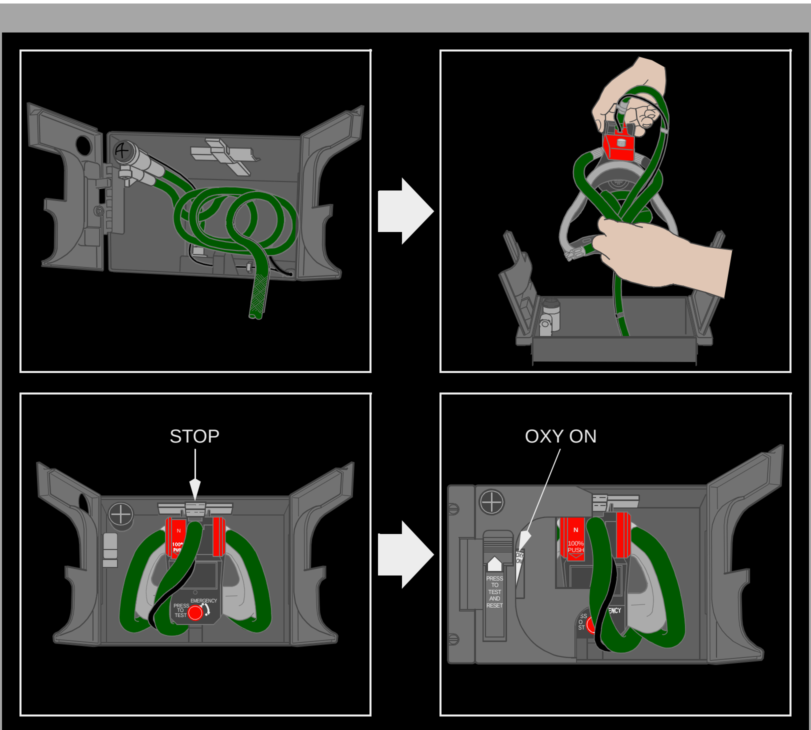
To stow the oxygen mask accomplish the following:

- Set the “N/100%” regulator control to “100%.”
- Ensure that the “EMERGENCY” oxygen control knob is off.
- Coil the supply hose into the bottom of the stowage box, making the largest diameter possible.
- Ensure that the harness is completely deflated.
- Hold the mask by the regulator, with the facepiece down and the inside of the mask toward you.
- Grasp the harness and pull it downward so the cross straps are below the facepiece. Allow the excess harness to hang downward.

CAUTION: Do not push the harness cross straps into or behind the nose piece. Doing this may cause the cross straps to hang up on the mask during inflation.

- Position the supply hose down the center of the facepiece.
- Insert the mask-regulator assembly into the stowage box, beginning with the harness (regulator up).
- Press down on the assembly until the mask-regulator is fully seated against the stop in the stowage box.
- Close the left-hand door. The “OXY ON” flag will slide into view at the center of the door
- Close the right-hand door, ensuring not to pinch the hose
- Press, then release the “TEST AND RESET” control lever on the left-hand door. Ensure that the “OXY ON” flag disappears when the control lever is released.

WARNING: Do not squeeze the red inflation levers during stowing. Doing this will inflate the harness and prevent the correct stowing of the mask.



MASK STOWING

Portable Protective Breathing Equipment

Protective Breathing Equipment (PBE/Smoke Hood) devices for crew use (for combating fires and/or entering areas of smoke or fume accumulation) may be stowed throughout the airplane; however, they are normally found in the forward and aft sections of the passenger cabin. The device is placed over the head and, when activated, provides approximately 15 to over 20 minutes of oxygen depending upon the device used. Manufacturer's operating instructions are placarded on the container.

Passenger Oxygen System

YA701 - YM484, YS151 - YV754

The passenger oxygen system is supplied by an individual oxygen source located at each Passenger Service Unit (PSU). Four continuous flow masks are connected to each oxygen source. An oxygen source with two masks is located above each attendant station and in each lavatory.

YN531 - YN534

The passenger oxygen system is supplied by an oxygen source. The oxygen is supplied by an oxygen source located in the aft cargo compartment to the oxygen masks located in the passenger service units. An oxygen source with two oxygen masks is provided in each lavatory service unit and in each attendants' service unit. The passenger oxygen system is normally inactive.

YA701 - YM484, YS151 - YV754

The system is activated automatically by a pressure switch at a cabin altitude of 14,000 feet or when the Passenger Oxygen Switch on the aft overhead panel is positioned to ON. When the system is activated, the PASS OXY ON light illuminates and OVERHEAD illuminates on the Master Caution System.

YN531 - YN534

The system is activated by two pressure switches. With the HIGH ALT LDG switch in the OFF or INOP position and a cabin altitude of approximately 10,000 feet, the cabin altitude warning horn will sound and at approximately 14,650 feet the passenger oxygen masks will deploy. When the HIGH ALT LDG switch is placed in the ON position the cabin altitude warning horn will sound at approximately 15,200 feet and the passenger oxygen masks will deploy at approximately 15,650 feet. The masks will deploy whenever the Passenger Oxygen Switch on the aft overhead panel is positioned to ON. When the system is activated by either pressure switch or the Passenger Oxygen Switch, the PASS OXY ON light illuminates and OVERHEAD illuminates on the Master Caution System.

YA701 - YF049, YF924 - YK971, YL076 - YM484, YS151 - YS174, YS179 - YS190, YT501 - YV754

Activating the system causes the masks to drop from the stowage compartments. The oxygen source is activated when any mask in the unit is pulled down. Pulling one mask down causes all masks in that unit to come down and 100% oxygen flows to all masks. A green in–line flow indicator is visible in the transparent oxygen hose whenever oxygen is flowing to the mask. Oxygen flows for approximately 12 minutes and cannot be shut off. If the passenger oxygen is activated and a PSU oxygen mask compartment does not open, the masks may be dropped manually.

YF921 - YF923, YK973 - YK980, YS175 - YS178, YS191 - YS194

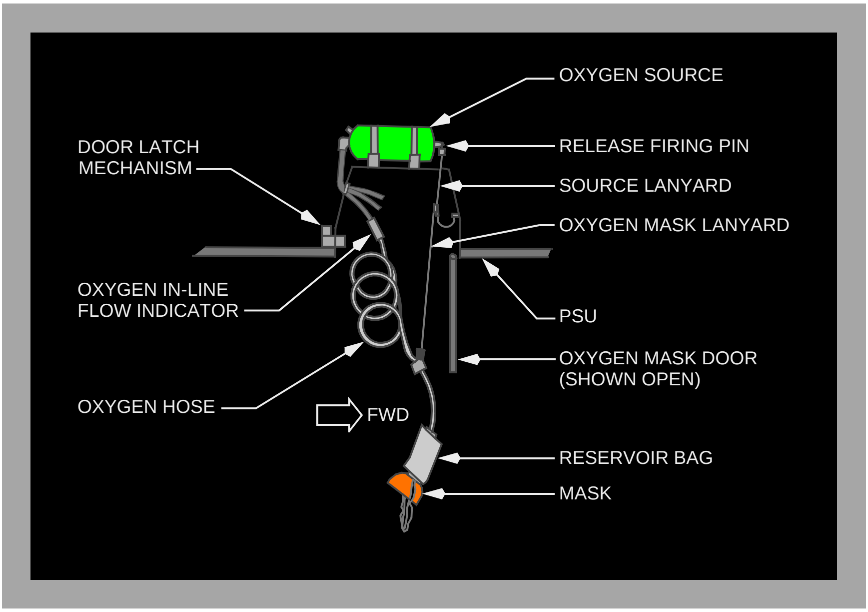
Activating the system causes the masks to drop from the stowage compartments. The oxygen source is activated when any mask in the unit is pulled down. Pulling one mask down causes all masks in that unit to come down and 100% oxygen flows to all masks. A green in–line flow indicator is visible in the transparent oxygen hose whenever oxygen is flowing to the mask. Oxygen flows for approximately 22 minutes and cannot be shut off. If the passenger oxygen is activated and a PSU oxygen mask compartment does not open, the masks may be dropped manually.

YN531 - YN534

Activating the system causes the masks to drop from the stowage compartments. The oxygen flows when any mask in the unit is pulled down. Pulling one mask down causes all masks in that unit to come down and 100% oxygen flows to all masks. A green in–line flow indicator is visible in the transparent oxygen hose whenever oxygen is flowing to the mask. Oxygen quantity is sufficient to provide for the passengers during an emergency descent to an altitude where supplementary oxygen is no longer required. If the passenger oxygen is activated and a PSU oxygen mask compartment does not open, the masks may be dropped manually.

PSU Oxygen Mask Compartment

YA701 - YM484, YS151 - YV754



WARNING: When using passenger oxygen, the "NO SMOKING" sign should be strictly observed. Once the oxygen source is activated, the flow of oxygen is constant, whether or not the mask is being worn.

WARNING: Do not use passenger oxygen with cabin altitude below 14,000 feet when smoke or an abnormal heat source is present. The use of passenger oxygen does not prevent the passengers from inhaling smoke. Air inhaled is a mixture of oxygen and cabin air.

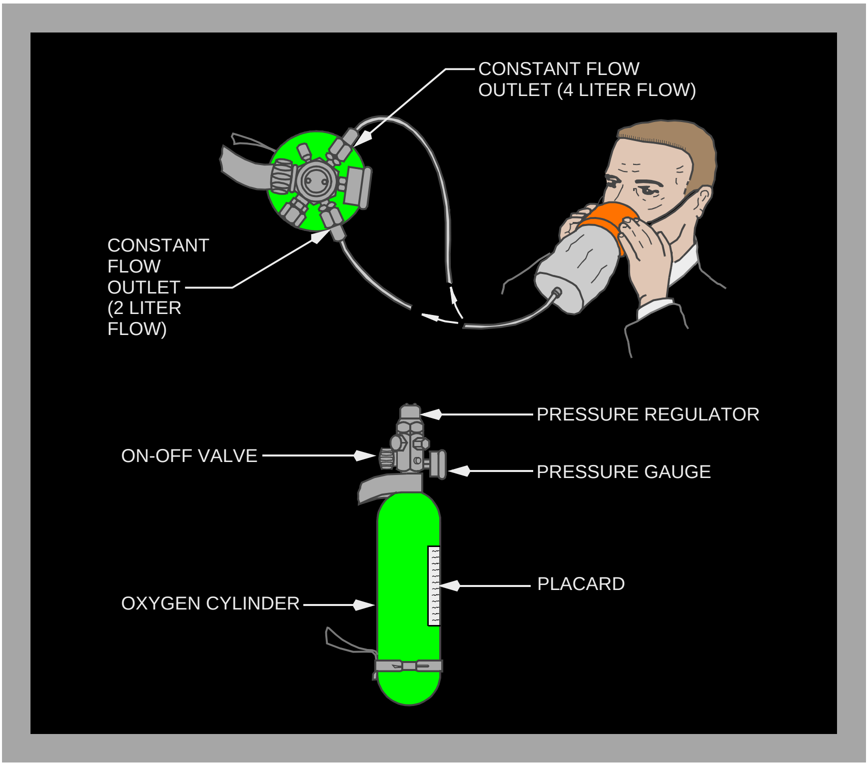
Passenger Portable Oxygen

YF048, YF049
First aid and supplemental portable oxygen cylinders are installed at suitable locations in the passenger cabin. The cylinders are fitted with a pressure gauge, pressure regulator and on–off valve. The cylinders are pressurized to 1800 psi. At this pressure and a temperature of 70 degrees Fahrenheit, (21 degrees Celsius) the cylinders have a capacity of 4.25 cubic feet (120 liters) of free oxygen. Two continuous flow outlets are provided on each cylinder, one regulates flow at two liters per minute for walk–around; the second outlet provides flow at four liters per minute. The four–liter flow is used for first aid.

YA701 - YA710, YF921 - YV754
First aid and supplemental portable oxygen cylinders are installed at suitable locations in the passenger cabin. The cylinders are fitted with a pressure gauge, pressure regulator and on–off valve. The cylinders are pressurized to 1800 psi. At this pressure and a temperature of 70 degrees Fahrenheit, (21 degrees Celsius) the cylinders have a capacity of 11 cubic feet (311 liters) of free oxygen. Two continuous flow outlets are provided on each cylinder, one regulates flow at two liters per minute for walk–around; the second outlet provides flow at four liters per minute. The four–liter flow is used for first aid.

Duration can be determined by dividing capacity by outflow (120 liters divided by 4 liters/minute = 30 minutes).

Passenger Portable Oxygen Schematic



Fire Extinguishers

Fire extinguishers are located in the flight deck and passenger cabin.

Water Fire Extinguishers

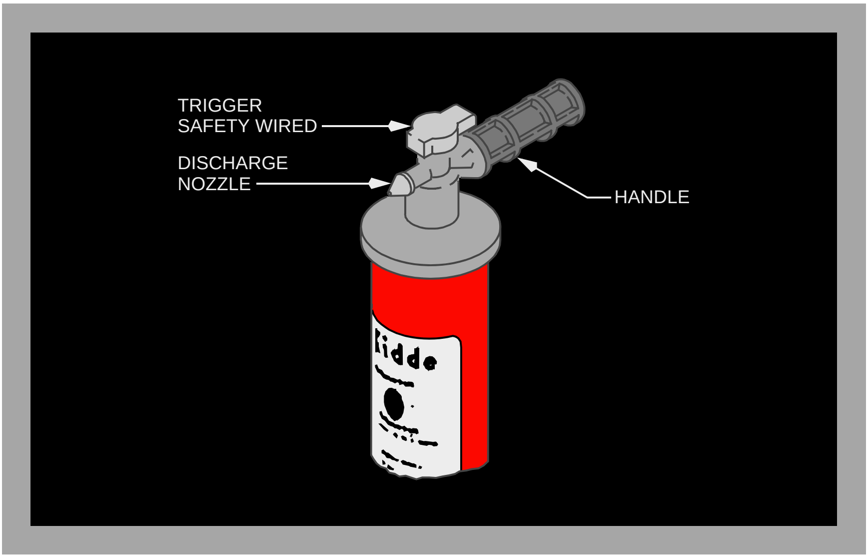
Water fire extinguishers contain a solution of water mixed with antifreeze. The container is pressurized by a CO2 cartridge when the extinguisher handle is rotated fully clockwise. The extinguisher should be used on fabric, paper or wood fires only.

To use the water fire extinguisher:

- remove from stowage
- rotate handle fully clockwise
- aim at base of fire and press trigger.

CAUTION: Do not use on electrical or grease type fires.

Water Fire Extinguisher

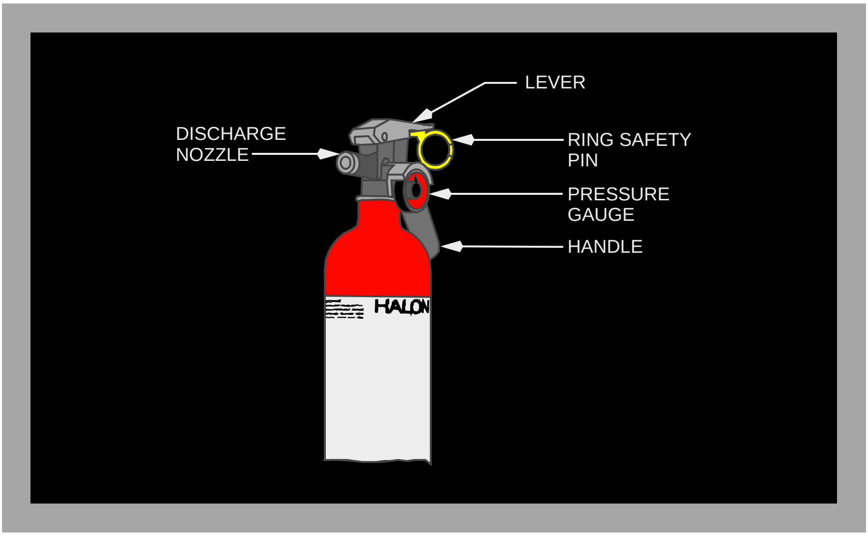


Halon (BCF) Fire Extinguishers

Halon (BCF) fire extinguishers contain a liquefied gas agent under pressure. The pressure indicator shows an acceptable pressure range, a recharge range, and an overcharged range. A safety pin with a pull ring prevents accidental trigger movement. When released the liquefied gas agent vaporizes and extinguishes the fire. The extinguisher is effective on all types of fires, but primarily on electrical, fuel and grease fires.

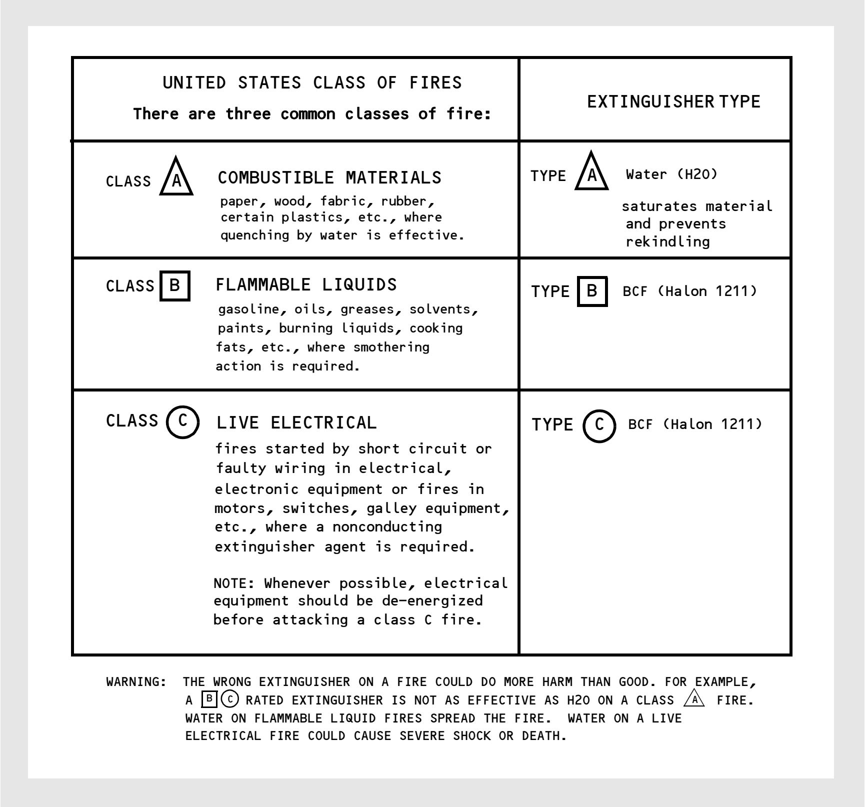
Direction for use of the fire extinguisher is printed on the extinguisher.

BCF Fire Extinguisher (Halon 1211)



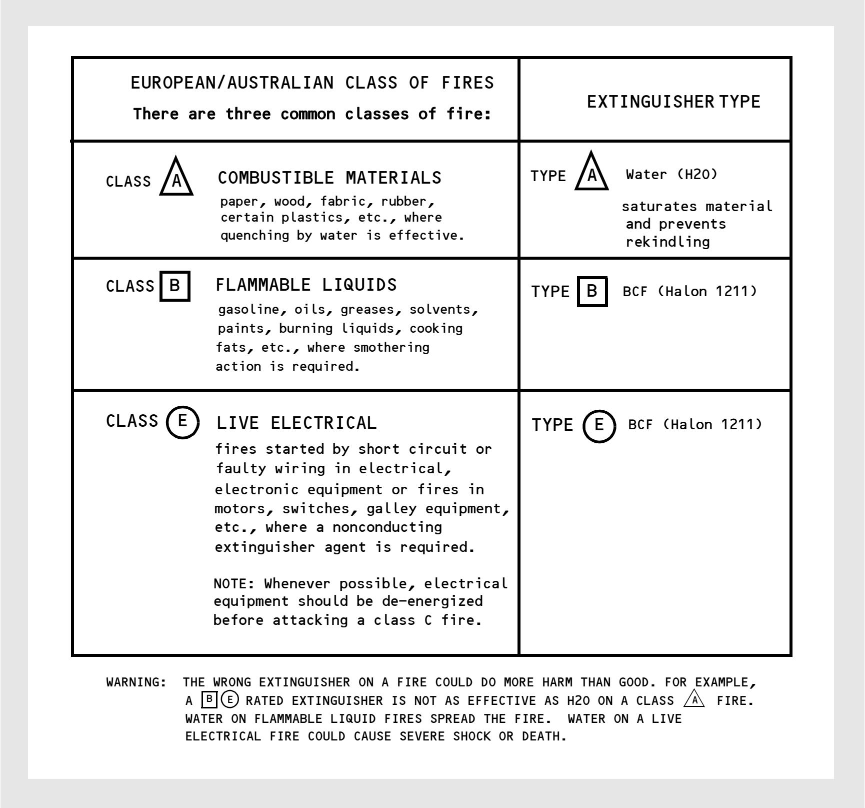
Fire Extinguisher Usage

Each class of fire calls for specialized action. Using the wrong extinguisher may do more harm than good. For your own protection, you should know these basic types, how to use them, and why. These are the fire classification codes:



UNITED STATES CLASS OF FIRES There are three common classes of fire:		EXTINGUISHER TYPE	
CLASS A	COMBUSTIBLE MATERIALS paper, wood, fabric, rubber, certain plastics, etc., where quenching by water is effective.	TYPE A	Water (H2O) saturates material and prevents rekindling
CLASS B	FLAMMABLE LIQUIDS gasoline, oils, greases, solvents, paints, burning liquids, cooking fats, etc., where smothering action is required.	TYPE B	BCF (Halon 1211)
CLASS C	LIVE ELECTRICAL fires started by short circuit or faulty wiring in electrical, electronic equipment or fires in motors, switches, galley equipment, etc., where a nonconducting extinguisher agent is required. NOTE: Whenever possible, electrical equipment should be de-energized before attacking a class C fire.	TYPE C	BCF (Halon 1211)

WARNING: THE WRONG EXTINGUISHER ON A FIRE COULD DO MORE HARM THAN GOOD. FOR EXAMPLE, A B C RATED EXTINGUISHER IS NOT AS EFFECTIVE AS H2O ON A CLASS A FIRE. WATER ON FLAMMABLE LIQUID FIRES SPREAD THE FIRE. WATER ON A LIVE ELECTRICAL FIRE COULD CAUSE SEVERE SHOCK OR DEATH.



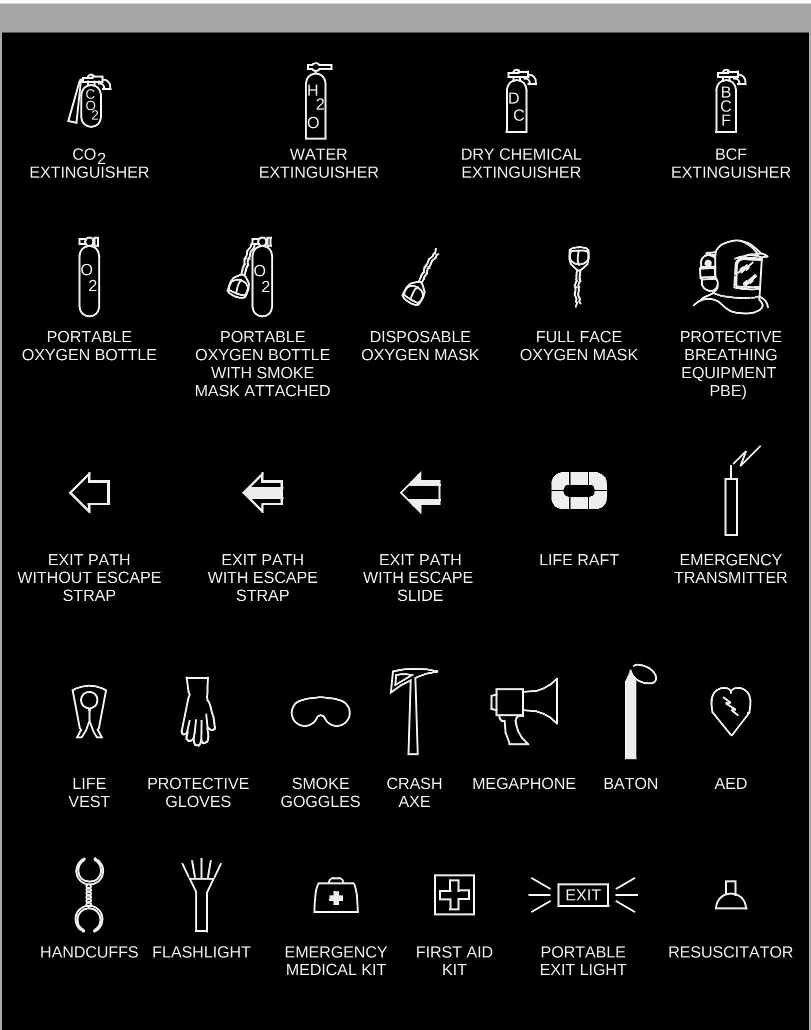
EUROPEAN/AUSTRALIAN CLASS OF FIRES There are three common classes of fire:	EXTINGUISHER TYPE
CLASS A COMBUSTIBLE MATERIALS paper, wood, fabric, rubber, certain plastics, etc., where quenching by water is effective.	TYPE A Water (H2O) saturates material and prevents rekindling
CLASS B FLAMMABLE LIQUIDS gasoline, oils, greases, solvents, paints, burning liquids, cooking fats, etc., where smothering action is required.	TYPE B BCF (Halon 1211)
CLASS E LIVE ELECTRICAL fires started by short circuit or faulty wiring in electrical, electronic equipment or fires in motors, switches, galley equipment, etc., where a nonconducting extinguisher agent is required. NOTE: Whenever possible, electrical equipment should be de-energized before attacking a class C fire.	TYPE E BCF (Halon 1211)

WARNING: THE WRONG EXTINGUISHER ON A FIRE COULD DO MORE HARM THAN GOOD. FOR EXAMPLE, A B E RATED EXTINGUISHER IS NOT AS EFFECTIVE AS H2O ON A CLASS A FIRE. WATER ON FLAMMABLE LIQUID FIRES SPREAD THE FIRE. WATER ON A LIVE ELECTRICAL FIRE COULD CAUSE SEVERE SHOCK OR DEATH.

WARNING: The concentrated agent, or the by-products created by the heat of the fire, are toxic when inhaled.

WARNING: If a fire extinguisher is to be discharged in the flight deck, then all crewmembers are to wear oxygen masks and use 100% oxygen with emergency selected.

Emergency Equipment Symbols

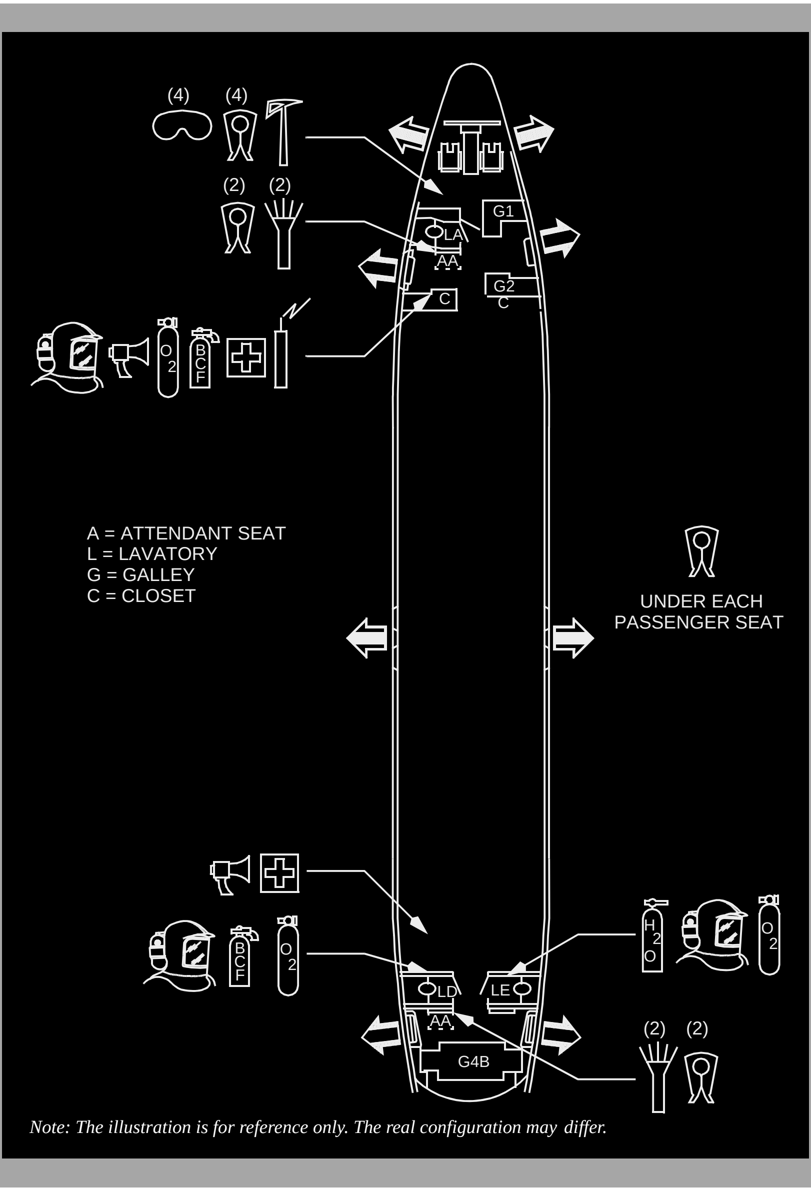


NOTE: SOME SYMBOLS DO NOT APPLY TO ALL CONFIGURATIONS.

Intentionally
Blank

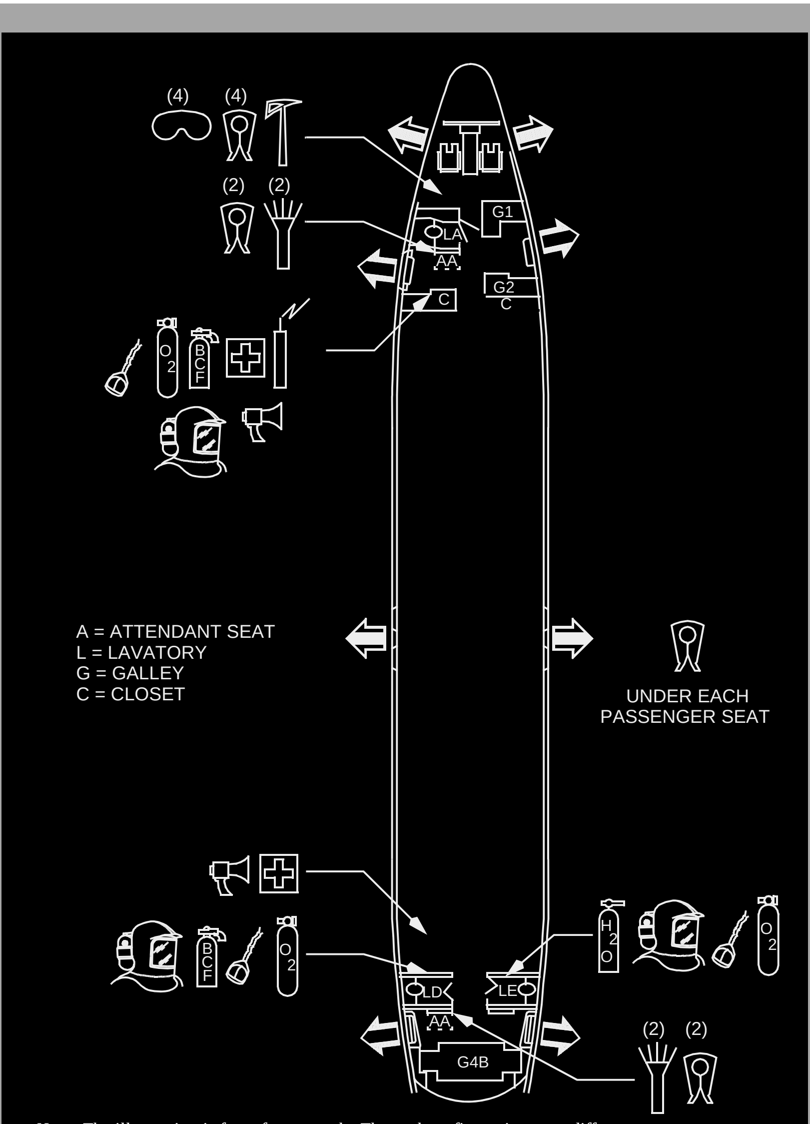
Emergency Equipment Locations

YA701, YA702, YA705 - YA710



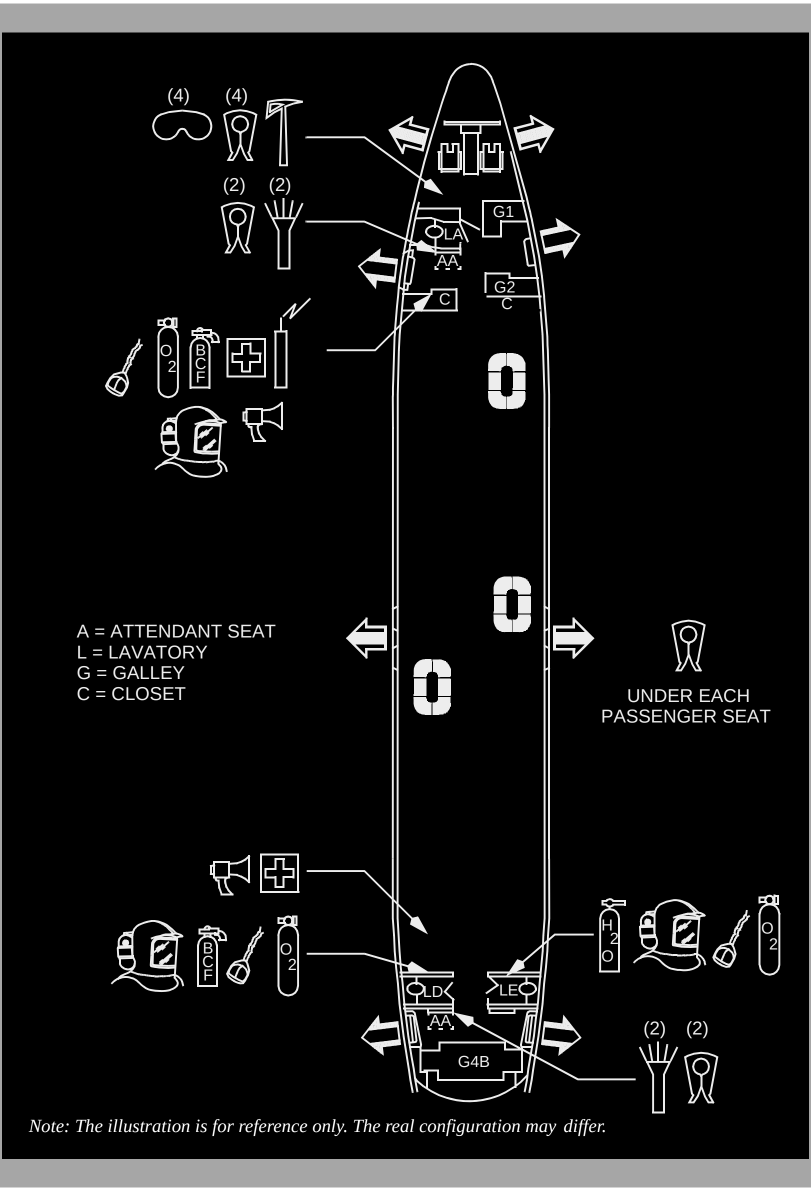
Note: The illustration is for reference only. The real configuration may differ.

YM482 - YM484



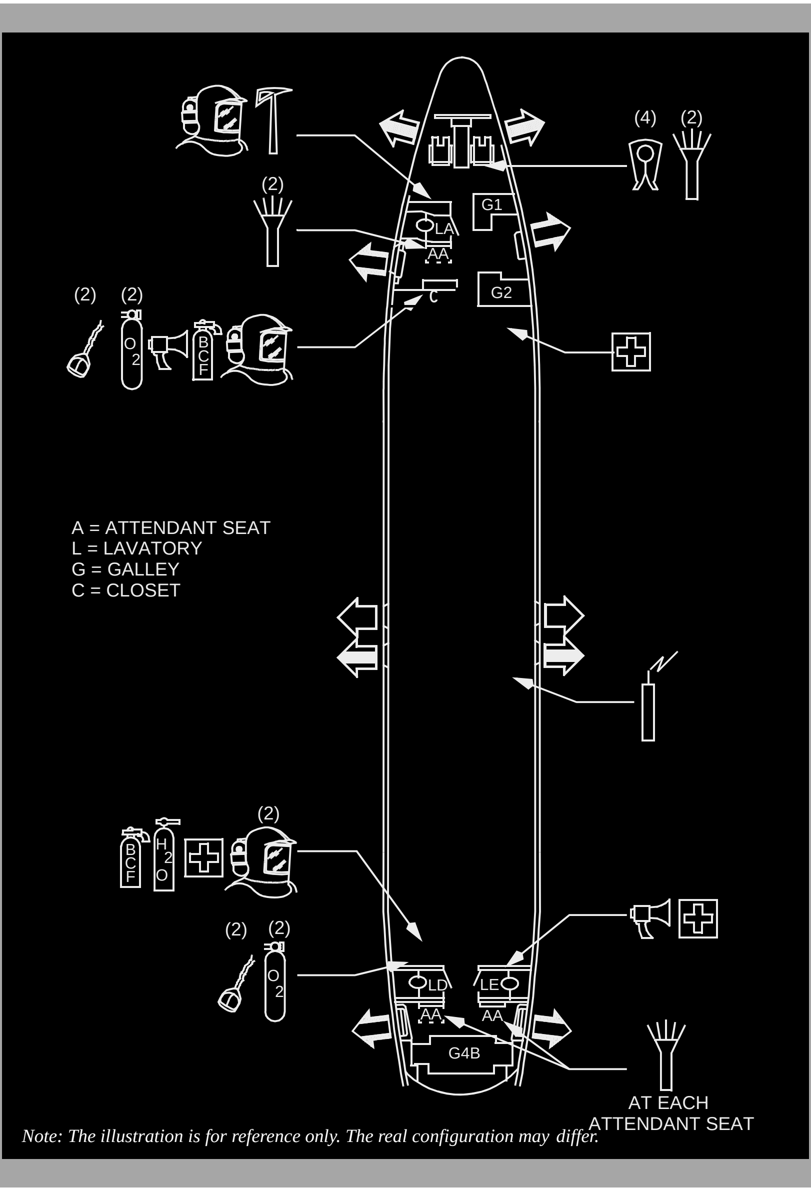
Note: The illustration is for reference only. The real configuration may differ.

YN531 - YN534



Note: The illustration is for reference only. The real configuration may differ.

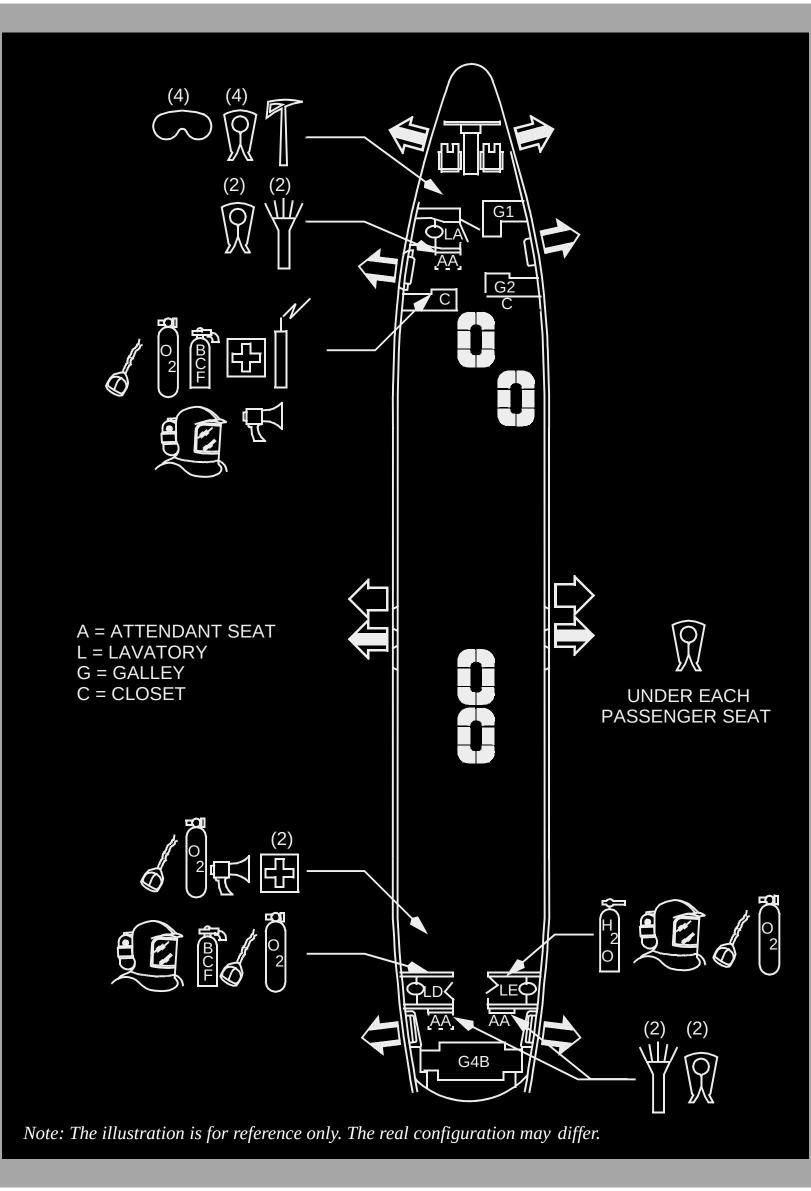
YF048, YF049



A = ATTENDANT SEAT
L = LAVATORY
G = GALLEY
C = CLOSET

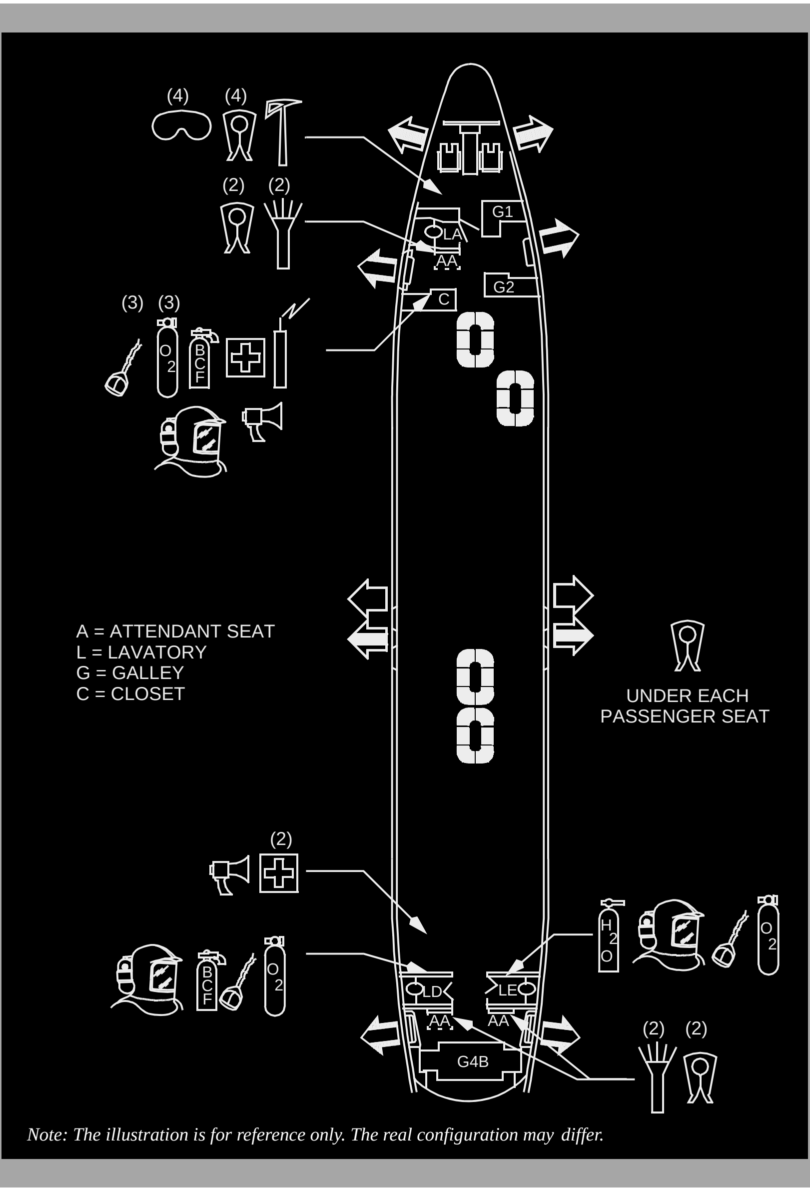
Note: The illustration is for reference only. The real configuration may differ.

YF921 - YL551



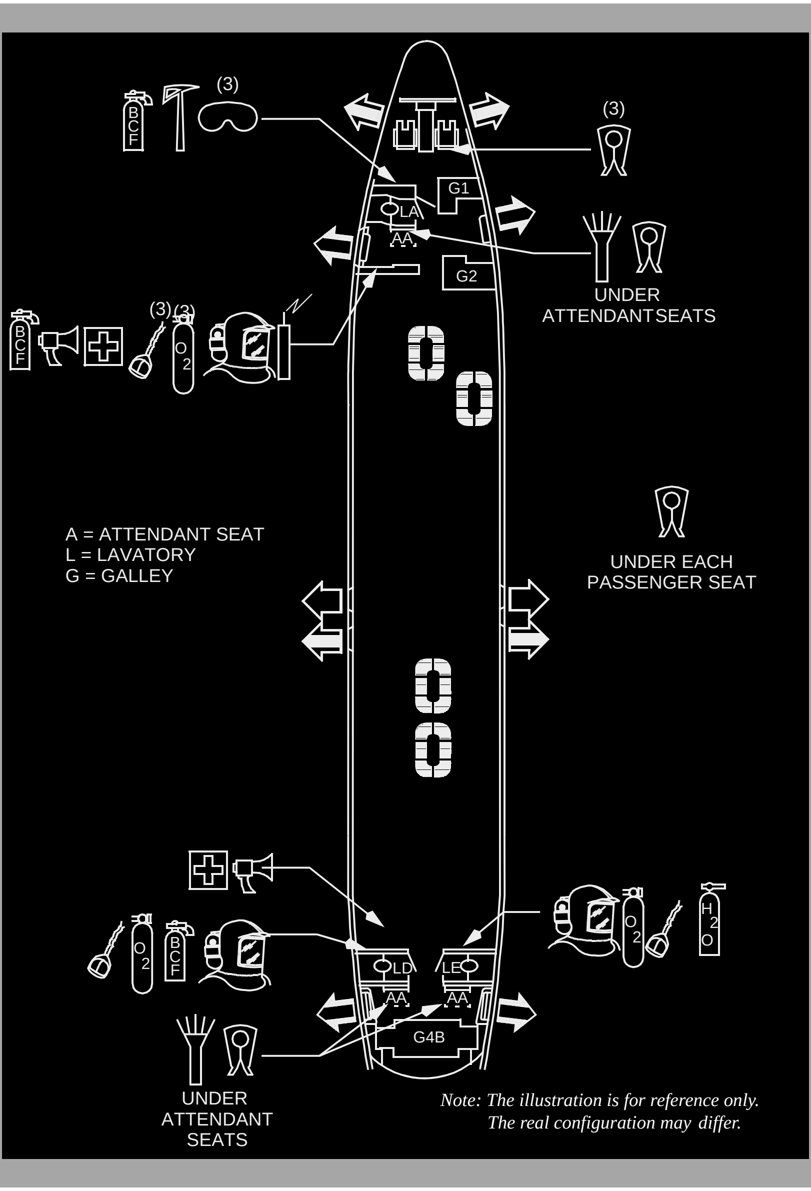
Note: The illustration is for reference only. The real configuration may differ.

YS166 - YT521



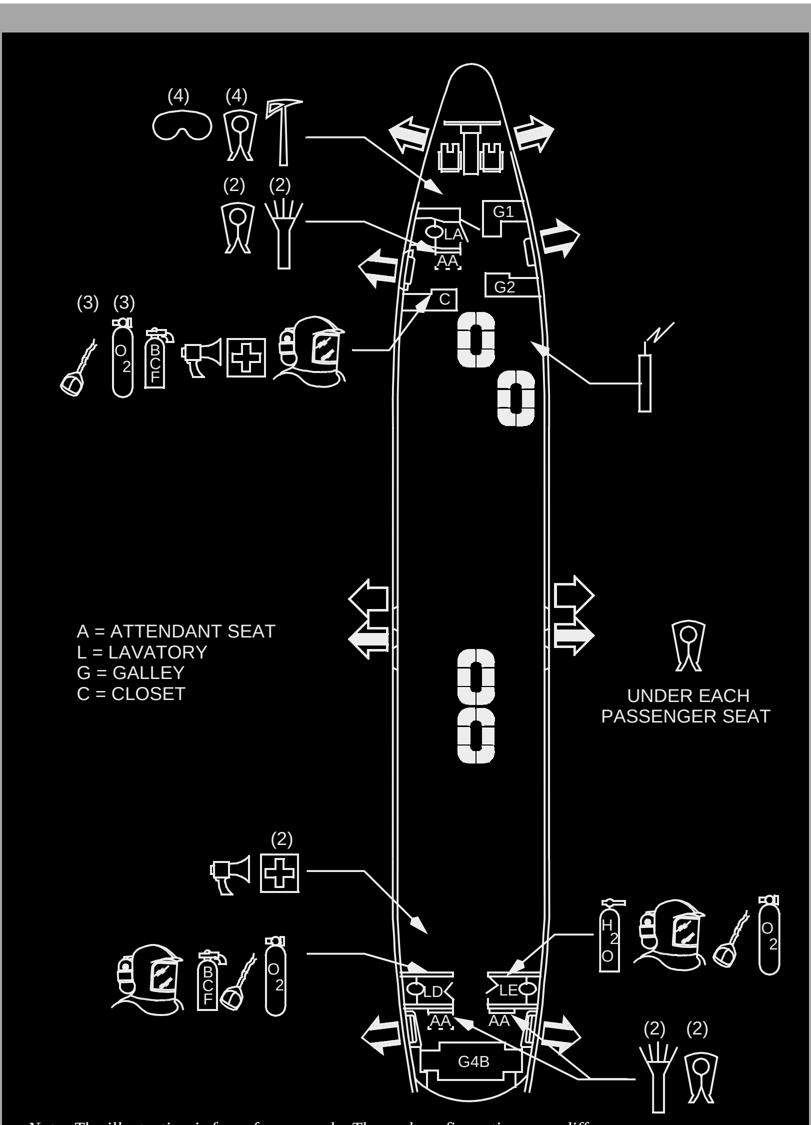
Note: The illustration is for reference only. The real configuration may differ.

YV604, YV605



Note: The illustration is for reference only. The real configuration may differ.

YV741 - YV754



Note: The illustration is for reference only. The real configuration may differ.

Doors and Windows

The airplane has two passenger entry doors, one cabin door (the flight deck/passenger cabin entry), two service doors and two cargo doors. There is also a center electrical and electronic (E/E) equipment access door and an equipment compartment access door on the bottom of the airplane.

The flight deck number two windows, one on the left and one on the right, can be opened by the flight crew.

CAUTION: Do not operate the entry or 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.

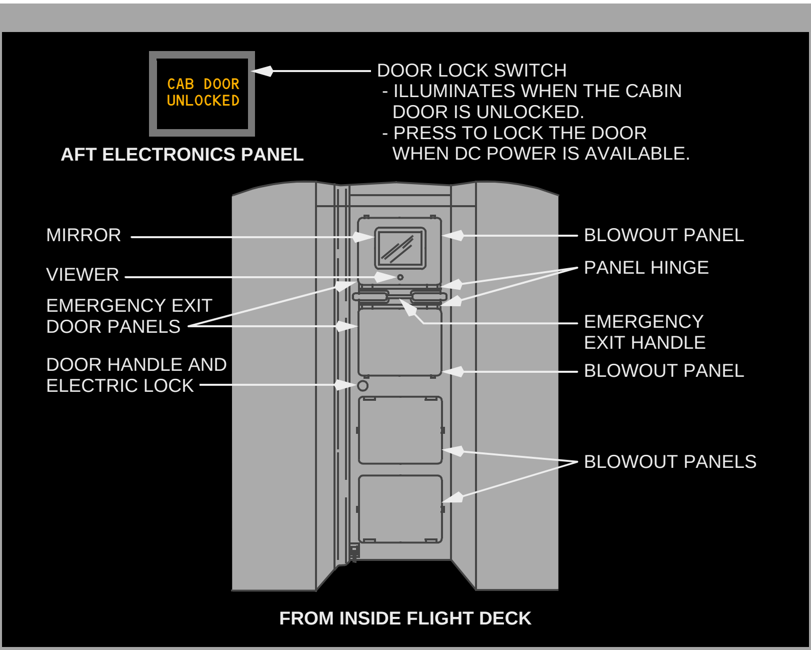
Cabin Door

YA701 - YA706

An electrical and keyed lock permits the door to be opened, closed and locked from either side. With 28 Volt DC power available, the door may be electrically locked or unlocked by pressing the door lock switch on the control stand; entrance from the passenger cabin requires a key when the door is electrically locked. The door cannot be locked without electrical power.

There are four blowout panels located in the cabin door. In the event of a sudden depressurization of the flight deck, the blowout panels hinge out from the door. This uncovers openings in the door and allows the air pressure in the flight deck and passenger cabin to equalize.

An emergency exit feature is also provided which permits the release and removal of the two upper blowout panels from the door. To operate, pull on the release handle while pressing on the panel below the release handle. Panel will not release unless both ends of handle have been pulled away from their locked position.



CABIN DOOR

Flight Deck Door

YA707 - YV754

The flight deck door meets requirements for resistance to ballistic penetration and intruder entrance. The door opens into the passenger cabin. When closed, the door locks when electrical power is available and unlocks when electrical power is removed. A viewing lens in the door allows observation of the passenger cabin. The door can be manually opened from the flight deck by turning the door handle.

The door incorporates a deadbolt with a key lock on the passenger cabin side. Rotating both concentric deadbolt levers to the locked (horizontal) position prevents the passenger cabin key from unlocking the door. Rotating only the forward deadbolt lever to locked allows the key to unlock the door.

The flight deck access system consists of an emergency access panel, chime module, three position Door Lock selector, two indicator lights, and an Access System switch. The emergency access panel includes a six button keypad for entering the numeric emergency access code along with red, amber, and green lights. The red light illuminates to indicate the door is locked. When the correct emergency access code is entered, the amber light illuminates. The green light illuminates to indicate the door is unlocked.

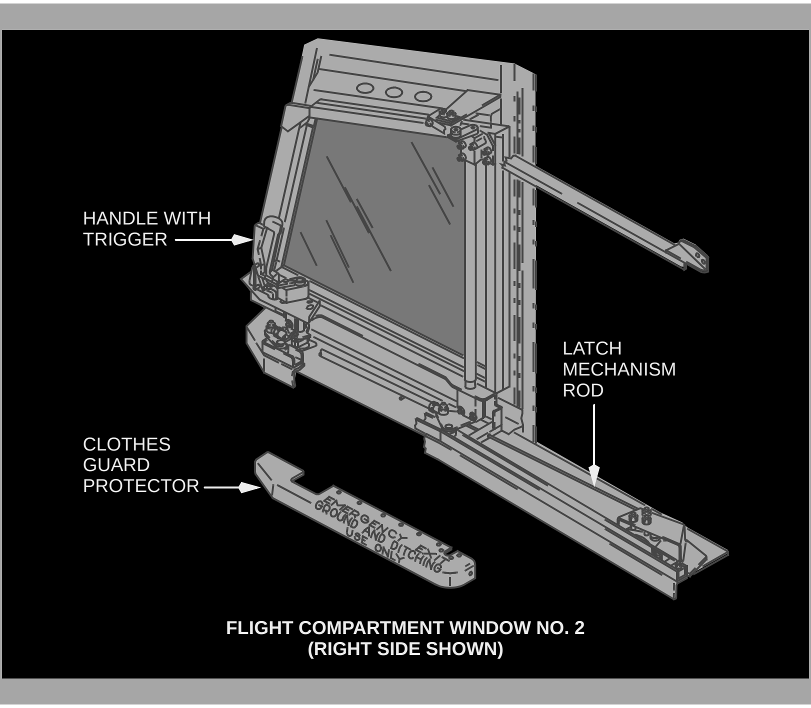
Two indicator lights and a three position Door Lock selector are located on the aisle stand. Illumination of the amber LOCK FAIL light indicates the door lock has failed or the Access System switch is in the OFF position.

The emergency access code is used to gain access to the flight deck in case of pilot incapacitation. A flight deck chime and illumination of the amber AUTO UNLK light indicates the correct emergency access code has been entered and the door is programmed to unlock after a time delay. Selecting the DENY position on the Door Lock selector denies entry and prevents further keypad entry for several minutes. To allow entry, the selector is turned to the UNLKD position which unlocks the door while held in that position. If the emergency access code is entered and the pilot takes no action, the door unlocks after expiration of the time delay. Before the door unlocks, the chime sounds continuously and the AUTO UNLK light flashes.

By pressing "1" then "ENT" keys on the emergency access panel, the flight deck chime will sound (if programmed).

The door incorporates two pressure sensors that unlock the decompression panels in the event pressurization is lost. The decompression panels have manual release pins. Pulling the pins frees the panels allowing egress in the event the door is jammed.

Flight Deck Number Two Windows



FLIGHT COMPARTMENT WINDOW NO. 2
(RIGHT SIDE SHOWN)

The flight deck number two windows can be opened on the ground or in flight and can be used for emergency evacuation. To open the window, depress the trigger and turn the handle back and inboard. After the window moves inboard, move it back until it locks in the open position.

To close the window, it must first be unlocked. Pull forward on the latch mechanism rod to unlock the window. Depress the trigger and move the window forward until the handle can be turned forward and outboard. When the trigger is released, the window latches.

Only the first officer’s window number two window can be opened from outside the airplane.

Lower Cargo Compartments

The lower cargo compartments are designed and constructed to satisfy FAA category Class C compartment requirements. This means the compartments are designed to completely confine a fire without endangering the safety of the airplane or its occupants. The compartments are sealed and pressurized but do not have fresh air circulation and temperature control as do the upper passenger compartments.

There are two cargo compartment doors on the lower right side of the fuselage. Both are plug type, inward opening pressure doors, hinged at their upper edges and operated manually from either inside or outside the airplane. Except for slight difference in shape, both doors are similar in design and operation. The door is locked closed by two latches. Each door has a balance mechanism which creates door–open force slightly more than equal to the weight of the door. The door can therefore, with little effort, be swung open. The door can be closed easily by pulling a lanyard attached to the door, grasping the handle and closing the door.

A pressure equalization valve is in the aft bulkhead of each compartment. The valves let only enough air flow into or out of the cargo compartments to keep the pressures nearly the same as the cabin pressure.

Blowout panels in the lower cargo compartments provide pressure relief at a greater rate than the pressure equalization valve in case the airplane pressurization is lost.

Emergency Escape

Emergency escape information included in this chapter includes:

- emergency evacuation routes
- flight deck windows
- escape slides
- escape straps
- emergency exit doors

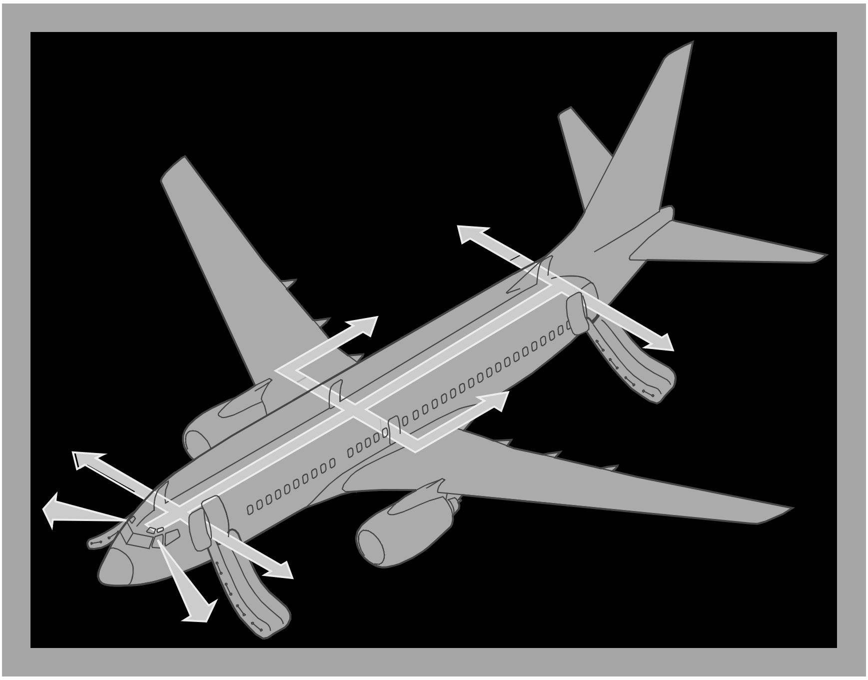
Emergency Evacuation Routes

YA701 - YA710, YM482 - YN534
Emergency evacuation may be accomplished through four entry/service doors and two overwing escape hatches. Flight deck crew members may evacuate the airplane through two sliding flight deck windows.

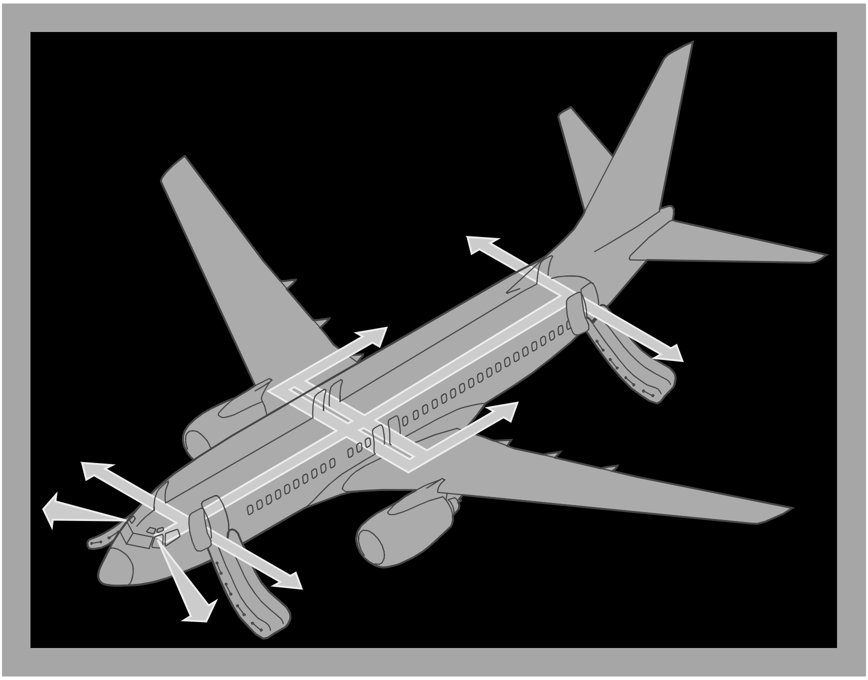
YF048 - YL551, YS151 - YV754
Emergency evacuation may be accomplished through four entry/service doors and four overwing escape hatches. Flight deck crew members may evacuate the airplane through two sliding flight deck windows.

Emergency Evacuation Routes

YA701 - YA710, YM482 - YN534



YF048 - YL551, YS151 - YV754

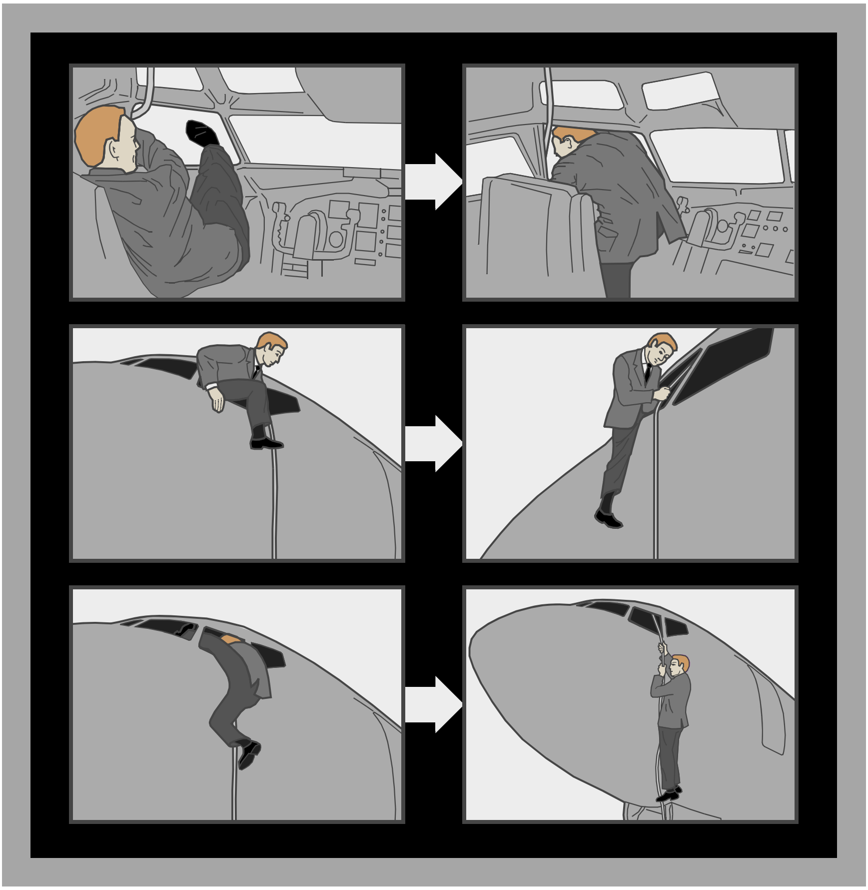


Flight Deck Window Emergency Egress

If the flight deck number two windows must be used for emergency egress, use the following procedure:

- open the window
- open the escape strap compartment (above and aft of window)
- pull on the escape strap to ensure it is securely attached
- throw the strap out the window
- sit on the window sill with upper body outside
- exit in accordance with the following illustration.

CAUTION: Ensure the escape strap is securely fastened to the airplane.

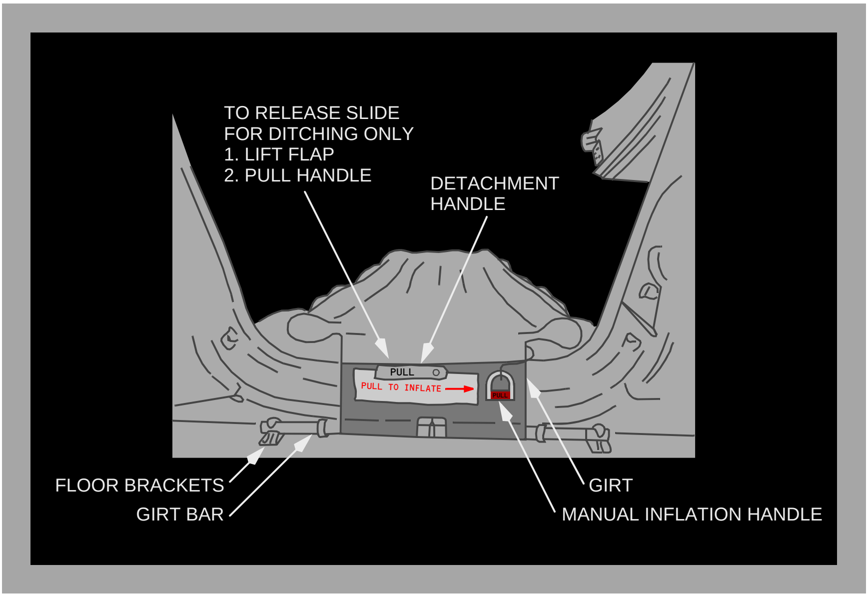


The above illustrated method of departure would probably be the easiest for most crewmembers. This technique is difficult and should be used only in extreme emergency.

Escape Slide Detachment Handle

The slide has not been certified to be part of the water landing emergency equipment. In a water environment, the slide may not properly inflate when deployed. If the deployed slide is recognized to be a potential obstruction to egress, a detachment handle is provided near the top of the slide. This handle is protected by a cover and is placarded. The escape slide is detached from the airplane by pulling the detachment handle. Once detached from the door sill, the slide is tethered to the door sill by a lanyard. A properly inflated slide could be buoyant, and useful as a flotation device for passengers in the water. Hand grips are positioned along the sides of the slide.

Escape Slide Detachment Handle



Escape Straps

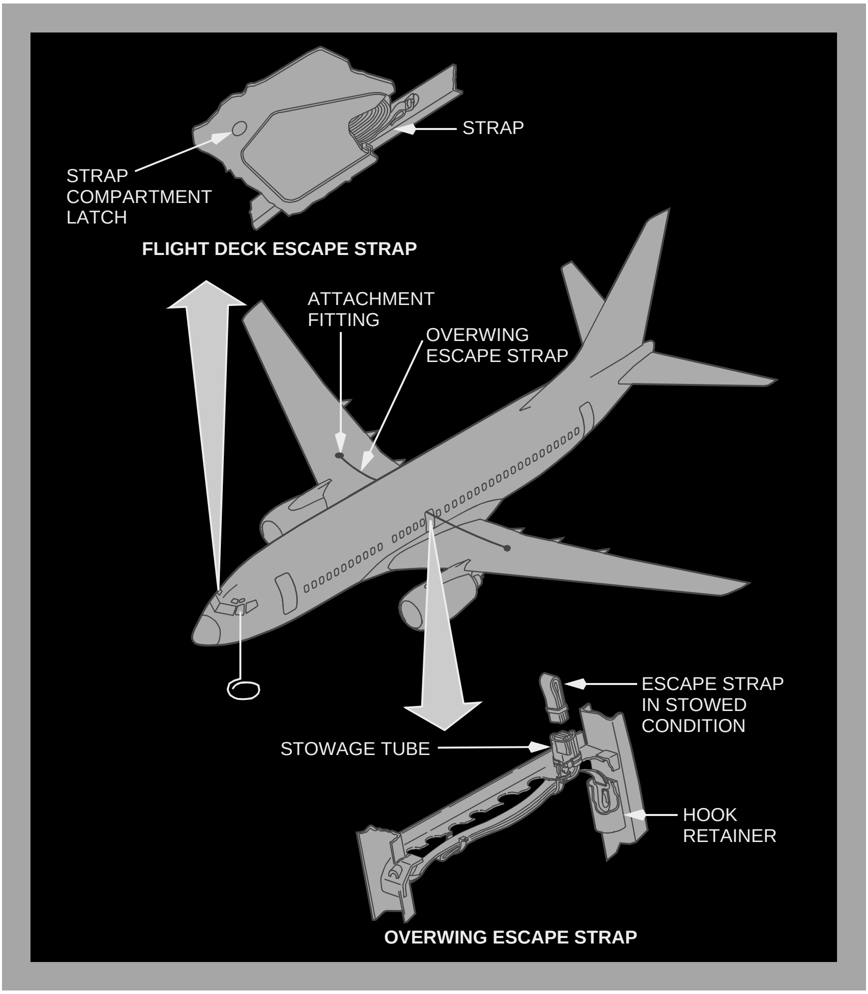
YA701 - YA710, YM482 - YN534

Escape straps are installed above each emergency exit door frame. The escape doors must be opened to expose the straps. One end of the strap is attached to the door frame. The remainder of the strap is stowed in a tube extending into the cabin ceiling. To use, the strap is pulled free from its stowage and attached to a ring on the top surface of the wing. The escape strap can be used as a hand hold in a ditching emergency for passengers to walk out on the wing and step into a life raft.

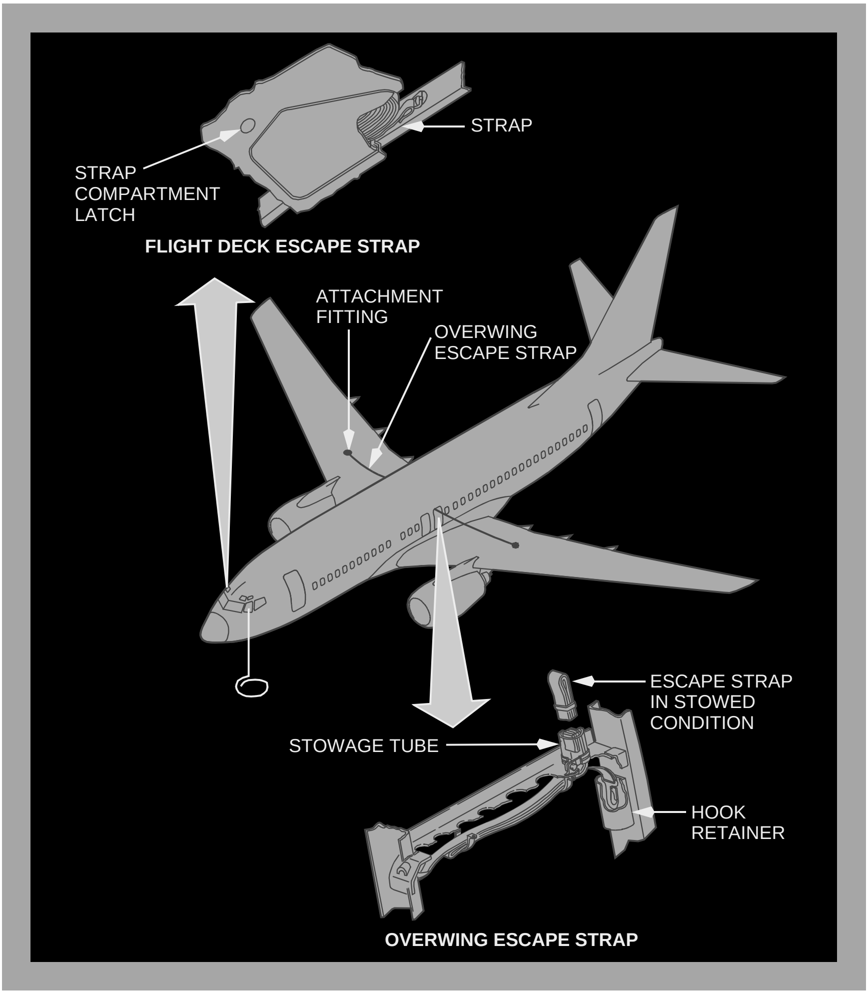
YF048 - YL551, YS151 - YV754

Escape straps are installed above each aft emergency exit door frame. The escape doors must be opened to expose the straps. One end of the strap is attached to the door frame. The remainder of the strap is stowed in a tube extending into the cabin ceiling. To use, the strap is pulled free from its stowage and attached to a ring on the top surface of the wing. The escape strap can be used as a hand hold in a ditching emergency for passengers to walk out on the wing and step into a life raft.

YA701 - YA710, YM482 - YN534



YF048 - YL551, YS151 - YV754



Emergency Exit Doors

YA701 - YA710, YM482 - YN534

Two Type III emergency exits are located in the passenger cabin over the wings. These are canopy-type doors and are held in place by mechanical locks and airplane cabin pressure.

YF048 - YL551, YS151 - YV754

Four Type III emergency exits are located in the passenger cabin over the wings. These are canopy-type doors and are held in place by mechanical locks and airplane cabin pressure.

The overwing exit doors can be opened from inside or outside of the airplane by a spring–loaded handle at the top of the door. The 28 Volt DC flight lock system is designed to ensure that the flight lock will automatically lock during takeoff, in-flight, and landing and unlock on the ground to allow for opening of the door in emergency situations. Commands for the flight lock to lock and unlock are dependent upon engine speed, thrust lever position, air/ground mode status, and the open/closed status of the doors.

The overwing emergency exits lock when:

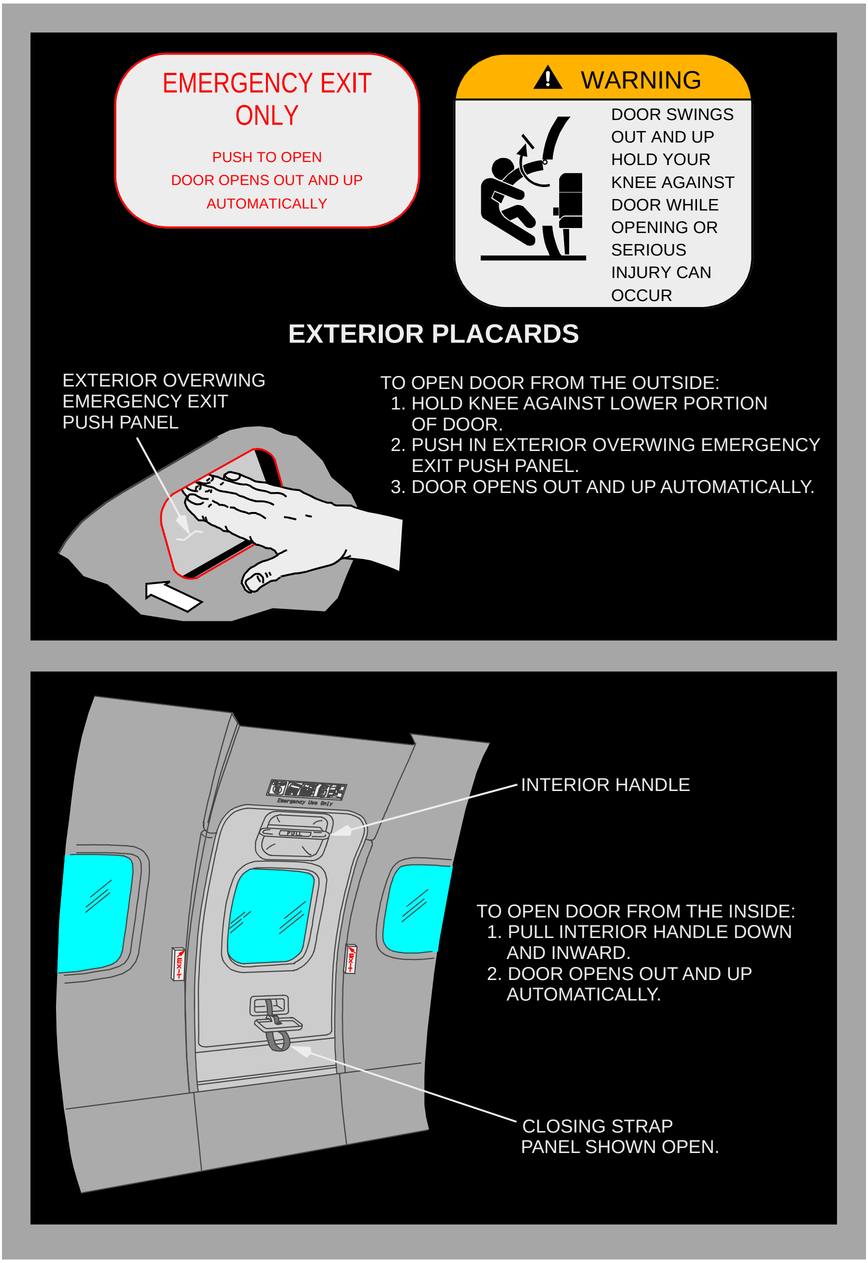
- three of the four Entry/Service doors are closed and
- either engine is running and
- the airplane air/ground logic indicates that the airplane is in the air or both thrust levers are advanced.

The overwing emergency exits unlock when any one of the above conditions is not met or DC power is lost.

The LEFT OVERWING and/or RIGHT OVERWING warning lights, DOORS annunciator, and MASTER CAUTION light illuminate when an emergency exit door is not fully closed and locked or when the flight lock is not engaged, either during the takeoff roll or in-flight.

If a flight lock has failed locked or a fault is detected the PSEU light, the OVERHEAD annunciator, and the MASTER CAUTION lights illuminate. These indications are inhibited from takeoff until 30 seconds after the airplane is in the ground mode. When the doors are latched and locked and the flight lock is operating properly none of these lights will illuminate.

YA701 - YA710, YM482 - YN534



EXTERIOR PLACARDS

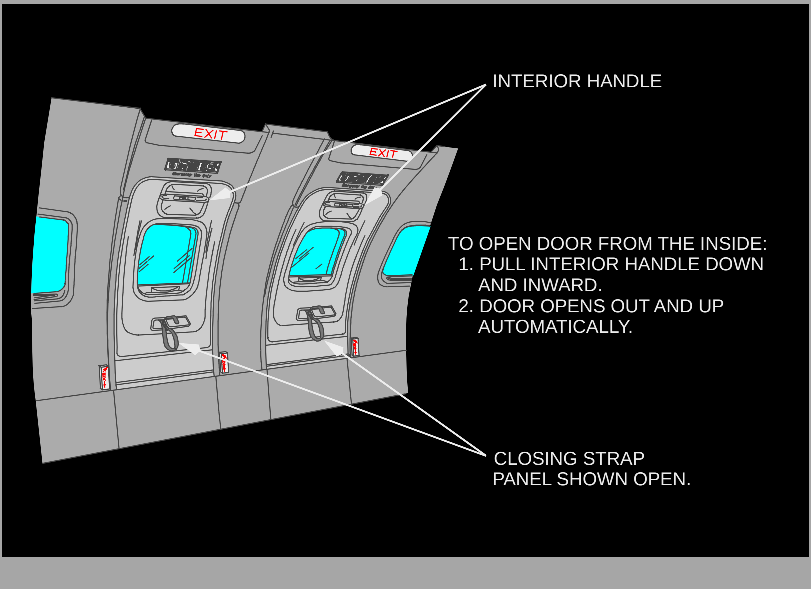
TO OPEN DOOR FROM THE OUTSIDE:
1. HOLD KNEE AGAINST LOWER PORTION OF DOOR.
2. PUSH IN EXTERIOR OVERWING EMERGENCY EXIT PUSH PANEL.
3. DOOR OPENS OUT AND UP AUTOMATICALLY.

TO OPEN DOOR FROM THE INSIDE:
1. PULL INTERIOR HANDLE DOWN AND INWARD.
2. DOOR OPENS OUT AND UP AUTOMATICALLY.

YF048 - YL551, YS151 - YV754

TO OPEN DOOR FROM THE OUTSIDE:

1. HOLD KNEE AGAINST LOWER PORTION OF DOOR.
2. PUSH IN EXTERIOR OVERWING EMERGENCY EXIT PUSH PANEL.
3. DOOR OPENS OUT AND UP AUTOMATICALLY.



TO OPEN DOOR FROM THE INSIDE:

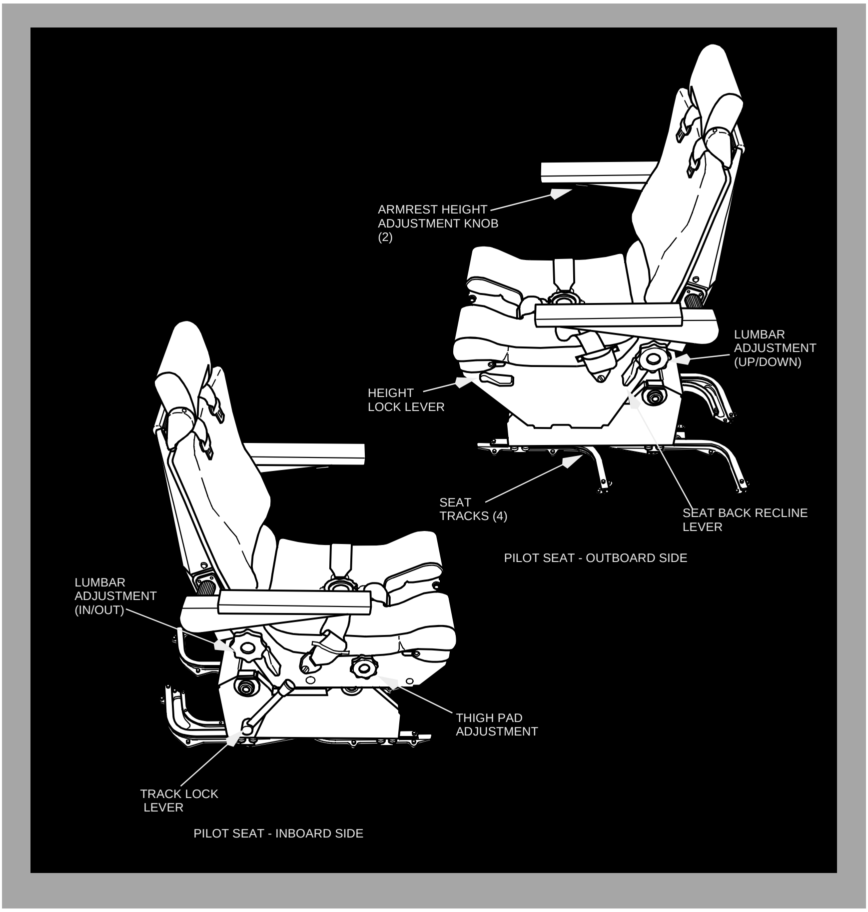
1. PULL INTERIOR HANDLE DOWN AND INWARD.
2. DOOR OPENS OUT AND UP AUTOMATICALLY.

Pilot Seat

The captain and first officer seats are adjustable. The following controls are provided:

- Seat height
- Thigh pad position
- Seat recline
- Armrest height and stowage
- Back cushion (lumbar support) position
- Headrest position

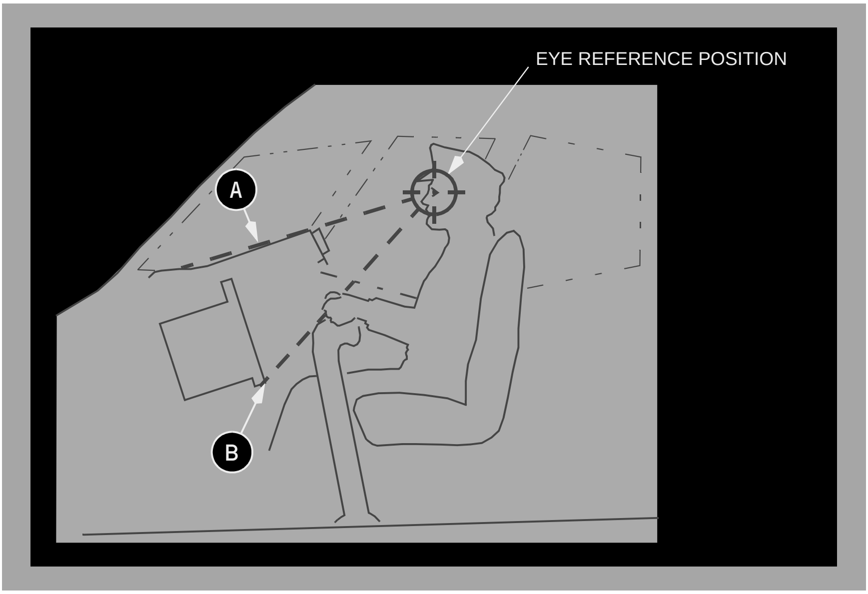
Four units hold the base of the seat to the aircraft seat tracks. A spring-loaded track lock lever mechanism sets fore and aft movement on the seat tracks.



Pilot Seat Adjustment

Adjust the seat position with the appropriate controls to obtain the optimum eye reference position. Use the handhold above the forward window to assist. The following sight references are used:

- Sight along the upper surface of the glareshield with a small amount of the airplane nose structure visible (A)
- Sight over the control column (in the neutral position) until the bottom edge of the outboard display unit is visible (B).



Galleys

Galleys are located in the passenger cabin to provide convenient and rapid service to the passengers. Generally, they are installed in the cabin adjacent to the forward and aft galley service doors.

In general the equipment of the galley unit consists of the following main items:

- high speed ovens
- hot beverage containers
- hot cup receptacles
- main storage compartments.

Electrical control panel switches and circuit breakers to operate the above equipment are conveniently located within the galley work area. Storage space, miscellaneous drawers and waste containers are also integrated in the galley units.

Electrical Power

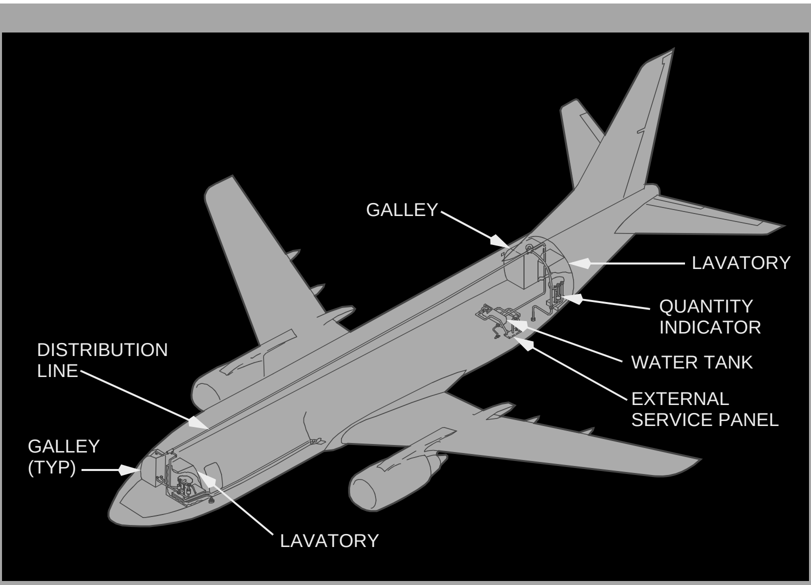
Electricity for the galleys is 115V AC supplied from the airplane transfer buses and controlled by a switch on the overhead panel. Circuit breakers are located in the lower E/E bay as part of the power distribution panels.

Water Service

Water is supplied to the galleys from the airplane pressurized water system and, in an emergency, may be shut off at the galley.

Water System

The potable airplane water system is supplied from a single tank located behind the aft cargo compartment. Fresh water is supplied to the galleys and lavatory sinks.



WATER SYSTEM

Quantity Indication and System Operation

A quantity indicator is located on the attendant panel. The system is pressurized by engine bleed air or by the water system air compressor. Shutoff valves are located on each galley and below the sink in each lavatory. The drain position of this valve is used to drain all water overboard. Normally, the drain shutoff valves are ON.

Hot Water

Hot and cold water is available in all lavatories. The water heater is located below the lavatory sink. When emptied, it heats a new water charge in four minutes. An amber light is ON when the heater is operating normally. The heater has an overheat switch which turns off the heating element if an excess temperature is reached. The heater may be turned off at any time by using a manual switch on the heater. Cold water is supplied at the galleys.

Servicing

The system is serviced from an exterior panel located on the bottom right side of the aft fuselage. Pressure filling is required. Waste water from the galleys and lavatory wash basins is drained overboard through two heated drain masts. The drain mast are on the bottom of the fuselage; one forward and one aft.

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Air Systems — Chapter 2
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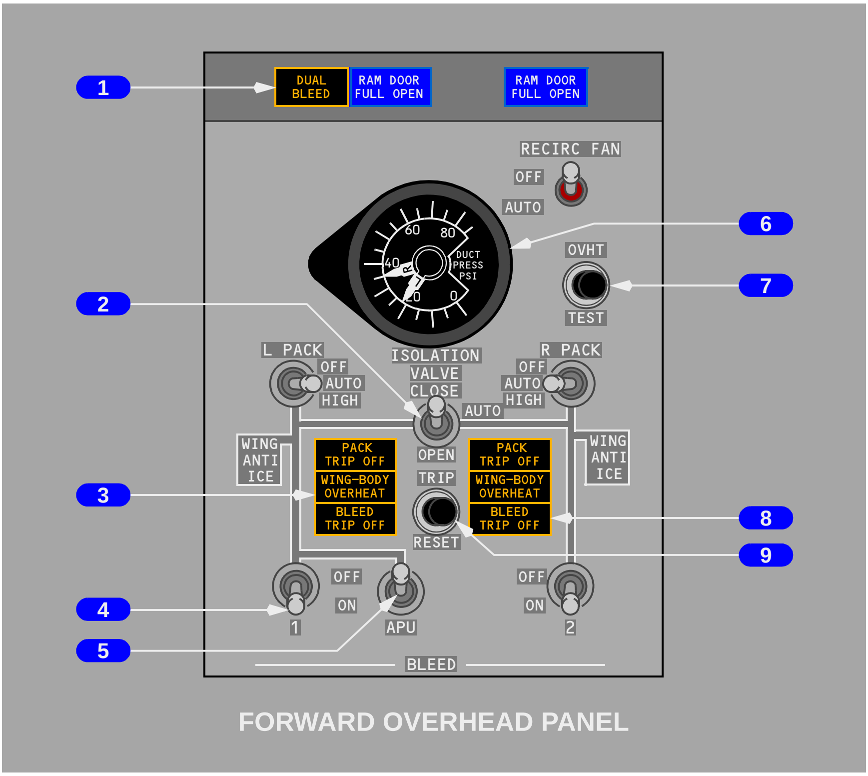
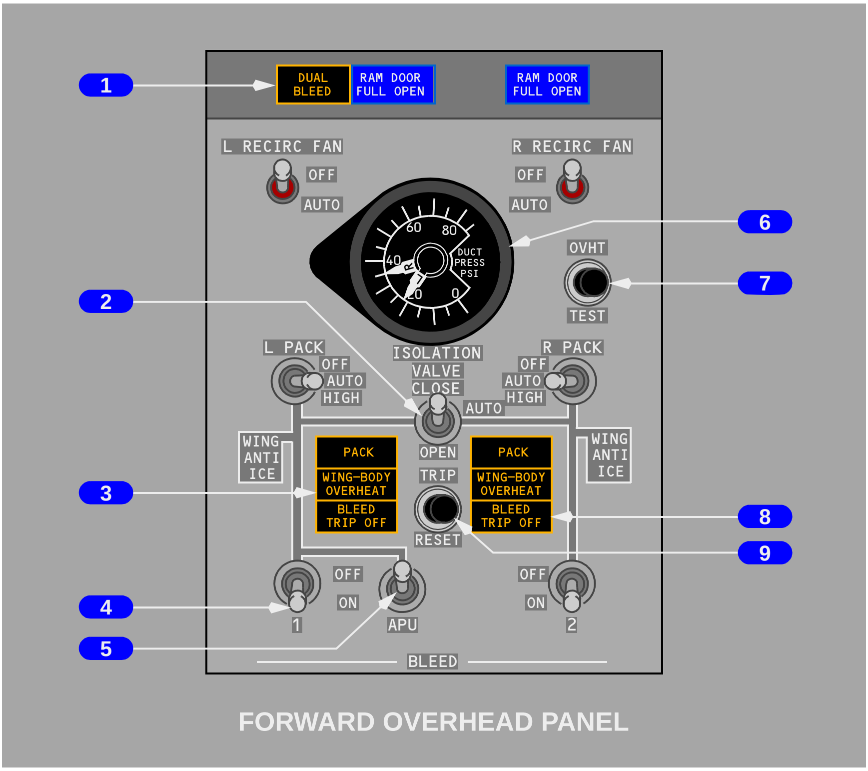
Bleed Air Controls and Indicators

YA701 - YA710, YM482 - YN534



YF048 - YL551, YS151 - YV754



FORWARD OVERHEAD PANEL

1 DUAL BLEED Light

Illuminated (amber) – APU bleed air valve open and engine No. 1 BLEED air switch ON, or engine No. 2 BLEED air switch ON, APU bleed air valve and isolation valve open.

2 ISOLATION VALVE Switch

CLOSE – closes isolation valve.

AUTO –

- closes isolation valve if both engine BLEED air switches are ON and both air conditioning PACK switches are AUTO or HIGH
- opens isolation valve automatically if either engine BLEED air or air conditioning PACK switch positioned OFF.

OPEN – opens isolation valve.

3 WING–BODY OVERHEAT Light

Illuminated (amber) –

- left light indicates overheat from bleed air duct leak in left engine strut, left inboard wing leading edge, left air conditioning bay, keel beam or APU bleed air duct
- right light indicates overheat from bleed air duct leak in right engine strut, right inboard wing leading edge or right air conditioning bay.

4 Engine BLEED Air Switches

OFF – closes engine bleed air valve.

ON – opens engine bleed air valve when engines are operating.

5 APU BLEED Air Switch

OFF – closes APU bleed air valve.

ON – opens APU bleed air valve when APU is operating.

6 Bleed Air DUCT PRESSURE Indicator

Indicates pressure in L and R (left and right) bleed air ducts.

7 Wing–Body Overheat (OVHT) TEST Switch

Push –

- tests wing–body overheat detector circuits
- illuminates both WING–BODY OVERHEAT lights.

8 BLEED TRIP OFF Light

Illuminated (amber) – excessive engine bleed air temperature or pressure

- related engine bleed air valve closes automatically
- requires reset.

9 TRIP RESET Switch

Push (if fault condition is corrected) –

YA701 - YA710, YM482 - YN534

- resets BLEED TRIP OFF, PACK TRIP OFF or DUCT OVERHEAT lights
- related engine bleed air valve opens, or related pack valve opens, or related air mix valve opens

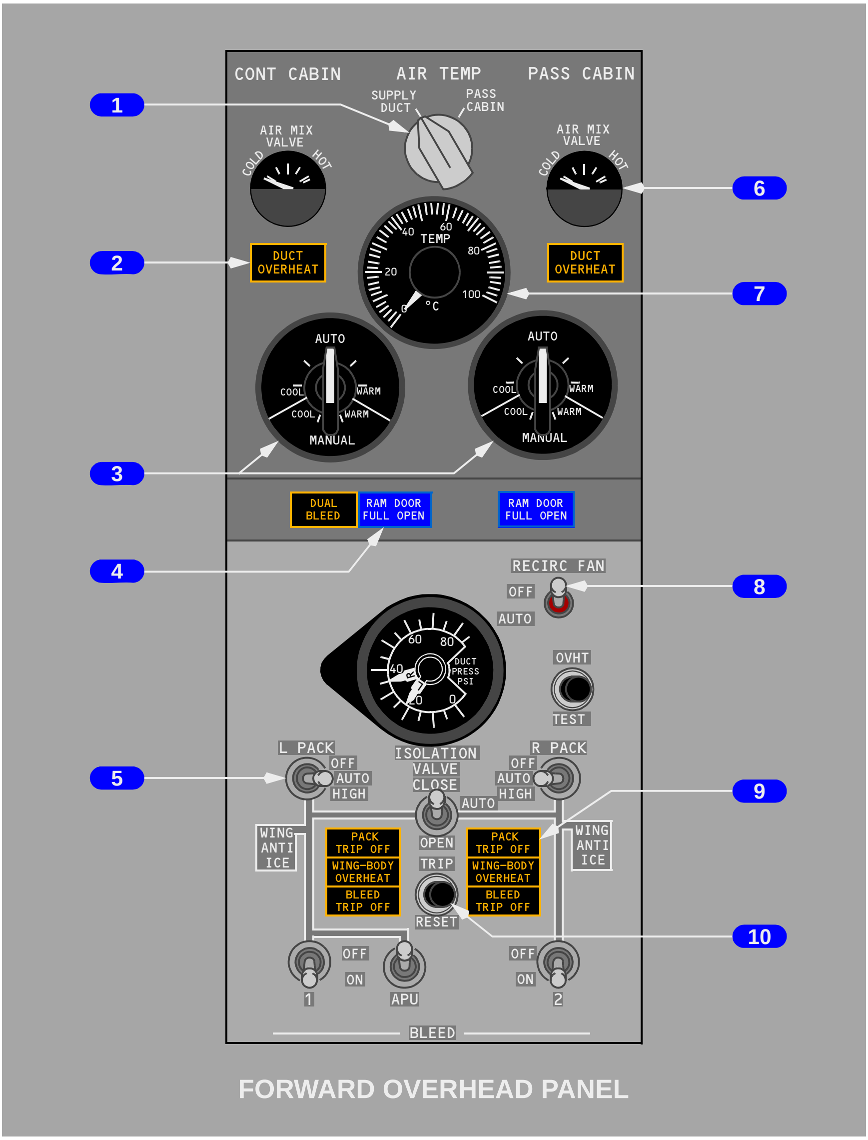
YF048 - YL551, YS151 - YV754

- resets BLEED TRIP OFF, PACK or ZONE TEMP lights
- related engine bleed air valve opens, or related pack valve opens, or related trim air modulating valve opens

Lights remain illuminated until reset.

Air Conditioning Controls and Indicators

YA701 - YA710, YM482 - YN534



1 AIR Temperature (TEMP) Source Selector

SUPPLY DUCT – selects main distribution supply duct sensor for TEMP indicator.

PASS CABIN – selects passenger cabin sensor for TEMP indicator.

2 DUCT OVERHEAT Light

Illuminated (amber) –

- distribution air temperature in related duct exceeds limit
- air mix valves drive full cold
- requires reset.

3 Control (CONT) CABIN and Passenger (PASS) CABIN Temperature Selector

AUTO – automatic temperature controller controls passenger cabin or flight deck temperature as selected.

MANUAL – air mix valves controlled manually. Automatic temperature controller bypassed.

4 RAM DOOR FULL OPEN Light

Illuminated (blue) – indicates ram door in full open position.

5 Air Conditioning PACK Switch

OFF – pack signaled OFF.

AUTO –

- with both packs operating, each pack regulates to low flow
- with one pack operating, operating pack regulates to high flow in flight with flaps up
- when operating one pack from APU (both engine BLEED air switches OFF), regulates to high flow.

HIGH –

- pack regulates to high flow
- provides maximum flow rate on ground with APU BLEED air switch ON.

6 AIR MIX VALVE Indicator

Indicates position of air mix valves:

- controlled automatically with related temperature selector in AUTO
- controlled manually with related temperature selector in MANUAL.

7 Air Temperature (TEMP) Indicator

Indicates temperature at location selected with AIR TEMP source selector.

8 Recirculation (RECIRC) FAN Switch

OFF - fan signaled off.

AUTO – fan signaled on except when both packs operating with either PACK switch in HIGH.

9 PACK TRIP OFF Light

Illuminated (amber) –

- indicates pack temperature has exceeded limits
- related pack valve automatically closes and mix valves drive full cold
- requires reset.

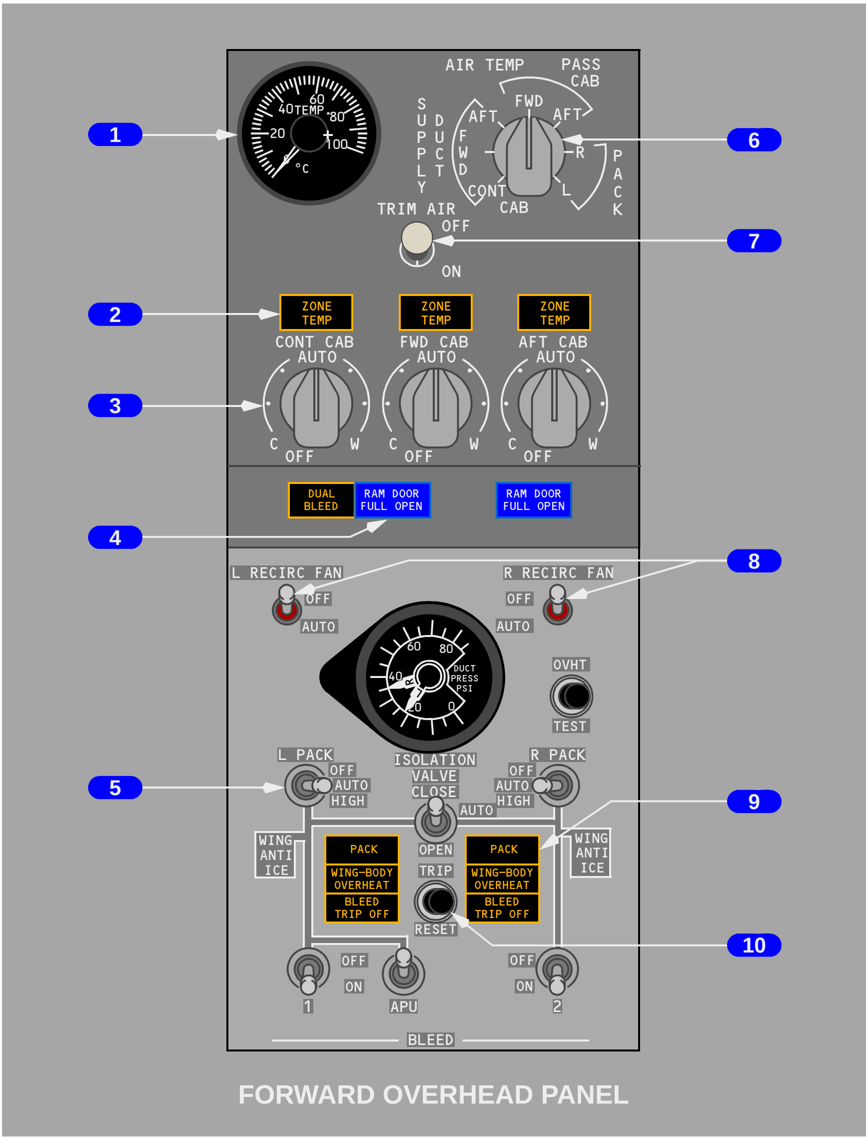
10 TRIP RESET Switch

Push (if fault condition is corrected) –

- resets BLEED TRIP OFF, PACK TRIP OFF or DUCT OVERHEAT lights
- related engine bleed air valve opens, or related pack valve opens, or related air mix valve opens

Lights remain illuminated until reset.

YF048 - YL551, YS151 - YV754



1 Air Temperature (TEMP) Indicator

Indicates temperature at location selected with AIR TEMP source selector.

2 ZONE TEMP Lights

Illuminated (amber) –

- CONT CAB indicates a duct temperature overheat or failure of the flight deck primary and standby temperature control
- FWD CAB or AFT CAB indicates duct temperature overheat.

During Master Caution light recall:

- CONT CAB indicates failure of the flight deck primary or standby temperature control
- either FWD CAB or AFT CAB indicates failure of the associated zone temperature control
- lights will extinguish when Master Caution is reset.

3 Temperature Selector

AUTO – provides automatic temperature control for the associated zones. Rotating the control toward C (cool) or W (warm) manually sets the desired temperature.

OFF – closes the associated trim air modulating valve.

4 RAM DOOR FULL OPEN Light

Illuminated (blue) – indicates ram door in full open position.

5 Air Conditioning PACK Switch

OFF – pack signaled OFF.

AUTO –

- with both packs operating, each pack regulates to low flow
- with one pack operating, operating pack regulates to high flow in flight with flaps up
- when operating one pack from APU (both engine BLEED air switches OFF), regulates to high flow.

HIGH –

- pack regulates to high flow
- provides maximum flow rate on ground with APU BLEED air switch ON.

6 AIR Temperature (TEMP) Source Selector

SUPPLY DUCT – selects appropriate zone supply duct temperature

PASS CAB – selects forward or aft passenger cabin temperature

PACK – selects left or right pack temperatures.

7 TRIM AIR Switch

ON - trim air pressure regulating and shutoff valve signaled open.

OFF - trim air pressure regulating and shutoff valve signaled closed.

8 Recirculation (RECIRC) FAN Switches

OFF - fan signaled off.

AUTO –

- in-flight –
  - the left recirculation fan operates if both packs are operating unless either PACK switch is in HIGH
  - the right recirculation fan operates if both packs are operating unless both PACK switches are in HIGH.
- on the ground –
  - the left recirculation fan operates unless both PACK switches are in HIGH
  - the right recirculation fan operates even if both PACK switches are in HIGH.

9 PACK Light

Illuminated (amber) –

- indicates pack trip off or failure of both primary and standby pack controls
- during Master Caution recall, indicates failure of either primary or standby pack control. Extinguishes when Master Caution is reset

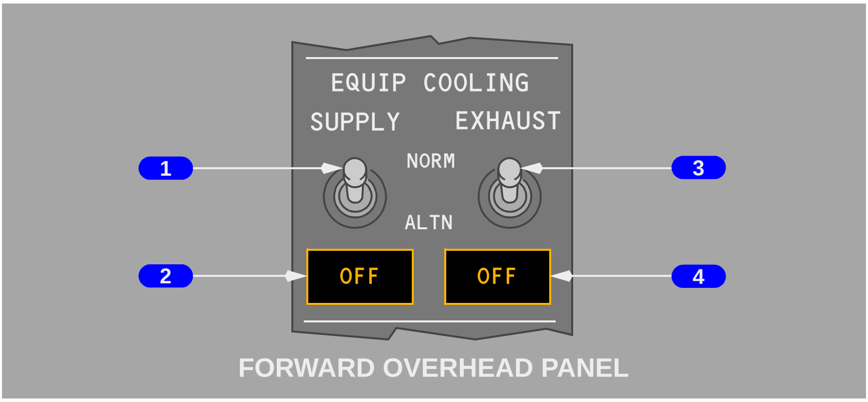
10 TRIP RESET Switch

Push (if fault condition is corrected) –

- resets BLEED TRIP OFF, PACK or ZONE TEMP lights
- related engine bleed air valve opens, or related pack valve opens, or related trim air modulating valve opens

Lights remain illuminated until reset.

Equipment Cooling Panel



1 Equipment (EQUIP) COOLING SUPPLY Switch

NORM – normal cooling supply fan activated.

ALTN – alternate cooling supply fan activated.

2 Equipment Cooling Supply OFF Light

Illuminated (amber) – no airflow from selected cooling supply fan.

3 Equipment (EQUIP) COOLING EXHAUST Switch

NORM – normal cooling exhaust fan activated.

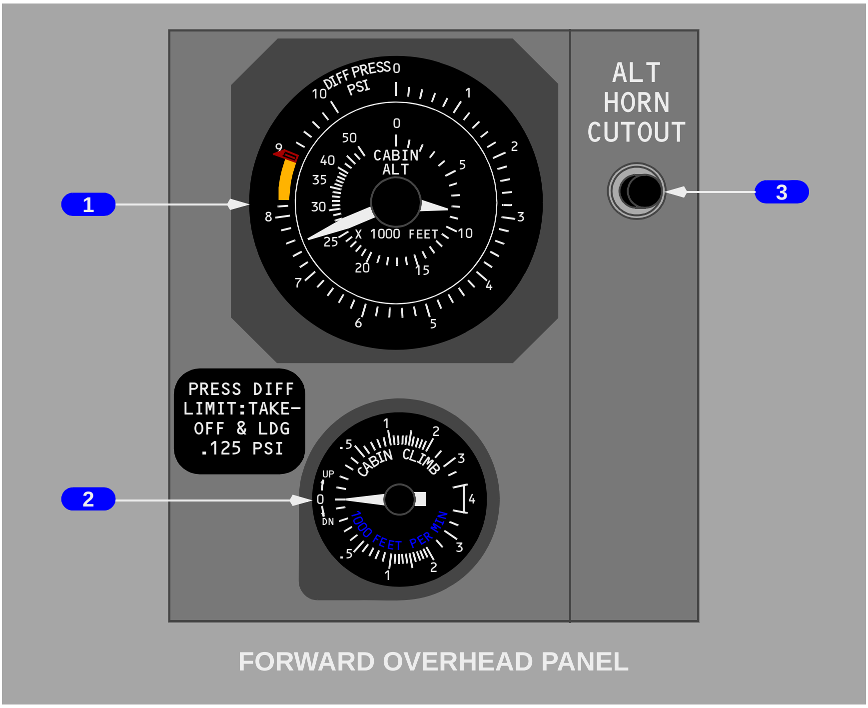
ALTN – alternate cooling exhaust fan activated.

4 Equipment Cooling Exhaust OFF Light

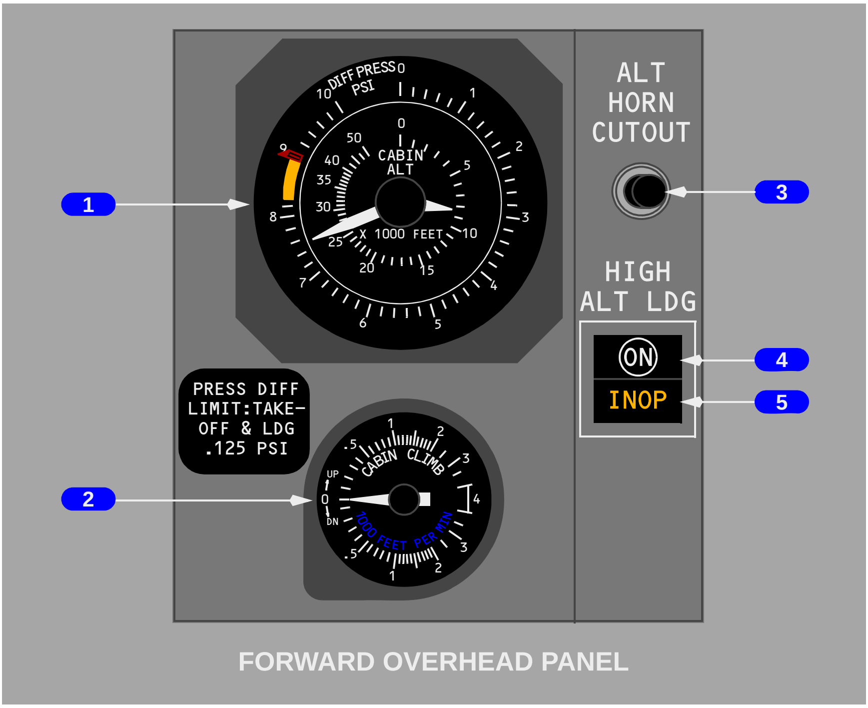
Illuminated (amber) – no airflow from selected cooling exhaust fan.

Cabin Altitude Panel

YA701 - YM484, YS151 - YV754



YN531 - YN534



1 CABIN Altimeter (ALT)/Differential Pressure (DIFF PRESS) Indicator

Inner Scale – indicates cabin altitude in feet.

Outer Scale – indicates differential pressure between cabin and ambient in psi.

2 CABIN Rate of CLIMB Indicator

Indicates cabin rate of climb or descent in feet per minute.

3 Altitude (ALT) HORN CUTOUT Switch

Push –

- cuts out intermittent cabin altitude warning horn
- altitude warning horn sounds when cabin exceeds 10,000 feet altitude.

YN531 - YN534

4 High Altitude Landing Switch

ON (white) – reprograms initiation of cabin altitude warning annunciation from 10,000 to 15,200 feet.

Off – (ON not visible)

- reprograms cabin pressurization from high altitude to normal operation
- extinguishes INOP light

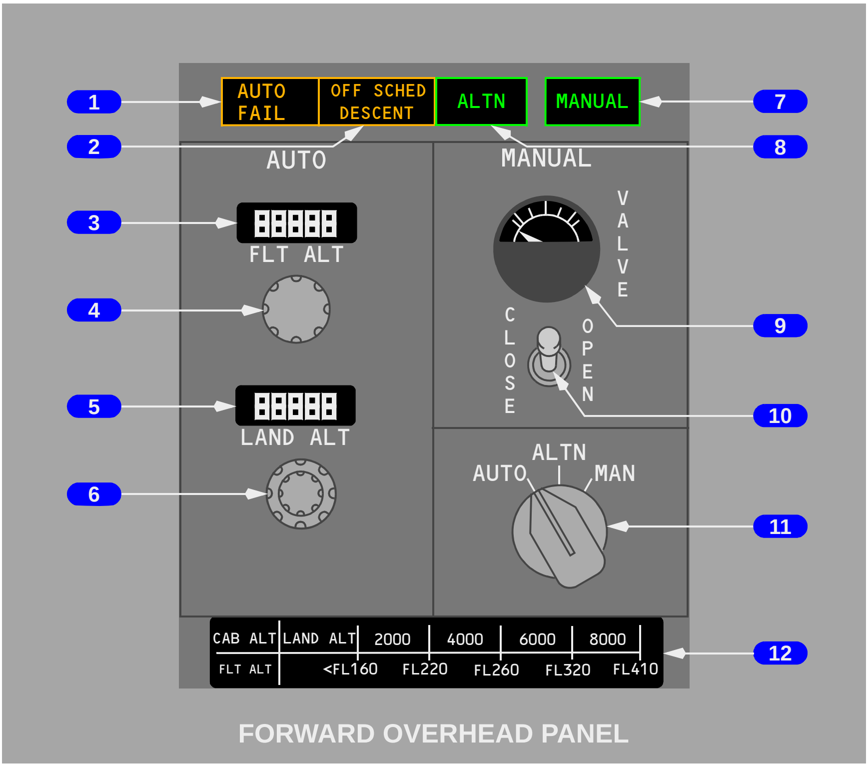
YN531 - YN534

5 High Altitude Landing INOP Light

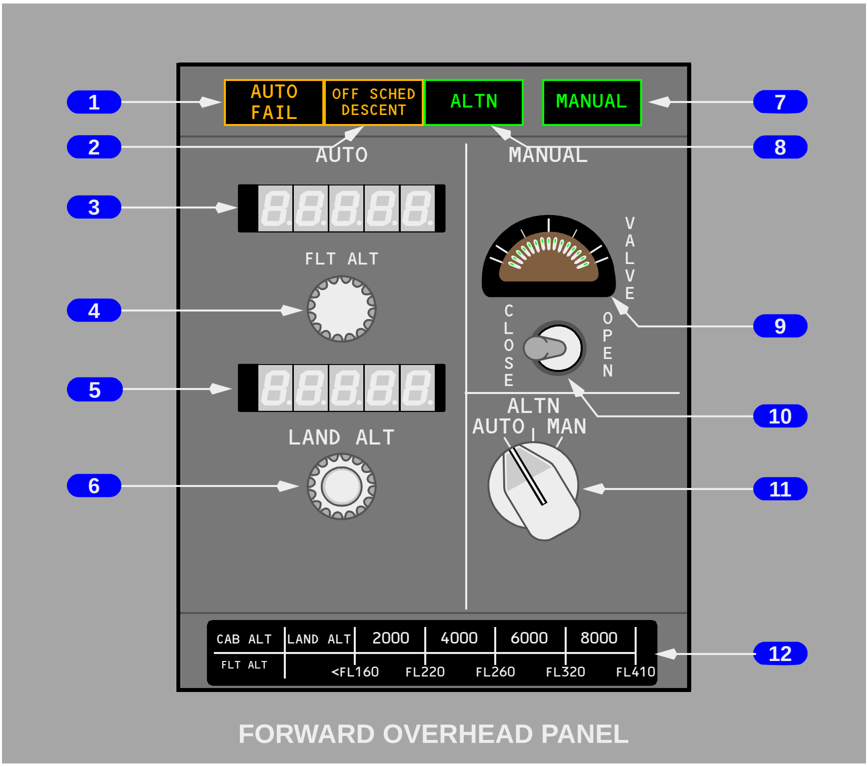
Illuminated (amber) – indicates high altitude landing system fault.

Cabin Pressurization Panel

YA701 - YS170



YS171 - YV754



1 AUTO FAIL Light

Illuminated (amber) – automatic pressurization system failure detected:

- indicates a single controller failure when ALTN light is also illuminated
- indicates a dual controller failure when illuminated alone.

2 OFF Schedule (SCHED) DESCENT Light

Illuminated (amber) – airplane descended before reaching the planned cruise altitude set in the FLT ALT indicator.

3 Flight Altitude (FLT ALT) Indicator

- indicates selected cruise altitude
- set before takeoff.

Note: A panel failure detected after a DC power interruption will result in the display of "88888" or all dashes. If cabin altitude and cabin rate are normal, automatic control of cabin pressure is not affected by the failure.

Note: FLT ALT indicator failure may result in the display of non-numbers or a blank display. If the indicator cannot be changed by rotating the flight altitude selector, it may be necessary to monitor the pressurization system to ensure normal operation, especially during climb and descent.

4 Flight Altitude Selector

Rotate – set planned cruise altitude (-1,000 ft. to 42,000 ft. in 500 ft. increments).

5 Landing Altitude (LAND ALT) Indicator

- indicates altitude of intended landing field
- set before takeoff.

Note: A panel failure detected after a DC power interruption will result in the display of "88888" or all dashes. If cabin altitude and cabin rate are normal, automatic control of cabin pressure is not affected by the failure.

Note: LAND ALT indicator failure may result in the display of non-numbers or a blank display. If the indicator cannot be changed by rotating the flight altitude selector, it may be necessary to monitor the pressurization system to ensure normal operation, especially during climb and descent.

6 Landing Altitude Selector

Rotate – select planned landing field altitude. (-1,000 ft. to 14,000 ft. in 50 ft. increments).

7 MANUAL Light

Illuminated (green) – pressurization system operating in the manual mode.

8 Alternate (ALTN) Light

Illuminated (green) – pressurization system operating in the alternate automatic mode:

- Illumination of both ALTN and AUTO FAIL lights indicates a single controller failure and automatic transfer to ALTN mode
- pressurization mode selector in ALTN position.

9 Outflow VALVE Position Indicator

- indicates position of outflow valve
- operates in all modes.

10 Outflow Valve Switch (spring–loaded to center)

CLOSE – closes outflow valve electrically with pressurization mode selector in MAN position.

OPEN – opens outflow valve electrically with pressurization mode selector in MAN position.

11 Pressurization Mode Selector

AUTO – pressurization system controlled automatically.

ALTN – pressurization system controlled automatically using ALTN controller.

MAN –

- pressurization system controlled manually by outflow valve switch
- both auto controllers bypassed.

12 Cabin /Flight Altitude (CAB ALT)(FLT ALT) Placard

Used to determine setting for cabin altitude when operating in manual mode.

Intentionally
Blank

Introduction

Air for the bleed air system can be supplied by the engines, APU, or an external air cart/source. The APU or external cart supplies air to the bleed air duct prior to engine start. After engine start, air for the bleed air system is normally supplied by the engines.

The following systems rely on the bleed air system for operation:

- Air conditioning/pressurization
- Wing and engine thermal anti-icing
- Engine starting
- Hydraulic reservoirs pressurization
- Water tank pressurization

Switches on the air conditioning panel operate the APU and engine bleed air supply system.

Engine Bleed System Supply

Engine bleed air is obtained from the 5th and 9th stages of the compressor section. When 5th stage low pressure bleed air is insufficient for the bleed air system requirements, the high stage valve modulates open to maintain adequate bleed air pressure. During takeoff, climb, and most cruise conditions, low pressure bleed air from the 5th stage is adequate and the high stage valve remains closed.

Engine Bleed Air Valves

The engine bleed air valve acts as a pressure regulator and shutoff valve. With the engine bleed air switch ON, the valve is DC activated and pressure operated. The valve maintains proper system operating pressure and reduces bleed air outflow in response to high bleed air temperature.

Bleed Trip Sensors

Bleed trip sensors illuminate the respective BLEED TRIP OFF light when engine bleed air temperature or pressure exceeds a predetermined limit. The respective engine bleed air valve closes automatically.

Duct Pressure Transmitters

Duct pressure transmitters provide bleed air pressure indications to the respective (L and R) pointers on the bleed air duct pressure indicator. The indicator is AC operated. Differences between L and R duct pressure on the bleed air duct pressure indicator are considered normal as long as there is sufficient air for cabin pressurization.

Isolation Valve

The isolation valve isolates the left and right sides of the bleed air duct during normal operations. The isolation valve is AC operated.

With the isolation valve switch in AUTO, both engine bleed air switches ON, and both air conditioning pack switches AUTO or HIGH, the isolation valve is closed. The isolation valve opens if either engine bleed air switch or air conditioning pack switch is positioned OFF. Isolation valve position is not affected by the APU bleed air switch.

External Air Connection

An external air cart/source provides an alternate air source for engine start or air conditioning.

APU Bleed Air Valve

The APU bleed air valve permits APU bleed air to flow to the bleed air duct. The valve closes automatically when the APU is shut down. The APU bleed air valve is DC controlled and pressure operated.

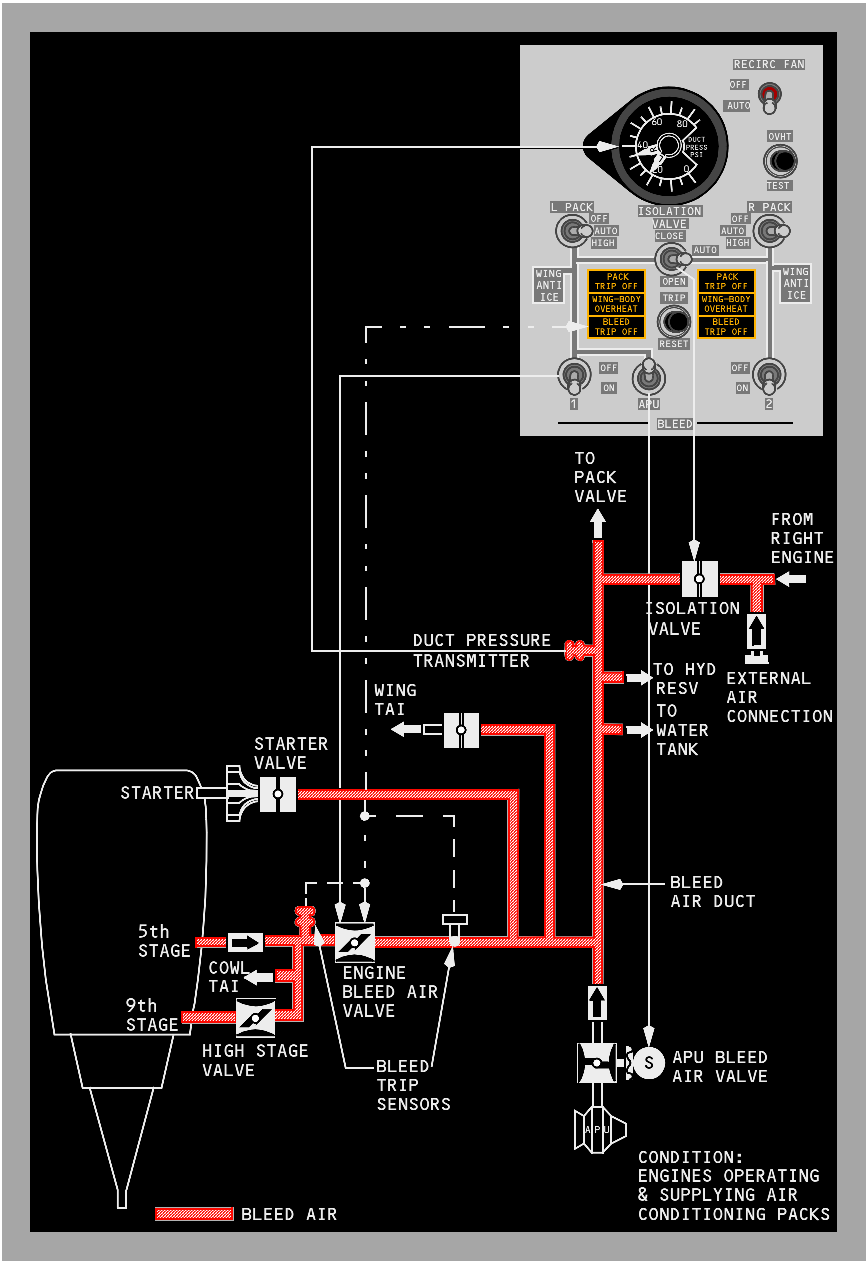
With both the APU and engine bleed air valves open, and the engines operating at idle thrust, there is a possibility of APU bleed air back-pressuring the 9th stage modulating and shutoff valve. This would cause the 9th stage valve to close.

DUAL BLEED Light

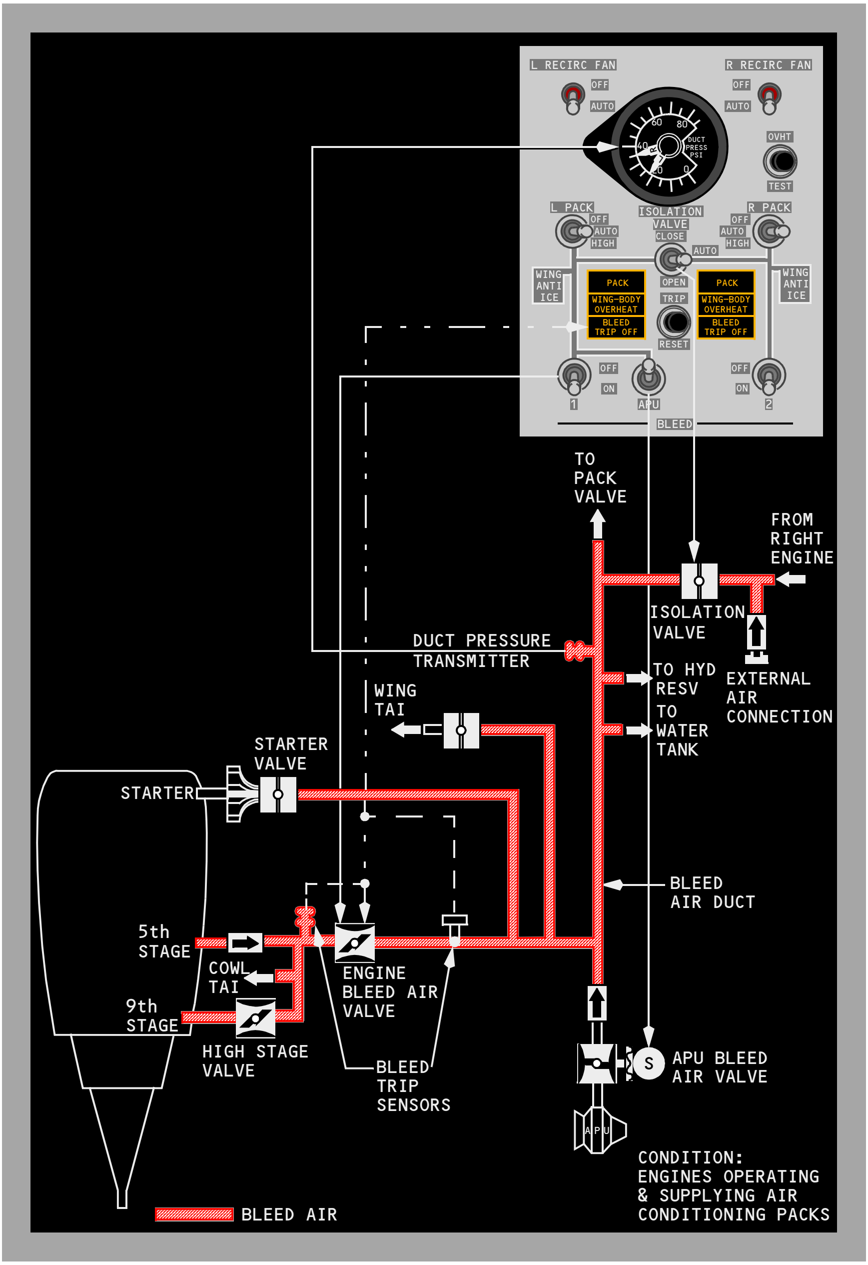
The DUAL BLEED light illuminates whenever the APU bleed air valve is open and the position of the engine bleed air switches and isolation valve would permit possible backpressure of the APU. Therefore, thrust must be limited to idle with the DUAL BLEED light illuminated.

Bleed Air System Schematic

YA701 - YA710, YM482 - YN534



YF048 - YL551, YS151 - YV754

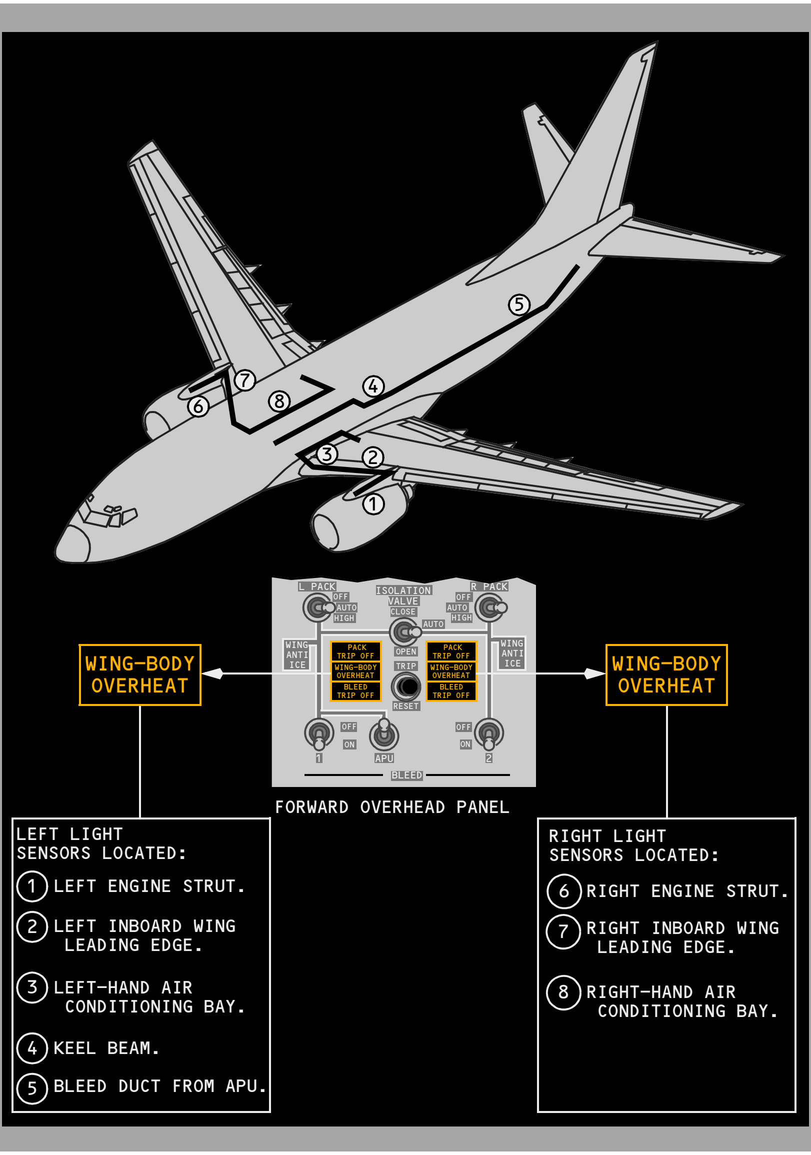


Wing-Body Overheat

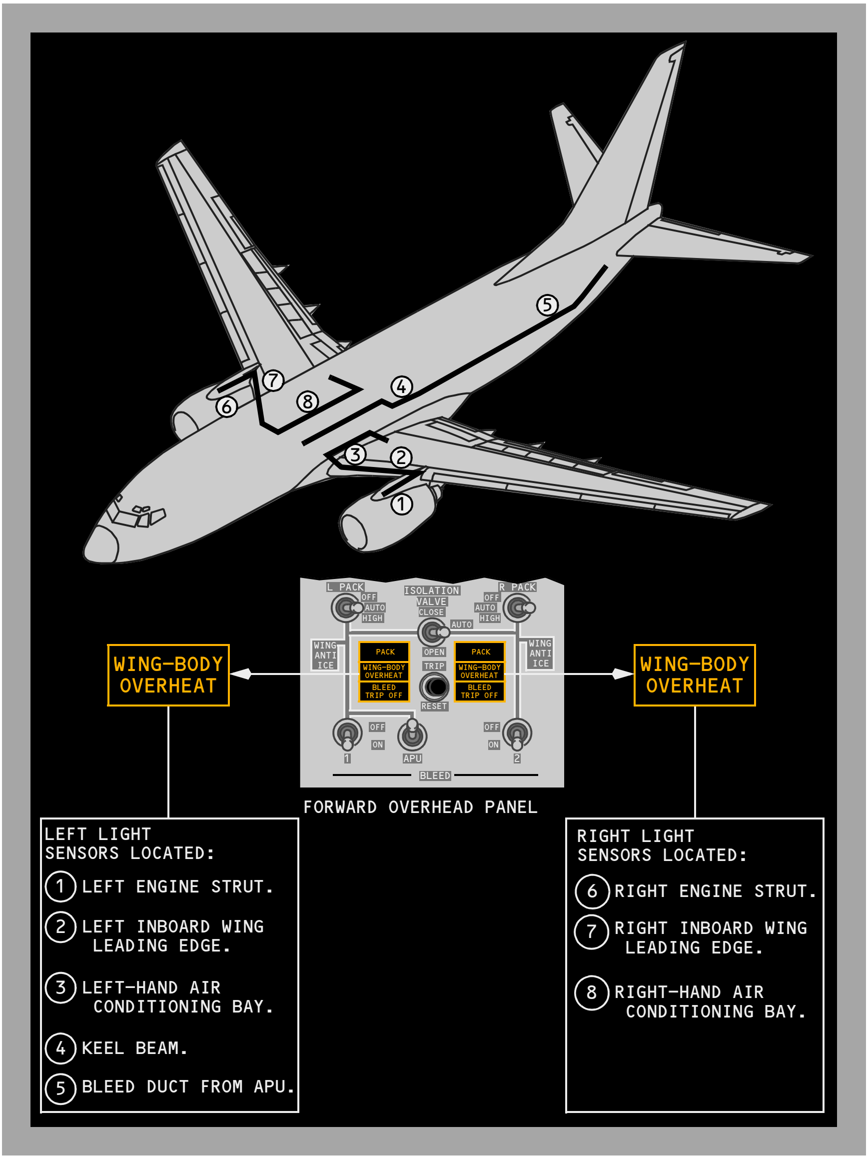
A wing-body overheat condition is caused by a bleed air duct leak. It is sensed by the overheat sensors located as shown.

Wing-Body Overheat Ducts and Lights

YA701 - YA710, YM482 - YN534



YF048 - YL551, YS151 - YV754



LEFT LIGHT
SENSORS LOCATED:

① LEFT ENGINE STRUT.

② LEFT INBOARD WING LEADING EDGE.

③ LEFT-HAND AIR CONDITIONING BAY.

④ KEEL BEAM.

⑤ BLEED DUCT FROM APU.

RIGHT LIGHT
SENSORS LOCATED:

⑥ RIGHT ENGINE STRUT.

⑦ RIGHT INBOARD WING LEADING EDGE.

⑧ RIGHT-HAND AIR CONDITIONING BAY.

Air Systems Chapter 2

Air Conditioning System Description Section 30

This Section Applies to YA701 - YA710, YM482 - YN534

Introduction

The air conditioning system provides temperature controlled air by processing bleed air from the engines, APU, or a ground air source in air conditioning packs. Conditioned air from the left pack, upstream of the mix manifold, flows directly to the flight deck. Excess air from the left pack, air from the right pack, and air from the recirculation system is combined in the mix manifold. The mixed air is then distributed through the left and right sidewall risers to the passenger cabin.

Conditioned air for the cabin comes from either the airplane air conditioning system or a preconditioned ground source. Air from the preconditioned ground source enters the air conditioning system through the mix manifold.

Air Conditioning Pack

The flow of bleed air from the main bleed air duct through each air conditioning pack is controlled by the respective pack valve. Normally the left pack uses bleed air from engine No. 1 and the right pack uses bleed air from engine No. 2. A single pack in high flow is capable of maintaining pressurization and acceptable temperatures throughout the airplane up to the maximum certified ceiling.

The APU is capable of supplying bleed air for two packs on the ground, or one pack in flight. Most external air carts are capable of supplying adequate bleed air for two pack operation. Do not operate more than one pack from one engine.

Airflow Control

With both air conditioning pack switches in AUTO and both packs operating, the packs provide “normal air flow”. However, with one pack not operating, the other pack automatically switches to “high air flow” in order to maintain the necessary ventilation rate. This automatic switching is inhibited when the airplane is on the ground, or inflight with the flaps extended, to insure adequate engine power for single engine operation. Automatic switching to “high air flow” occurs if both engine bleed air switches are OFF and the APU bleed air switch is ON, regardless of flap position, air/ground status or number of packs operating.

With the air conditioning pack switch in HIGH, the pack provides “high air flow”. Additionally, an “APU high air flow” rate is available when the airplane is on the ground, the APU bleed air switch is ON and either or both pack switches are positioned to HIGH. This mode is designed to provide the maximum airflow when the APU is the only source of bleed air.

Ram Air System

The ram air system provides cooling air for the heat exchangers. Operation of the system is automatically controlled by the packs through operation of ram air inlet doors.

On the ground, or during slow flight with the flaps not fully retracted, the ram air inlet doors move to the full open position for maximum cooling. In normal cruise, the doors modulate between open and closed. A RAM DOOR FULL OPEN light illuminates whenever a ram door is fully open.

Deflector doors are installed forward of the ram air inlet doors to prevent slush ingestion prior to liftoff and after touchdown. Deflector doors extend when activated electrically by the air–ground safety sensor.

Cooling Cycle

The flow through the cooling cycle starts with bleed air passing through a heat exchanger for cooling. The air then flows to an air cycle machine for refrigeration and to a water separator which removes moisture. The processed cold air is then combined with hot air. The conditioned air flows into the mix manifold and distribution system.

Overheat protection is provided by temperature sensors located in the cooling cycle. An overheat condition causes the pack valve to close and the PACK TRIP OFF light to illuminate.

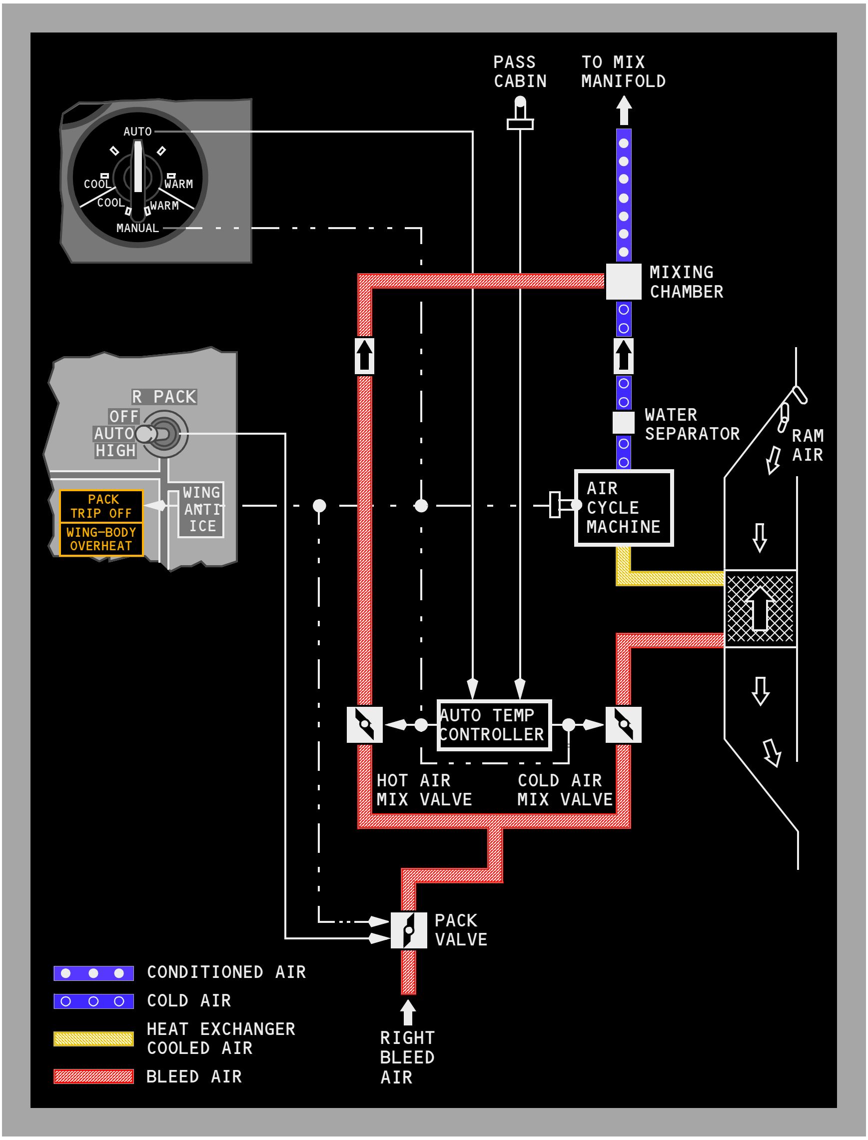
Air Mix Valves

The two air mix valves for each pack control hot and cold air according to the setting of the CONT CABIN or PASS CABIN temperature selector. Air that flows through the cold air mix valve is processed through a cooling cycle and then combined with hot air flowing from the hot air mix valve.

In the automatic temperature mode, the air mix valves are operated by the automatic temperature controller. The automatic temperature controller uses inputs from the respective temperature selector and cabin temperature sensor. The automatic temperature controller is bypassed when the temperature selector is positioned to MANUAL.

Anytime the pack valve closes, the air mix valves are driven to the full cold position automatically. This aids startup of the cooling cycle and prevents nuisance hot air trips when the pack is turned on.

Air Conditioning Pack Schematic



Air Conditioning Distribution

Conditioned air is collected in the mix manifold. The temperature of the air is directly related to the setting of the CONT CABIN and PASS CABIN temperature selectors.

Overheat detection is provided by temperature sensors located downstream of the packs. An overheat condition causes the appropriate mix valves to drive full cold and the DUCT OVERHEAT light to illuminate. A temperature higher than the duct overheat causes the appropriate pack valve to close and the PACK TRIP OFF light to illuminate.

Flight Deck

Since the flight deck requires only a fraction of the air supply provided by the left pack, most of the left pack air output is mixed with the right pack supply and routed to the passenger cabin.

Conditioned air for the flight deck branches into several risers which end at the floor, ceiling, and foot level outlets. Air diffusers on the floor under each seat deliver continuous air flow as long as the manifold is pressurized.

Overhead diffusers are located on the flight deck ceiling, above and aft of the No. 3 windows. Each of these outlets can be opened or closed as desired by turning a slotted adjusting screw.

There is also a dual purpose valve behind the rudder pedals of each pilot. These valves provide air for warming the pilots’ feet and for defogging the inside of the No. 1 windshields. Each valve is controlled by knobs located on the Captain’s and First Officer’s panel, respectively.

Passenger Cabin

The passenger cabin air supply distribution system consists of the mix manifold, sidewall risers, and an overhead distribution duct.

Sidewall risers go up the right and left wall of the passenger cabin to supply air to the overhead distribution duct. The overhead distribution duct routes conditioned air to the passenger cabin. It extends from the forward to the aft end of the ceiling along the airplane centerline and also supplies the sidewall diffusers.

Recirculation Fan

The recirculation fan system reduces the air conditioning system pack load and the engine bleed air demand. Air from the passenger cabin and electrical equipment bay is drawn to the forward cargo bay where it is filtered and recirculated to the mix manifold. The fan is driven by an AC motor. The fan operates with the recirc fan switch in AUTO except with both packs on and one or both in HIGH.

Equipment Cooling

The equipment cooling system cools electronic equipment in the flight deck and the E & E bay.

The equipment cooling system consists of a supply duct and an exhaust duct. Each duct has a normal fan and an alternate fan. The supply duct supplies cool air to the flight deck displays and electronic equipment in the E & E bay. The exhaust duct collects and discards warm air from the flight deck displays, the overhead and aft electronic panels, circuit breaker panels in the flight deck, and electronic equipment in the E & E bay.

Loss of airflow due to failure of an equipment cooling fan results in illumination of the related equipment cooling OFF light. Selecting the alternate fan should restore airflow and extinguish the OFF light within approximately 5 seconds.

YM482 - YN534
In the event of a forward cargo fire warning, the equipment cooling exhaust fan is shut off and the equipment cooling exhaust OFF light is inhibited.

If an overtemperature occurs on the ground, alerting is provided through the crew call horn in the nose wheel well.

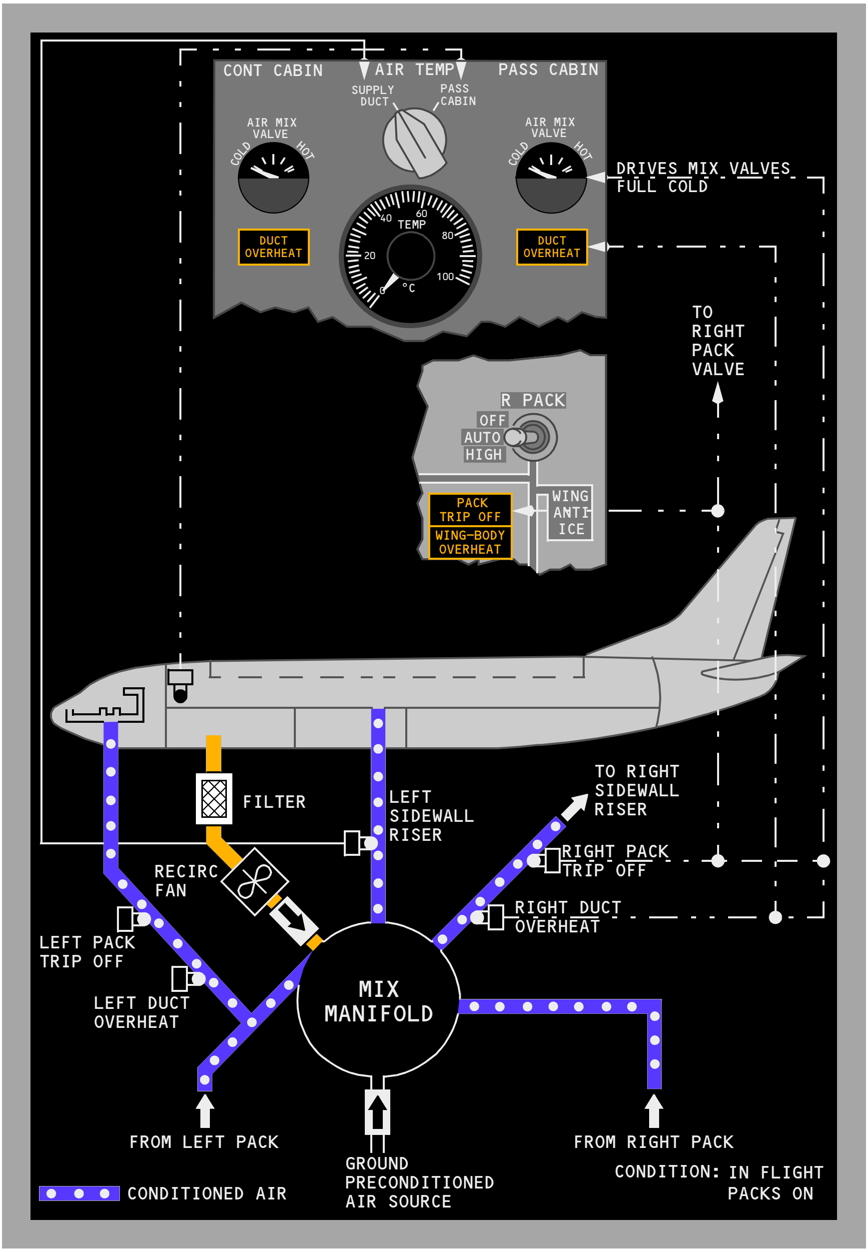
Forward Cargo Compartment

The recirculation fan system circulates air from the passenger cabin around the lining of the forward cargo compartment. When the overboard exhaust valve is closed, exhaust air from the equipment cooling system is also diffused to the lining of the forward cargo compartment for additional inflight heating.

Conditioned Air Source Connection

A ground air conditioning source may be connected to the mix manifold to distribute preconditioned air throughout the airplane.

Air Conditioning Distribution Schematic



Air Systems Chapter 2

Air Conditioning System Description Section 31

This Section Applies to YF048 - YL551, YS151 - YV754

Introduction

The air conditioning system provides temperature controlled air by processing bleed air from the engines, APU, or a ground air source in air conditioning packs. Conditioned air from the left pack, upstream of the mix manifold, flows directly to the flight deck. Excess air from the left pack, air from the right pack, and air from the recirculation system is combined in the mix manifold. The mixed air is then distributed through the left and right sidewall risers to the passenger cabin.

Conditioned air for the cabin comes from either the airplane air conditioning system or a preconditioned ground source. Air from the preconditioned ground source enters the air conditioning system through the mix manifold.

Air Conditioning Pack

The flow of bleed air from the main bleed air duct through each air conditioning pack is controlled by the respective pack valve. Normally, the left pack uses bleed air from engine No. 1 and the right pack uses bleed air from engine No. 2. A single pack in high flow is capable of maintaining pressurization and acceptable temperatures throughout the airplane up to the maximum certified ceiling.

The APU is capable of supplying bleed air for two packs on the ground, or one pack in flight. Most external air carts are capable of supplying adequate bleed air for two pack operation. Do not operate more than one pack from one engine.

Airflow Control

With both air conditioning pack switches in AUTO and both packs operating, the packs provide “normal air flow”. However, with one pack not operating, the other pack automatically switches to “high air flow” in order to maintain the necessary ventilation rate. This automatic switching is inhibited when the airplane is on the ground, or inflight with the flaps extended, to insure adequate engine power for single engine operation. Automatic switching to “high air flow” occurs if both engine bleed air switches are OFF and the APU bleed air switch is ON, regardless of flap position, air/ground status or number of packs operating.

With the air conditioning pack switch in HIGH, the pack provides “high air flow”. Additionally, an “APU high air flow” rate is available when the airplane is on the ground, the APU bleed air switch is ON and either or both pack switches are positioned to HIGH. This mode is designed to provide the maximum airflow when the APU is the only source of bleed air.

Ram Air System

The ram air system provides cooling air for the heat exchangers. Operation of the system is automatically controlled by the packs through operation of ram air inlet doors.

On the ground, or during slow flight with the flaps not fully retracted, the ram air inlet doors move to the full open position for maximum cooling. In normal cruise, the doors modulate between open and closed. A RAM DOOR FULL OPEN light illuminates whenever a ram door is fully open.

Deflector doors are installed forward of the ram air inlet doors to prevent slush ingestion prior to liftoff and after touchdown. Deflector doors extend when activated electrically by the air–ground safety sensor.

Cooling Cycle

Flow through the cooling cycle starts with bleed air passing through a heat exchanger for cooling. The air then flows to an air cycle machine for refrigeration. The processed cold air is then combined with hot air which has bypassed the air cycle machine, then through a high pressure water separator which removes moisture. This conditioned air then flows into the mix manifold and distribution system.

Overheat protection is provided by temperature sensors located in the cooling cycle. An overheat condition causes the pack valve to close and the PACK light to illuminate.

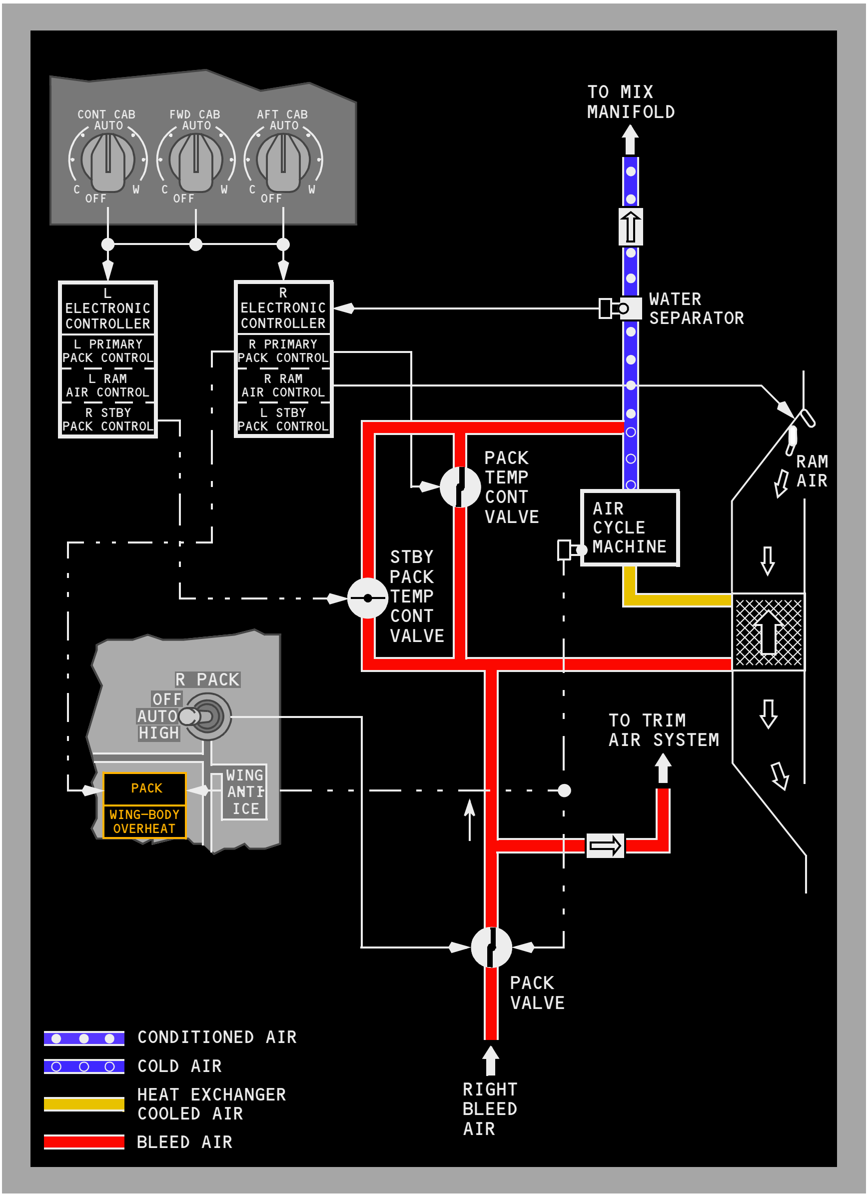
Pack Temperature Control

Electronic controllers command the pack temperature control valve toward open or closed to satisfy pack discharge requirements.

If a primary pack control fails, the affected pack is controlled by the standby pack control in the opposite controller. A primary or standby pack control failure causes the PACK, MASTER CAUTION and AIR COND System Annunciator lights to illuminate during recall.

If both the primary and the standby pack controls fail for the same pack, the PACK, MASTER CAUTION, and AIR COND System Annunciator lights illuminate. The pack will continue to operate without control unless excessive temperatures cause the pack to trip off.

Air Conditioning Pack Schematic



Zone Temperature Control

There are three zones: flight deck, forward cabin and aft cabin. Desired zone temperature is set by adjusting the individual Temperature Selectors. The selector range is approximately 65°F (18°C) to 85°F (30°C).

The packs produce an air temperature that satisfies the zone which requires the most cooling. Zone temperature is controlled by introducing the proper amount of trim air to the zone supply ducts. The quantity of trim air is regulated by individual trim air modulating valves.

During single pack operation with the TRIM AIR selected ON, zone temperature is controlled the same as during two pack operation. During single pack operation with the TRIM AIR selected OFF, the pack attempts to produce an air temperature to satisfy the average temperature demands of all three zones.

If air in a zone supply duct overheats, the associated amber ZONE TEMP light illuminates, and the associated trim air modulating valve closes. The trim air modulating valve may be reopened after the duct has cooled by pushing the TRIP RESET Switch.

Zone Temperature Control Modes

The left electronic controller controls the aft cabin zone and provides backup control for the flight deck. The right controller controls the forward cabin zone and provides primary control for the flight deck.

Failure of the primary flight deck temperature control will cause an automatic switch to the back up control and will illuminate the CONT CAB amber ZONE TEMP light upon Master Caution Recall. Failure of both the primary and standby controls will illuminate the lights automatically.

Failure of the forward or aft cabin temperature control will cause the associated trim air modulating valve to close. The Temperature Selectors operate normally, but the Temperature Selector settings of the two passenger cabin zones will be averaged. The amber ZONE TEMP light will illuminate upon Master Caution Recall to indicate failure of the associated zone control.

Unbalanced Pack Temperature Control Mode

Any failure affecting the supply of trim air will cause the temperature control system to control both packs independently. If flight deck trim air is lost, the left pack will provide conditioned air to the flight deck at the selected temperature and the right pack will satisfy the demand of the passenger zone which requires the most cooling. If a passenger cabin zone trim air, or all trim air is lost, the forward and aft zone temperature demands will be averaged for control of the right pack.

If any individual zone is switched OFF, the Temperature Selector setting will be ignored by the temperature control system.

Standby Pack Average Temperature

If all zone controls and primary pack controls fail, the standby pack controls command the packs to produce air temperatures which will satisfy the average temperature demand of the two cabin zones. The trim air modulating valves will close. The flight deck zone Temperature Selector will have no effect on the standby pack controls.

Fixed Cabin Temperature

If all Temperature Selectors are positioned OFF, the pack controls will cause the left pack to maintain a fixed temperature of 75°F (24°C) and the right pack to maintain 65°F (18°C) as measured at the pack temperature sensor.

Air Conditioning Distribution

Conditioned air is collected in the mix manifold. The temperature of the air is directly related to the setting of the Temperature Selectors.

Overheat detection is provided by temperature sensors located downstream of the packs and the mix manifold. An overheat condition causes the appropriate trim air modulating valve to close and the ZONE TEMP light to illuminate.

Flight Deck

Since the flight deck requires only a fraction of the air supply provided by the left pack, most of the left pack output is routed to the mix manifold.

Conditioned air for the flight deck branches into several risers which end at the floor, ceiling and foot level outlets. Air diffusers on the floor under each seat deliver continuous air flow as long as the manifold is pressurized.

Overhead diffusers are located on the flight deck ceiling, above and aft of the No. 3 windows. Each of these outlets can be opened or closed as desired by turning a slotted adjusting screw.

There is also a dual purpose valve behind the rudder pedal of each pilot. These valves provide air for warming the pilots' feet and for defogging the inside of the No. 1 windshields. Each valve is controlled by knobs located on the Captain's and First Officer's panels.

Passenger Cabin

The passenger cabin air supply distribution system consists of the mix manifold, sidewall risers, and an overhead distribution duct.

Sidewall risers go up the right and left walls of the passenger cabin to supply air to the overhead distribution duct. The overhead distribution duct routes conditioned air to the passenger cabin. It extends from the forward to the aft end of the ceiling along the airplane centerline and also supplies the sidewall diffusers.

Recirculation Fan

The recirculation fan system reduces the air conditioning system pack load and the engine bleed air demand. Air from the passenger cabin and electrical equipment bay is drawn to the forward cargo bay where it is filtered and recirculated to the mix manifold. The fans are driven by AC motors. Each recirculation fan operates only if the respective RECIRC FAN Switch is selected to AUTO. In flight, the left recirculation fan operates if both packs are operating unless either PACK switch is in HIGH. The right recirculation fan operates in flight if both packs are operating unless both PACK switches are in HIGH. On the ground, the left recirculation fan operates unless both PACK switches are in HIGH and the right recirculation fan operates even if both PACK switches are in HIGH.

Equipment Cooling

The equipment cooling system cools electronic equipment in the flight deck and the E & E bay.

The equipment cooling system consists of a supply duct and an exhaust duct. Each duct has a normal fan and an alternate fan. The supply duct supplies cool air to the flight deck displays and electronic equipment in the E & E bay. The exhaust duct collects and discards warm air from the flight deck displays, the overhead and aft electronic panels, circuit breaker panels in the flight deck, and electronic equipment in the E & E bay.

Loss of airflow due to failure of an equipment cooling fan results in illumination of the related equipment cooling OFF light. Selecting the alternate fan should restore airflow and extinguish the OFF light within approximately 5 seconds.

In the event of a forward cargo fire warning, the equipment cooling exhaust fan is shut off and the equipment cooling exhaust OFF light is inhibited.

If an overtemperature occurs on the ground, alerting is provided through the crew call horn in the nose wheel well.

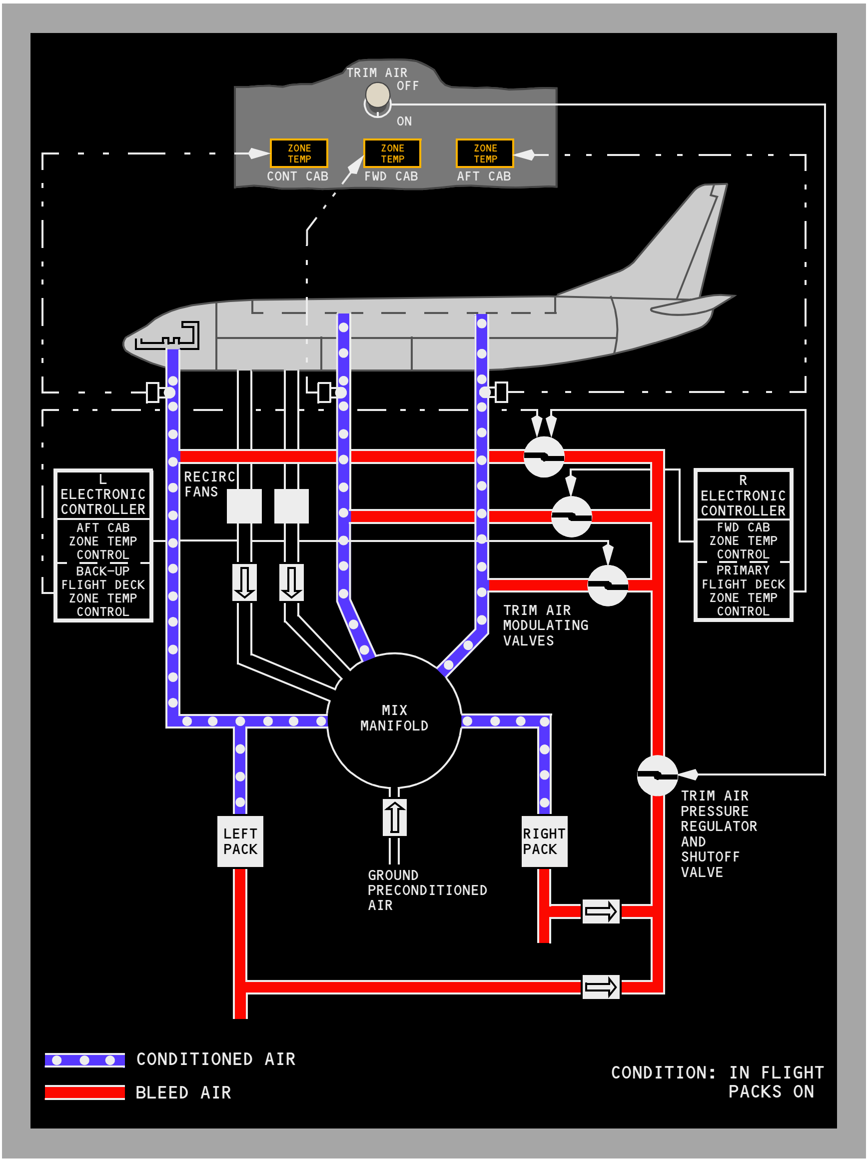
Forward Cargo Compartment

The recirculation fan system circulates air from the passenger cabin around the lining of the forward cargo compartment. When the overboard exhaust valve is closed, exhaust air from the equipment cooling system is also diffused to the lining of the forward cargo compartment for additional inflight heating.

Conditioned Air Source Connection

A ground air conditioning source may be connected to the mix manifold to distribute preconditioned air throughout the airplane.

Air Conditioning Distribution Schematic



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Introduction

Cabin pressurization is controlled during all phases of airplane operation by the cabin pressure control system. The cabin pressure control system includes two identical automatic controllers available by selecting AUTO or ALTN and a manual (MAN) pilot–controlled mode.

The system uses bleed air supplied to and distributed by the air conditioning system. Pressurization and ventilation are controlled by modulating the outflow valve and the overboard exhaust valve.

Pressure Relief Valves

Two pressure relief valves provide safety pressure relief by limiting the differential pressure to a maximum of 9.1 psi. A negative relief valve prevents external atmospheric pressure from exceeding internal cabin pressure.

Cabin Pressure Controller

Cabin altitude is normally rate–controlled by the cabin pressure controller up to a cabin altitude of 8,000 feet at the airplane maximum certified ceiling of 41,000 feet.

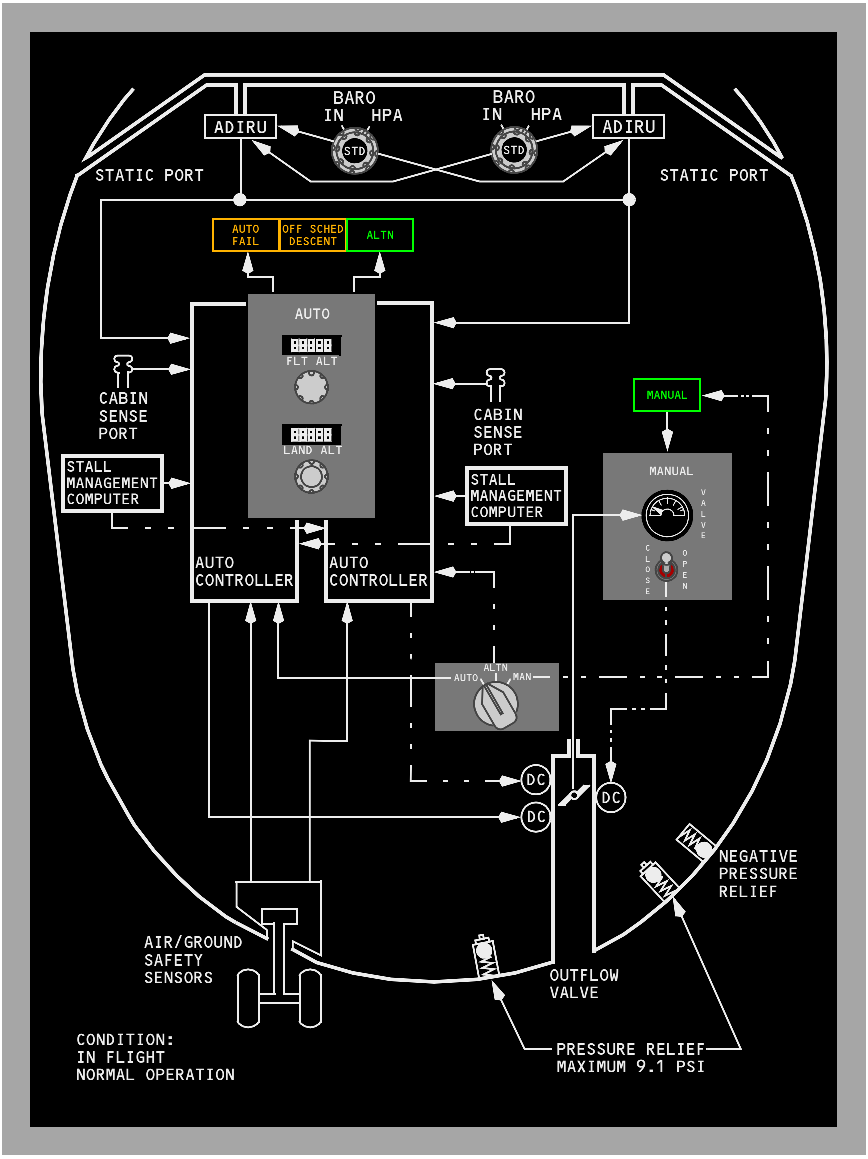
The cabin pressure controller controls cabin pressure in the following modes:

- AUTO – Automatic pressurization control; the normal mode of operation. Uses DC motor.
- ALTN – Automatic pressurization control; the alternate mode of operation. Uses DC motor.
- MAN – Manual control of the system using DC motor.

The air data inertial reference units (ADIRUs) provides ambient static pressure, baro corrected altitude, non-corrected altitude and calibrated airspeed to both automatic controllers. The ADIRUs receive barometric corrections from the Captain’s and First Officer’s BARO reference selectors.

The automatic controllers also receive throttle position from both stall management computers and signals from the air/ground sensors.

Cabin Pressure Control System Schematic



Pressurization Outflow

Cabin air outflow is controlled by the outflow valve and the overboard exhaust valve. A small amount is also exhausted through toilet and galley vents, miscellaneous fixed vents, and by seal leakage.

Outflow Valve

The outflow valve is the overboard exhaust exit for the majority of the air circulated through the passenger cabin. Passenger cabin air is drawn through foot level grills, down around the aft cargo compartment, where it provides heating, and is discharged overboard through the outflow valve.

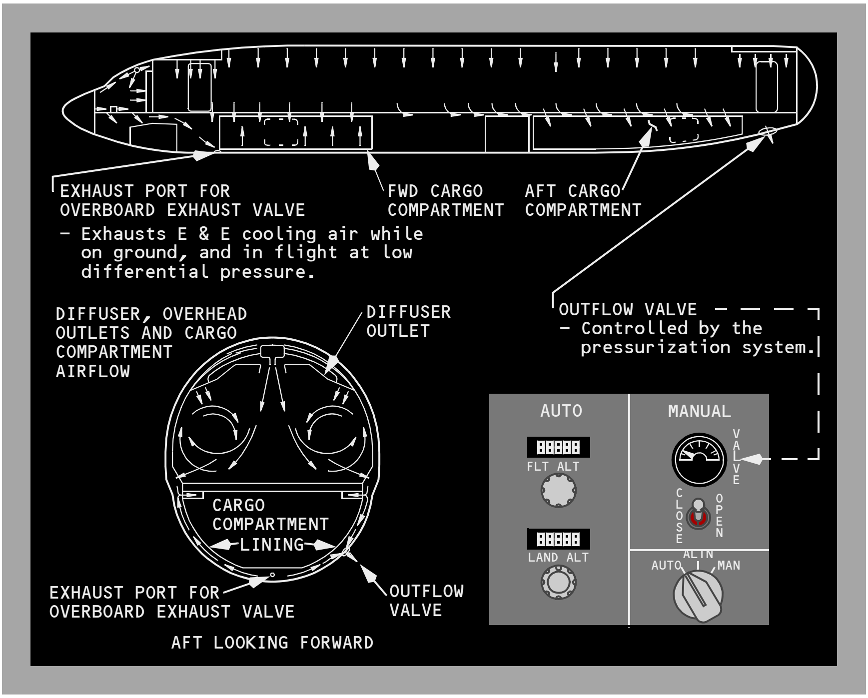
Overboard Exhaust Valve

On the ground and in flight with low differential pressure, the overboard exhaust valve is open and warm air from the E & E bay is discharged overboard. In flight, at higher cabin differential pressures, the overboard exhaust valve is normally closed and exhaust air is diffused to the lining of the forward cargo compartment.

YA701 - YA710, YM482 - YN534
However, the overboard exhaust valve is driven open if either pack switch is in high and the recirculation fan is off. This allows for increased ventilation in the smoke removal configuration.

YF048 - YL551, YS151 - YV754
However, the overboard exhaust valve is driven open if either pack switch is in high and the right recirculation fan is off. This allows for increased ventilation in the smoke removal configuration.

Pressurization Outflow Schematic



Auto Mode Operation

The AUTO system consists of two identical controllers, with one controller alternately sequenced as the primary operational controller for each new flight. The other automatic controller is immediately available as a backup.

In the AUTO or ALTN mode, the pressurization control panel is used to preset two altitudes into the auto controllers:

- FLT ALT (flight or cruise altitude).
- LAND ALT (landing or destination airport altitude).

Takeoff airport altitude (actually cabin altitude) is fed into the auto controllers at all times when on the ground.

The air/ground safety sensor signals whether the airplane is on the ground or in the air. On the ground and at lower power settings, the cabin is depressurized by driving the outflow valve to the full open position.

The cabin begins to pressurize on the ground at higher power settings. The controller modulates the outflow valve toward close, slightly pressurizing the cabin. This ground pressurization of the cabin makes the transition to pressurized flight more gradual for the passengers and crew, and also gives the system better response to ground effect pressure changes during takeoff.

In the air, the auto controller maintains a proportional pressure differential between airplane and cabin altitude. By increasing the altitude at a rate proportional to the airplane climb rate, cabin altitude change is held to the minimum rate required.

An amber OFF SCHED DESCENT light illuminates if the airplane begins to descend without having reached the preset cruise altitude; for example, a flight aborted in climb and returning to the takeoff airport. The controller programs the cabin to land at the takeoff field elevation without further pilot inputs. If the FLT ALT indicator is changed, the automatic abort capability to the original takeoff field elevation is lost.

The cruise mode is activated when the airplane climbs to within 0.25 psi of the selected FLT ALT. During cruise the controller maintains the lowest possible cabin altitude based on the differential pressure limits indicated in the table below. In certain circumstances the selected LAND ALT may exceed the target cabin altitude determined by the differential pressure limits. In these cases, the controller will maintain a cabin altitude slightly below the selected LAND ALT. Deviations from flight altitude can cause the pressure differential to vary as the controller modulates the outflow valve to maintain a constant cabin altitude.

Selected FLT ALT	Differential Pressure Limit
At or below 28,000 feet	7.45 psid
28,000 feet to 37,000 feet	7.80 psid
Above 37,000 feet	8.35 psid

The descent mode is activated when the airplane descends 0.25 psi below the selected FLT ALT. The cabin begins a proportional descent to slightly below the selected LAND ALT. The controller programs the cabin to land slightly pressurized so that rapid changes in altitude during approach result in minimum cabin pressure changes.

While taxiing in, the controller drives the outflow valve slowly to the full open position depressurizing the cabin.

An amber AUTO FAIL light illuminates if any of the following conditions occurs:

- Loss of DC power
- Controller fault
- Outflow valve control fault

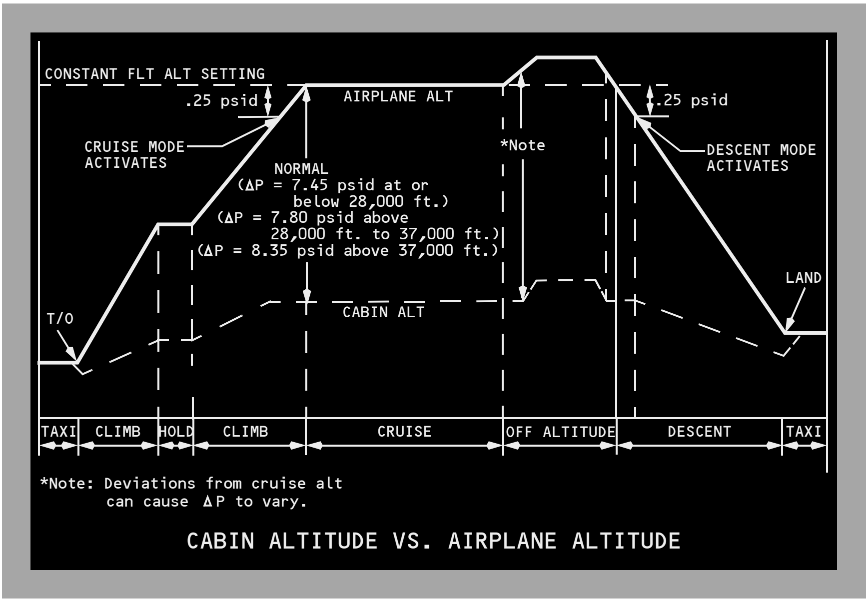
- Excessive differential pressure (> 8.75 psi)*
- Excessive rate of cabin pressure change (±2000 sea level feet/minute)*
- High cabin altitude (above 15,800 feet).*

*If controller is not responding properly

With illumination of the AUTO FAIL light, the pressure control automatically transfers to the other auto controller (ALTN mode).

Moving the pressurization mode selector to the ALTN position extinguishes the AUTO FAIL light, however the ALTN light remains illuminated to indicate single channel operation.

Flight Path Events – Auto Mode



*Note: Deviations from cruise alt can cause ΔP to vary.

CABIN ALTITUDE VS. AIRPLANE ALTITUDE

High Altitude Landing

YN531 - YN534

The High Altitude Landing System is engaged by selecting the high altitude landing switch ON. This switch is located on the Cabin Altitude Panel. When the high altitude landing system is engaged and the actual landing altitude is set, the controller brings the cabin altitude to the landing airport elevation when the descent mode is activated. Upon departure from a high altitude airport, the system returns to normal operation as the cabin altitude descends through 8,500 feet.

Manual Mode Operation

A green MANUAL Light illuminates with the pressurization mode selector in the MAN position.

Manual control of the cabin altitude is used if both the AUTO and ALTN modes are inoperative. In the MAN mode, the outflow valve position switch is used to modulate the outflow valve by monitoring the cabin altitude panel and valve position on the outflow valve position indicator. A separate DC motor, powered by the DC standby system, drives the outflow valve at a slower rate than the automatic modes. Outflow valve full range of motion takes up to 20 seconds.

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Anti-Ice, Rain Chapter 3

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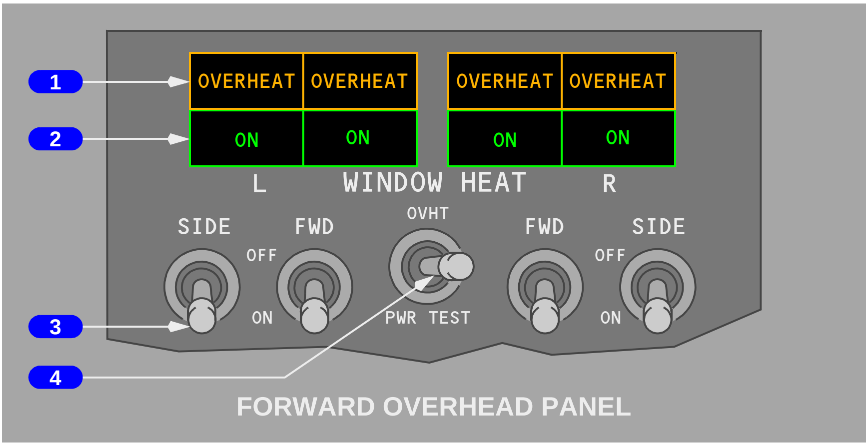
Window Heat Panel



1 Window OVERHEAT Lights

Illuminated (amber) – overheat condition is detected.

Note: OVERHEAT lights also illuminate if electrical power to window(s) is interrupted.

2 Window Heat ON Lights

Illuminated (green) – window heat is being applied to selected window(s).

Extinguished –

- switch is OFF, or
- an overheat is detected, or
- a system failure has occurred
- system is at correct temperature.

3 WINDOW HEAT Switches

ON – window heat is applied to selected window(s).

OFF – window heat not in use.

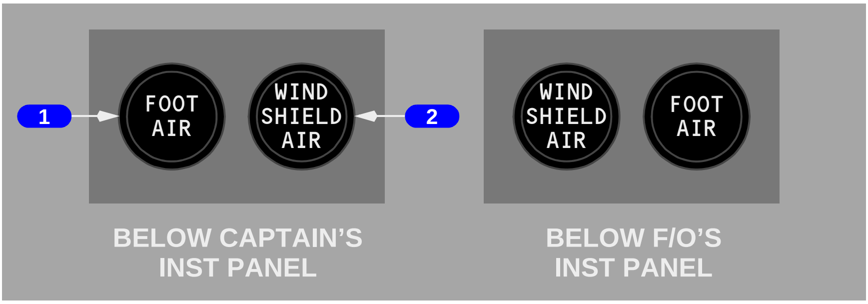
4 WINDOW HEAT Test Switch (spring–loaded to neutral)

OVHT – simulates an overheat condition.

PWR TEST – provides a confidence test.

Note: Refer to Supplementary Normal Procedures for Window Heat Test procedures.

Windshield/Foot Air Controls



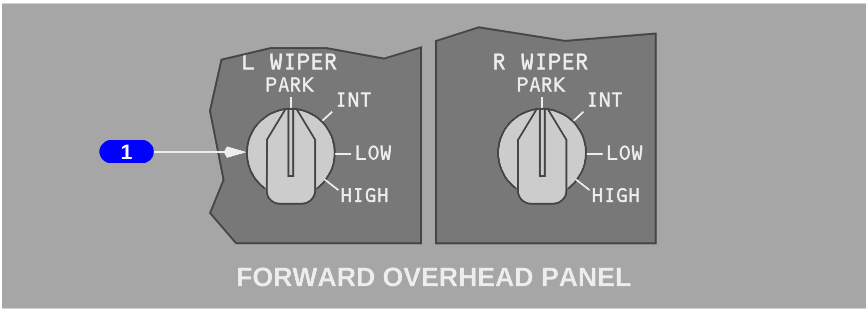
1 FOOT AIR Controls

PULL – supplies conditioned air to pilots' leg positions.

2 WINDSHIELD AIR Controls

PULL – supplies conditioned air to number 1 windows for defogging.

Windshield Wiper Selector Panel



1 Windshield WIPER Selectors

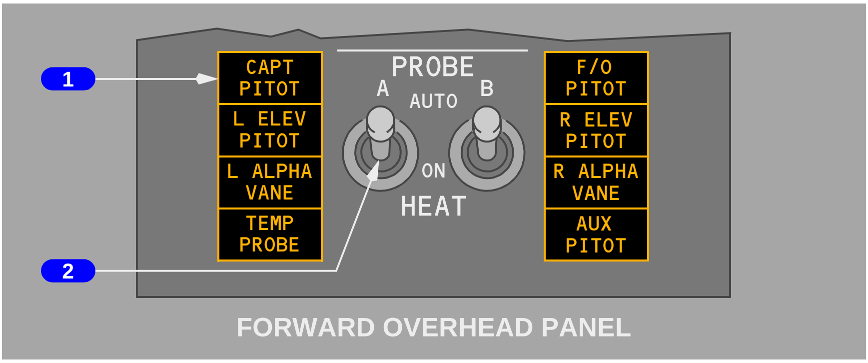
PARK – turns off wiper motors and stows wiper blades.

INT – seven second intermittent operation.

LOW – low speed operation.

HIGH – high speed operation.

Probe Heat Panel



1 Probe Heat Lights

Illuminated (amber) – related probe not heated.

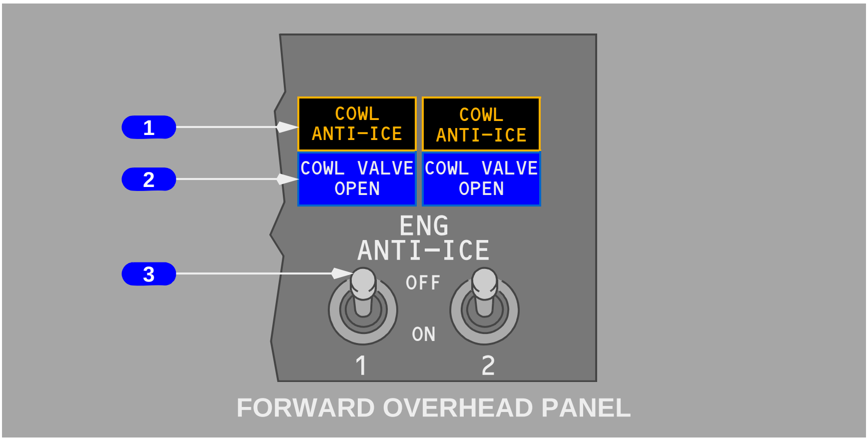
Note: If operating on standby power, probe heat lights do not indicate system status.

2 PROBE HEAT Switches

ON – power is supplied to heat related system.

AUTO – power is automatically supplied to both A and B probe heat systems when either engine is running.

Engine Anti–Ice Panel



1 COWL ANTI–ICE Lights

Illuminated (amber) – indicates an overpressure condition in duct downstream of engine cowl anti–ice valve.

2 COWL VALVE OPEN Lights

Illuminated (blue) –

- bright – related cowl anti–ice valve is in transit, or, cowl anti–ice valve position disagrees with related ENGINE ANTI–ICE switch position
- dim – related cowl anti–ice valve is open (switch ON).

Extinguished – related cowl anti–ice valve is closed (switch OFF).

3 ENGINE ANTI–ICE Switches

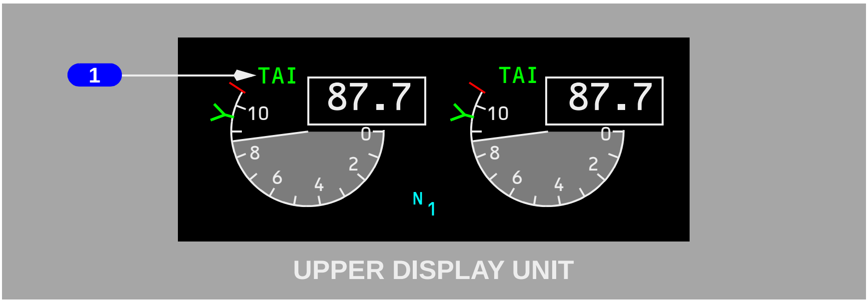
ON –

- related engine anti–ice valve is open
- stick shaker logic is set for icing conditions.

OFF –

- related engine anti–ice valve is closed
- stick shaker logic returns to normal if wing anti–ice has not been used in flight.

Thermal Anti–Ice Indication

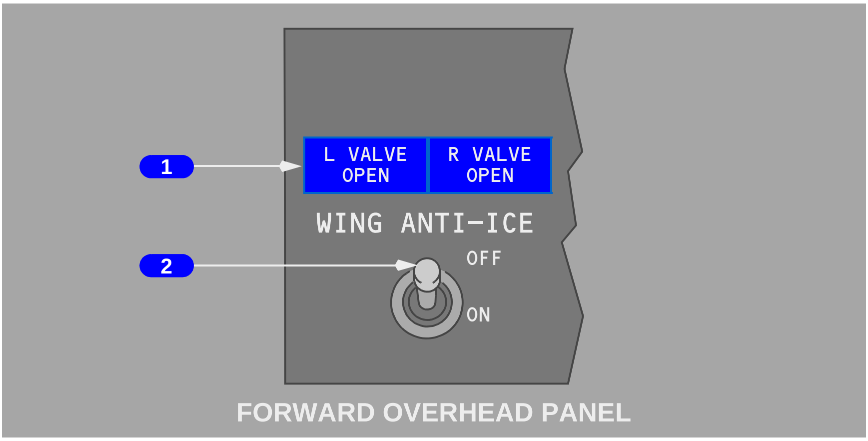


1 Thermal Anti–Ice Indications

Illuminated –

- Green – cowl anti–ice valve(s) open
- Amber – cowl anti–ice valve is not in position indicated by related engine anti–ice switch.

Wing Anti–Ice Panel



1 Wing Anti–Ice VALVE OPEN Lights

Illuminated (blue) –

- bright – related wing anti–ice control valve is in transit, or, related wing anti–ice control valve position disagrees with WING ANTI–ICE switch position
- dim – related wing anti–ice control valve is open (switch ON).

Extinguished – related wing anti–ice control valve is closed (switch OFF).

2 WING ANTI–ICE Switch

OFF – wing anti–ice control valves are closed.

ON (in the air) –

- wing anti–ice control valves are open
- stick shaker logic is set for icing conditions.

Note: Stick shaker logic remains set for icing conditions for the remainder of the flight, regardless of subsequent WING ANTI–ICE switch position.

ON (on the ground) –

- wing anti–ice control valves open if thrust on both engines is below takeoff warning setting and temperature inside both distribution ducts is below thermal switch activation temperature
- control valves close if either engine thrust is above takeoff warning setting or thermal switch is activated in either distribution duct. Switch remains ON
- switch trips OFF at lift–off.

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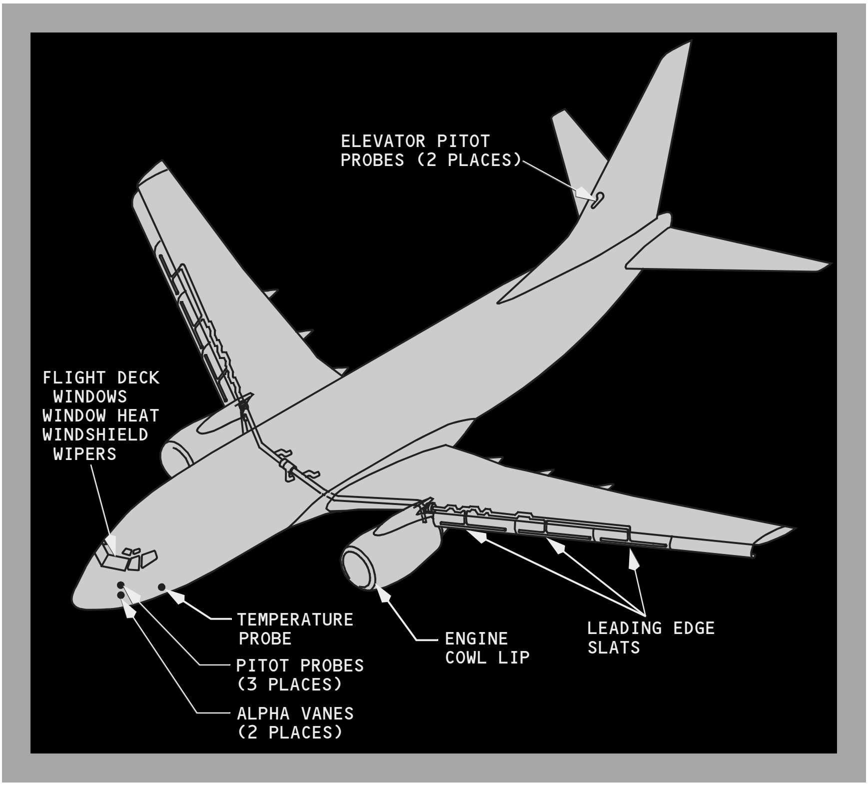
Introduction

Thermal anti-icing (TAI), electrical anti-icing, and windshield wipers are the systems provided for ice and rain protection.

The anti-ice and rain systems include:

- Flight Deck Window Heat
- Windshield Wipers
- Probe and Sensor Heat
- Engine Anti-Ice System
- Wing Anti-Ice System

Anti-Ice Components Diagram



Flight Deck Window Heat

YA701 - YA710
Flight deck window numbers 1, 2, 4 and 5 consist of glass panes laminated to each side of a vinyl core. Flight deck window number 4 has an additional vinyl layer and acrylic sheet laminated to the inside surface. Flight deck window number 3 consists of two acrylic panes separated by an air space.

YA701 - YA710
A conductive coating on the outer glass pane of window numbers 1 and 2 permits electrical heating to prevent ice build–up and fogging. A conductive coating on the inner glass pane of window numbers 4 and 5 permits electrical heating to prevent fogging. Window number 3 is not electrically heated.

YF048 - YV754
Flight deck window numbers 1 and 2 consist of glass panes laminated to each side of a vinyl core. Flight deck window number 3 consists of two acrylic panes separated by an air space.

YF048 - YV754
A conductive coating on the outer glass pane of window numbers 1 and 2 permits electrical heating to prevent ice build–up and fogging. Window number 3 is not electrically heated.

Flight Deck Window Heat Operation

YA701 - YA710
The FWD WINDOW HEAT switches control heat to window No. 1. The SIDE WINDOW HEAT switches control heat to window number 2, 4, and 5.

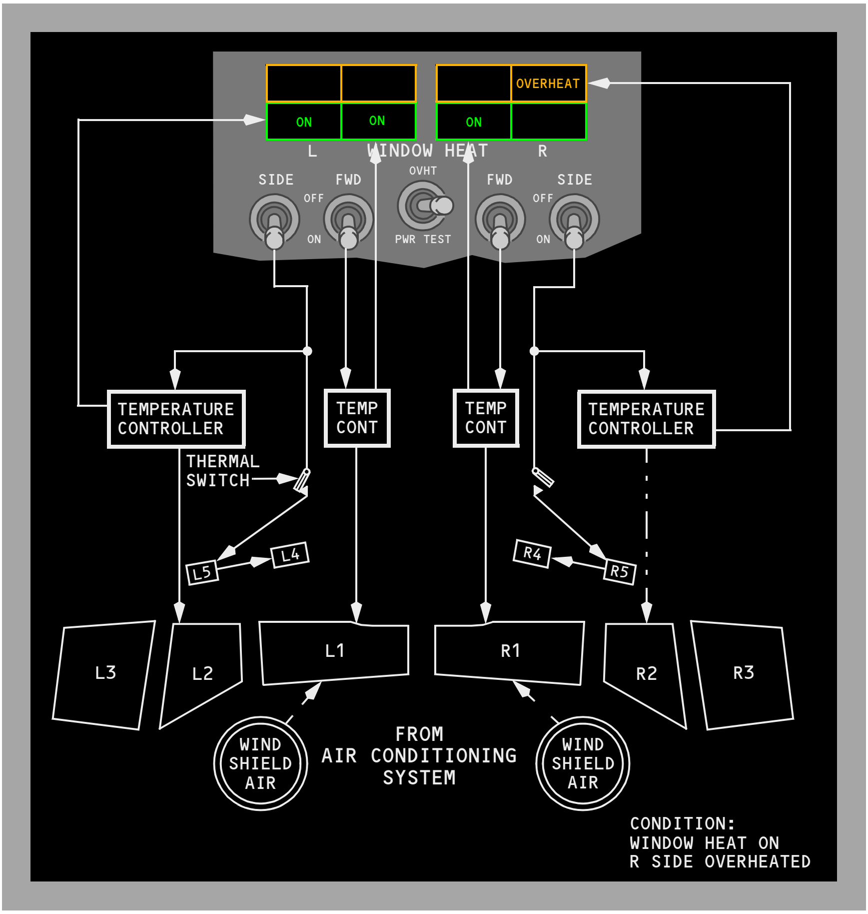
YA701 - YA710
Temperature controllers maintain window numbers 1 and 2 at the correct temperature to ensure maximum strength of the windows in the event of bird impact. Power to window numbers 1 and 2 is automatically removed if an overheat condition is detected. A thermal switch located on window 5 opens and closes to maintain the correct temperature of window numbers 4 and 5.

YF048 - YV754
The FWD WINDOW HEAT switches control heat to window No. 1. The SIDE WINDOW HEAT switches control heat to window numbers 2.

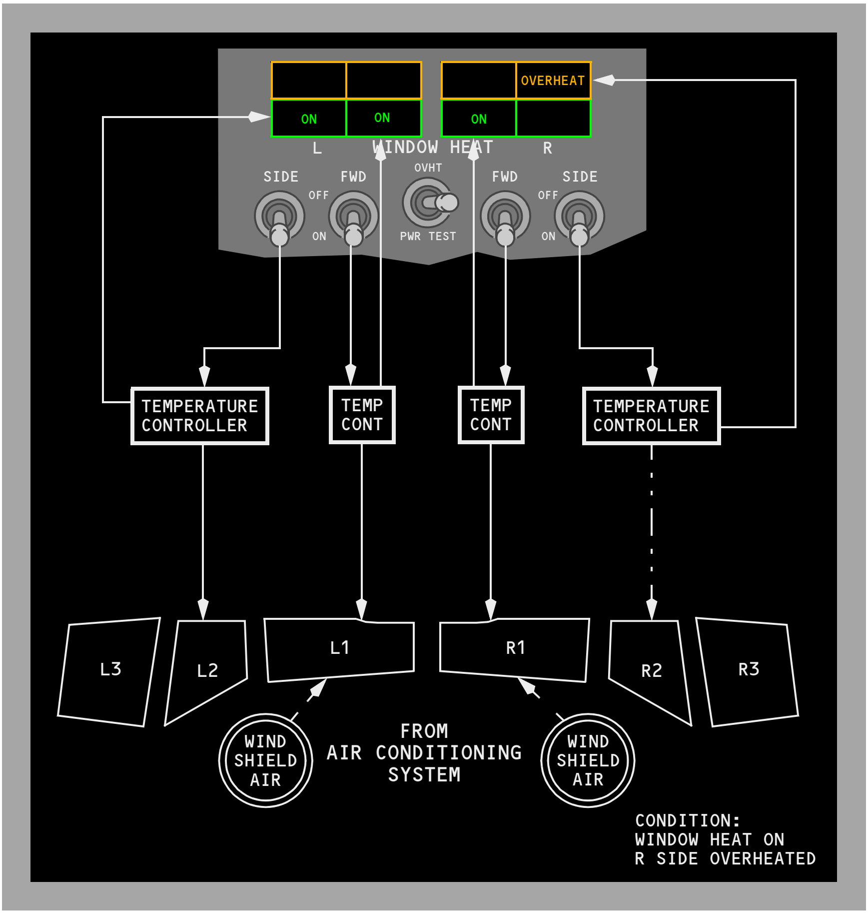
YF048 - YV754
Temperature controllers maintain window numbers 1 and 2 at the correct temperature to ensure maximum strength of the windows in the event of bird impact. Power to window numbers 1 and 2 is automatically removed if an overheat condition is detected.

Flight Deck Window Heat Schematic

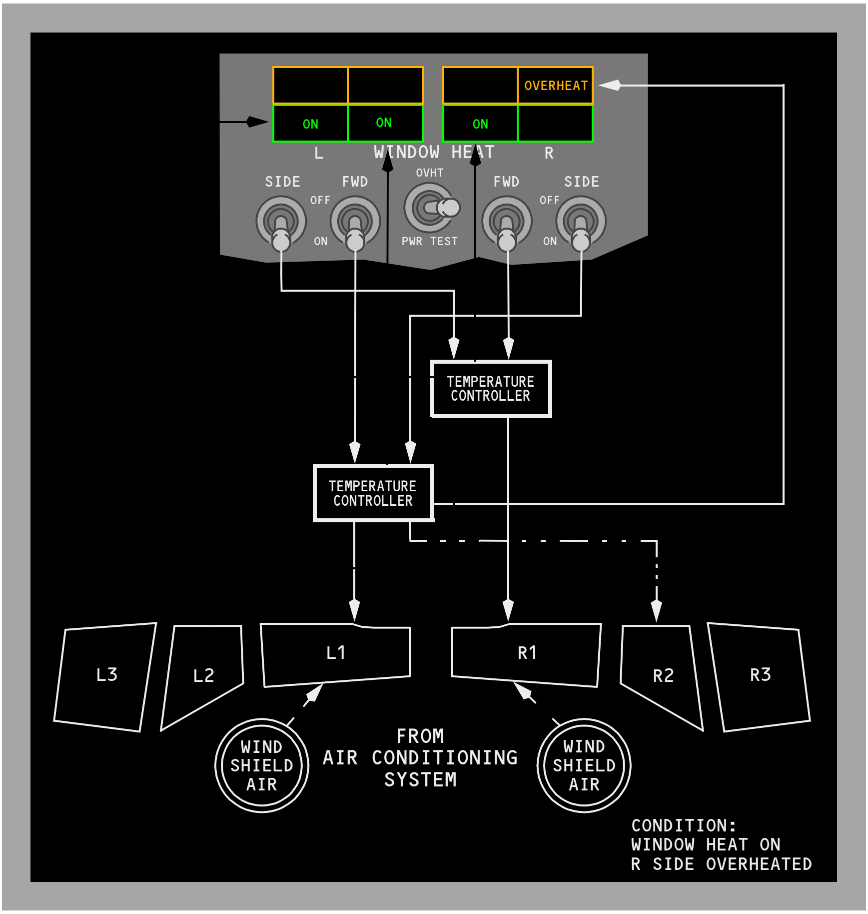
YA701 - YA710



YF048 - YT520, YV604 - YV741



YT521, YV742 - YV754



Windshield Wipers

The rain removal system for the forward windows consists of windshield wipers and a permanent rain repellent coating on the windows.

CAUTION: Windshield scratching will occur if the windshield wipers are operated on a dry windshield.

Probe and Sensor Heat

YA701 - YF049, YM482 - YM484

Pitot probes, the total air temperature probe and the alpha vanes are electrically heated. Static ports are not heated.

YF921 - YL551, YN531 - YV754
Pitot probes, the total air temperature probe and the alpha vanes are electrically heated. Static ports are not heated. When operating on standby power, only the captain's pitot probe is heated, however, the CAPT PITOT light does not illuminate for a failure.

Note: The pitot probe for standby airspeed is not heated when the airplane is on standby power.

Engine Anti–Ice System

Engine bleed air thermal anti–icing prevents the formation of ice on the engine cowl lip. Engine anti–ice operation is controlled by individual ENG ANTI–ICE switches. The engine anti–ice system may be operated on the ground and in flight.

Engine Anti–Ice System Operation

Each cowl anti–ice valve is electrically controlled and pressure actuated. Positioning the ENG ANTI–ICE switches to ON:

- allows engine bleed air to flow through the cowl anti–ice valve for cowl lip anti–icing
- sets stall warning logic for icing conditions.

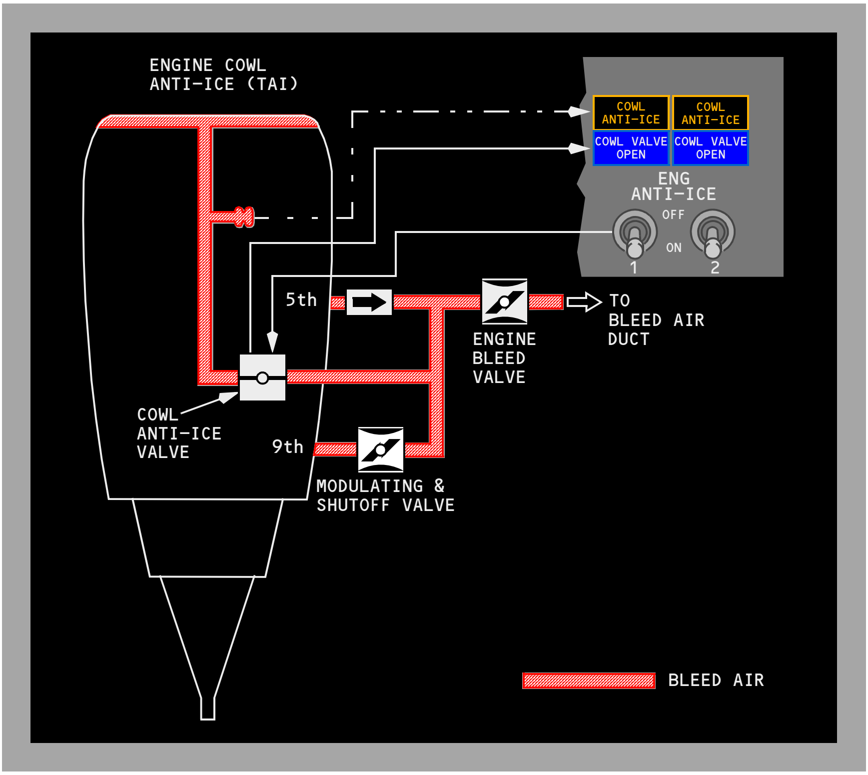
Note: Stall warning logic adjusts stick shaker and minimum maneuver speed bars on the airspeed indicator. FMC displayed VREF is not adjusted automatically.

Note: Stall warning logic, airspeed indications, and minimum maneuver speeds on the airspeed indicator return to normal when engine anti–ice is positioned OFF if wing anti–ice has not been used in flight.

If the cowl anti–ice valve fails to move to the position indicated by the ENG ANTI–ICE switch, the COWL VALVE OPEN light remains illuminated bright blue and an amber TAI indication illuminates on the CDS after a short delay.

The amber COWL ANTI–ICE light illuminates due to excessive pressure in the duct leading from the cowl anti–ice valve to the cowl lip.

Engine Anti–Ice System Schematic



Wing Anti–Ice System

The wing anti–ice system provides protection for the three inboard leading edge slats by using bleed air. The wing anti–ice system does not include the leading edge flaps or the outboard leading edge slats.

The wing anti–ice control valves are AC motor–operated. With a valve open, bleed air flows to the three leading edge inboard slats, and is then exhausted overboard. The wing anti–ice system is effective with the slats in any position.

Wing Anti–Ice System Operation

On the ground, positioning the WING ANTI–ICE switch ON opens both control valves if thrust on both engines is below the setting for takeoff warning activation and the temperature inside both wing distribution ducts is less than the thermal switch activation temperature.

Both valves close if either engine thrust is above the takeoff warning setting or either temperature sensor senses a duct overtemperature. The valves automatically reopen if thrust on both engines is reduced and both temperature sensors are cool.

With the air/ground sensor in the ground mode and the WING ANTI–ICE switch ON, the switch remains in the ON position regardless of control valve position. The WING ANTI–ICE switch automatically trips OFF at lift–off when the air/ground sensor goes to the air mode.

Positioning the WING ANTI–ICE switch to ON in flight:

- opens both control valves
- sets stall warning logic for icing conditions.

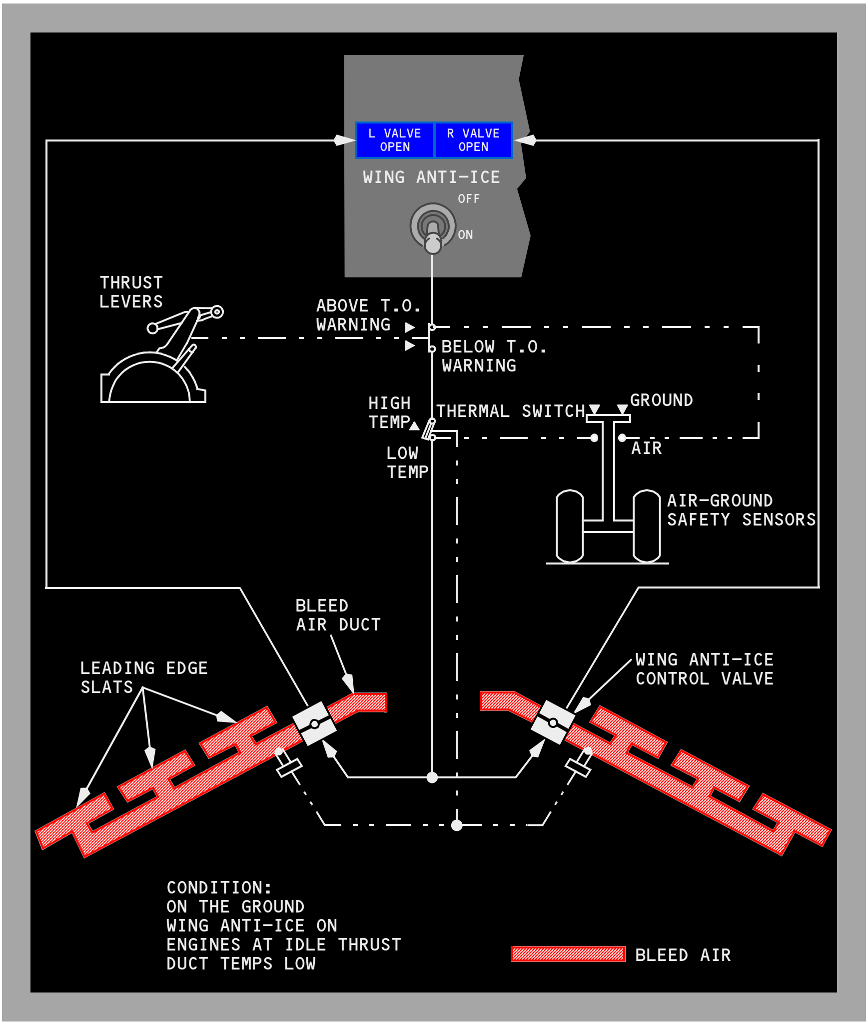
Note: Stall warning logic adjusts stick shaker and minimum maneuver speed bars on airspeed indications. FMC displayed VREF is not adjusted automatically.

Note: Stall warning logic remains set for icing conditions for the remainder of the flight, regardless of subsequent WING ANTI–ICE switch position.

Duct temperature and thrust setting logic are disabled and have no affect on control valve operation in flight.

Valve position is monitored by the blue VALVE OPEN lights.

Wing Anti–Ice System Schematic



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Automatic Flight Chapter 4
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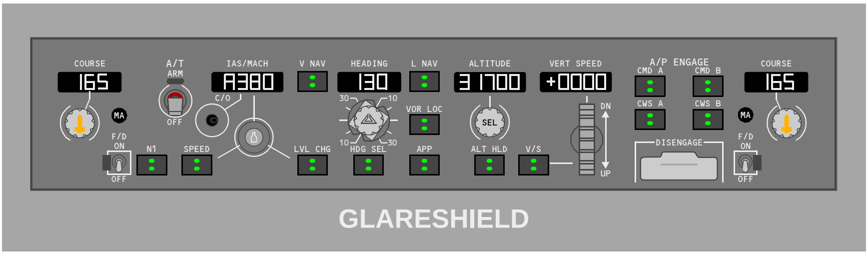
Mode Control Panel (MCP)

YF048 - YV754

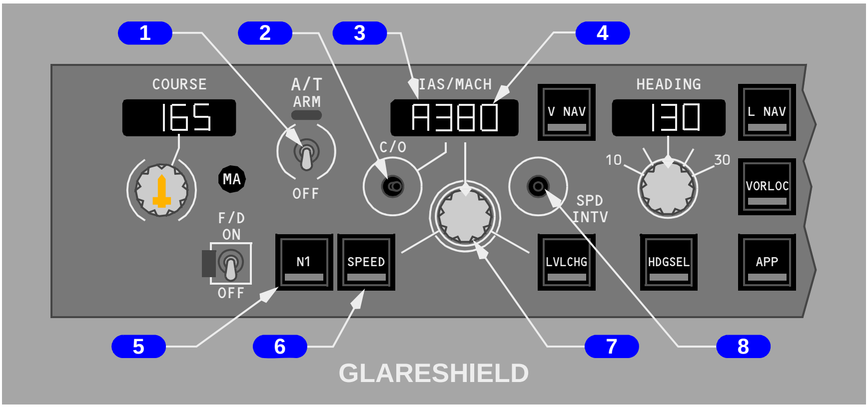
YA709, YA710

YA701 - YA708

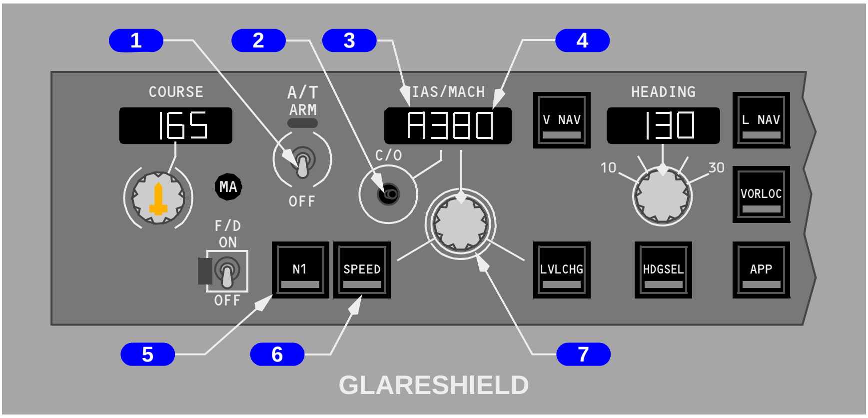


Speed Controls

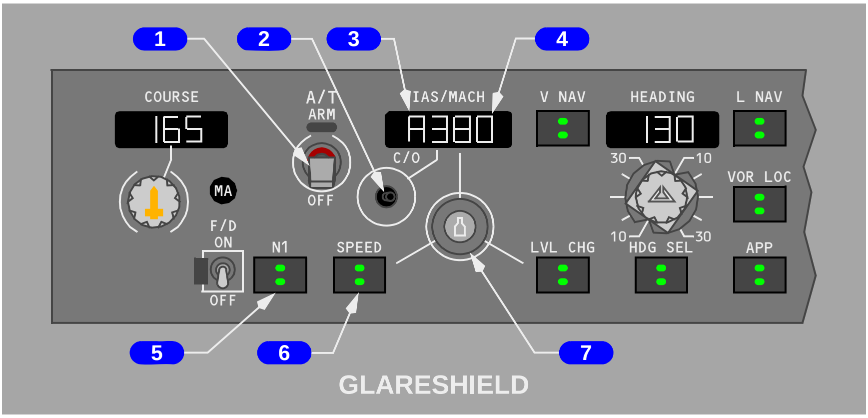
YF048 - YV754



YA709, YA710



YA701 - YA708



1 Autothrottle (A/T) ARM Switch

ARM – Arms A/T for engagement. Magnetically held at ARM. A/T engages automatically when following AFDS modes are engaged:

- LVL CHG
- ALT ACQ
- V/S
- VNAV
- ALT HOLD
- G/S capture
- TO/GA.

The indicator light illuminates green when A/T ARM switch is in the ARM position.

OFF – disengages A/T and prevents A/T engagement.

2 Changeover (C/O) Switch

Push –

- changes IAS/MACH display between IAS and MACH
- automatic changeover occurs at approximately FL260.

3 MCP Speed Condition Symbols

Overspeed or underspeed limiting symbol appears when commanded speed cannot be reached.

Underspeed limiting (flashing character “A”) – minimum speed

Overspeed limiting (flashing character “8”) –

- Vmo or Mmo limit
- landing gear limit
- flap limit.

4 IAS/MACH Display

Displays speed selected by IAS/MACH selector

- display is blank when:
  - VNAV mode engaged
  - A/T engaged in FMC SPD mode
  - during 2 engine AFDS go–around
- displays 100 knots when power is first applied
- display range is:
  - 100 KIAS – Vmo in 1 knot increments
  - .60M – Mmo in .01M increments.

5 N1 Switch

Push – (light not illuminated)

- engages A/T in N1 mode if compatible with AFDS modes already engaged
- illuminates N1 switch light
- annunciates N1 autothrottle mode.

Push – (light illuminated)

- deselects N1 mode and extinguishes switch light
- engages autothrottles in ARM mode.

N1 Mode

- A/T maintains thrust at N1 limit selected from FMC CDU. N1 mode engaged manually by pushing N1 switch if N1 mode is compatible with existing AFDS modes. N1 mode engages automatically when:
  - engaging LVL CHG in climb (except during inhibit period for 2 1/2 minutes after lift-off)
  - engaging VNAV in climb.

6 SPEED Switch

Push – (light not illuminated)

- engages A/T in SPEED mode if compatible with engaged AFDS modes
- illuminates SPEED switch light
- annunciates MCP SPD autothrottle mode
- maintains speed in MCP IAS/MACH display.

Push – (light illuminated)

- deselects speed mode and extinguishes switch light
- engages A/T in ARM mode.

Speed Mode

Autothrottle holds speed in IAS/MACH display or a performance or limit speed. Speed mode engaged manually by pushing SPEED switch if speed mode is compatible with existing AFDS modes. Speed mode engages automatically when:

- ALT ACQ engages
- ALT HOLD engages
- V/S engages
- G/S capture occurs.

When the “N1 SET” outer knob is in the AUTO position the A/T will not set thrust above the displayed N1 limit, however, A/T can exceed an N1 value manually set with the “N1 SET” outer knob in the manual BOTH, 1, or 2 position. Setting the thrust reference manually is intended to provide guidance when manually controlling thrust.

7 IAS/MACH Selector

Rotate –

- sets speed in IAS/MACH display and positions airspeed cursor
- selected speed is reference speed for AFDS and A/T
- not operative when IAS/MACH display is blank.

YF048 - YV754

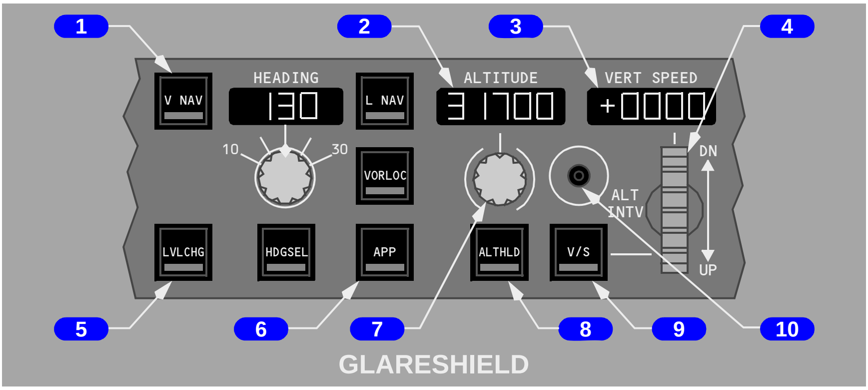
8 Speed Intervention (SPD INTV) Switch

Push (when VNAV engaged) –

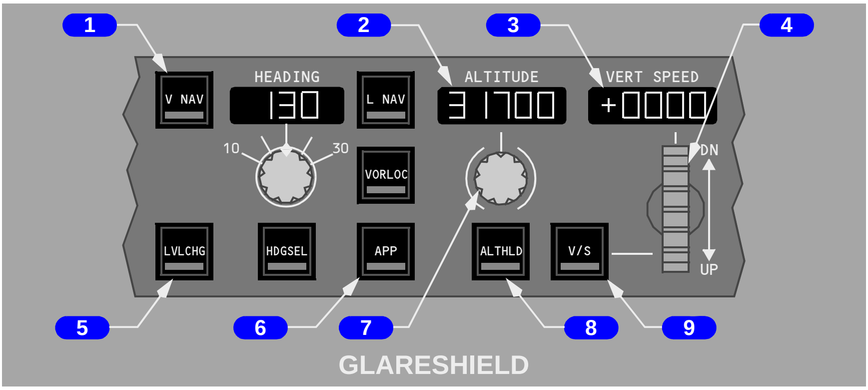
- IAS/MACH display alternately shows selected IAS/Mach and blanks
- when IAS/MACH display is unblanked, FMC speed intervention is active, FMC target speed is displayed, and IAS/MACH Selector may be used to set desired speed
- when IAS/MACH display is blank, FMC computed target speed is active and displayed on the airspeed indicator.

Vertical Navigation

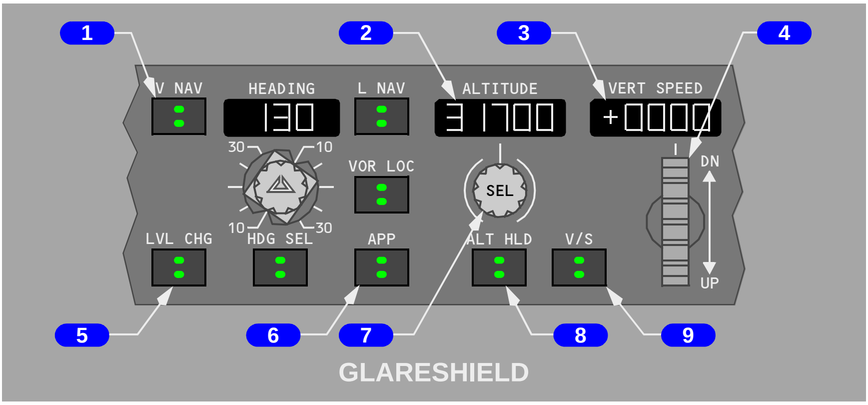
YF048 - YV754



YA709, YA710



YA701 - YA708



1 VNAV Switch

Push –

- VNAV switch light illuminates
- pitch mode annunciates VNAV SPD, VNAV PTH, or VNAV ALT
- A/T mode annunciates FMC SPD, N1, RETARD, or ARM
- IAS/MACH display blanks and airspeed cursors positioned to FMC commanded airspeed.

VNAV Mode

The FMC commands AFDS pitch and autothrottle to fly vertical profile selected on FMC CDUs. Profile includes climb, cruise, descent, speeds, and can also include waypoint altitude constraints.

YA709 - YV754

VNAV arm criteria on the ground:

- a valid flight plan has been entered.
- performance data has been entered and executed.
- both flight director switches have been switched on.
- VNAV guidance becomes active at 400 feet AGL

Climb –

- autothrottle holds FMC thrust limit
- AFDS holds FMC target speed
- automatic level-off occurs at MCP altitude or VNAV altitude, whichever is reached first
  - MCP constrained altitude annunciates VNAV ALT
  - VNAV constrained altitude annunciates VNAV PTH.

Cruise –

- autothrottle holds FMC target speed
- AFDS holds FMC altitude
- selecting a lower MCP altitude arms FMC to automatically begin descent upon arrival at FMC top of descent point.

Descent –

- VNAV SPD descent
  - autothrottle holds idle
  - AFDS holds FMC target speed.
- VNAV PTH descent
  - autothrottle holds idle but can command FMC SPD mode if ground speed becomes too low to maintain FMC vertical path
  - AFDS tracks FMC descent path.
- automatic level-off occurs at MCP altitude or VNAV altitude, whichever is reached first
  - MCP constrained altitude annunciates VNAV ALT
  - VNAV constrained altitude annunciates VNAV PTH.

Inhibited below 400 ft RA or if performance initialization not complete.

VNAV mode is terminated by any one of the following:

- selecting another pitch mode
- glideslope capture
- reaching end of LNAV route
- transition of glideslope intercept waypoint if G/S is armed
- crosstrack deviation exceeds twice the RNP value during PTH descent for an active leg with a database vertical angle and LNAV not engaged

In the event of glideslope intercept waypoint transition, VNAV can be re-engaged.

2 ALTITUDE Display

Displays selected altitude

- displayed altitude is reference for altitude alerting and automatic level–offs
- altitude range is 0 to 50,000 feet in 100 foot increments
- displays previously selected altitude when power first applied.

3 Vertical Speed (VERT SPEED) Display

Displays:

- blank when V/S mode not active
- present V/S when V/S mode is engaged with V/S switch
- selected V/S when V/S set with thumbwheel
- range is –7900 to +6000 fpm.

Display increments are:

- 50 fpm if V/S is less than 1000 fpm
- 100 fpm if V/S is 1000 fpm or greater.

4 Vertical Speed Thumbwheel

Rotate –

- DN –
  - sets vertical speed in VERT SPEED display
  - increases rate of descent or reduces rate of ascent.
- UP –
  - sets vertical speed in VERT SPEED display
  - increases rate of ascent or reduces rate of descent.

5 Level Change (LVL CHG) Switch

Push –

- LVL CHG switch light illuminates
- pitch mode annunciates MCP SPD for climb or descent
- autothrottle mode annunciates N1 for climb and RETARD followed by ARM for descent
- IAS/MACH display and airspeed cursors display target speed.

LVL CHG Mode

The LVL CHG mode coordinates pitch and thrust commands to make automatic climbs and descents to preselected altitudes at selected airspeeds.

A LVL CHG climb or descent is initiated by:

- selecting a new altitude
- pushing LVL CHG switch
- setting desired airspeed.

Climb –

- autothrottle holds limit thrust
- AFDS holds selected airspeed.

Descent –

- autothrottle holds idle thrust
- AFDS holds selected airspeed.

Airspeed –

- if a speed mode is active when LVL CHG is engaged, this speed is retained as target speed
- if a speed mode is not active when LVL CHG is engaged, existing speed becomes target speed
- speed can be changed with MCP IAS/MACH Selector.

The LVL CHG mode is inhibited after glideslope capture.

6 Approach (APP) Switch

(See Lateral Navigation)

7 Altitude Selector (SEL)

Rotate –

- sets altitude in ALTITUDE display in 100 foot increments
- arms V/S mode if rotated while in ALT HOLD at selected altitude.

8 Altitude Hold (ALT HLD) Switch

Push –

- engages ALT HOLD command mode
- commands pitch to hold uncorrected barometric altitude at which switch was pressed
- annunciates ALT HOLD pitch mode and illuminates ALT HLD switch light.

Altitude Hold Command Mode

ALT HOLD mode commands pitch to hold either:

- MCP selected altitude
  - pitch mode annunciates ALT HOLD
  - ALT HLD switch light extinguishes.
- uncorrected barometric altitude at which ALT HLD switch was pressed if not at MCP selected altitude
  - pitch mode annunciates ALT HOLD
  - ALT HLD switch light illuminates.

When in ALT HOLD at selected MCP altitude:

- selecting a new MCP altitude illuminates the ALT HLD switch light and arms V/S mode
- LVL CHG, V/S, and VNAV climb and descent functions are inhibited until a new MCP altitude is selected.

ALT HOLD mode is inhibited after G/S capture.

The selected MCP altitude is referenced to:

- Captain’s barometric altimeter setting for A A/P and F/D
- First Officer’s barometric altimeter setting for B A/P and F/D.

Note: After ALT HOLD engages, changes in altimeter barometric settings do not change the selected altitude reference.

9 Vertical Speed (V/S) Switch

Push –

- arms or engages V/S command mode
- commands pitch to hold vertical speed
- engages A/T in speed mode to hold selected airspeed
- annunciates V/S pitch mode and illuminates V/S switch light.

Vertical Speed Command Mode

The V/S mode commands pitch to hold selected vertical speed and engages A/T in SPEED mode to hold selected airspeed. V/S mode has both an armed and an engaged state.

Engaged –

- annunciates V/S pitch mode
- vertical speed display changes from blank to present vertical speed
- desired vertical speeds can be selected with vertical speed thumbwheel.

V/S becomes armed if:

- pitch mode is ALT HLD at selected MCP altitude and
- new MCP altitude is selected (more than 100 feet from current altitude).

With V/S armed, V/S mode is engaged by moving vertical speed thumbwheel.

V/S mode automatically engages if ALT ACQ mode is engaged and a new MCP altitude is selected which is more than 100 feet different from previously selected altitude.

- vertical speeds can be selected which command flight toward or away from selected altitude.

Inhibited if:

- ALT HOLD mode is active at selected MCP altitude
- glideslope captured in APP mode.

YF048 - YV754

10 Altitude Intervention (ALT INTV) Switch

Allows manual deletion of next FMC altitude constraint via altitude SEL and ALT INTV switch.

Push – (during VNAV climb)

- lowest FMC altitude constraint below selected MCP altitude is deleted
- if airplane is currently at an FMC altitude constraint, deletion allows airplane to resume climb. MCP altitude must be set above current altitude

- for each press of switch, one deletion occurs
- if MCP altitude is set above current FMC altitude, FMC cruise altitude resets to MCP altitude. FMC cruise altitude cannot be decreased using ALT INTV switch.

Push – (during VNAV cruise)

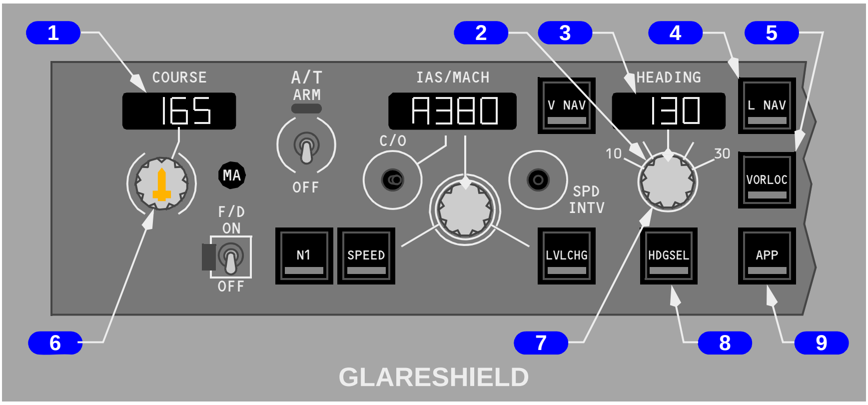
- if MCP altitude is set above current FMC cruise altitude, FMC resets cruise altitude to MCP altitude and initiates a cruise climb
- if MCP altitude is set below current FMC cruise altitude, an early descent is initiated. Lower FMC cruise altitude cannot be entered using ALT INTV switch.

Push – (during VNAV descent)

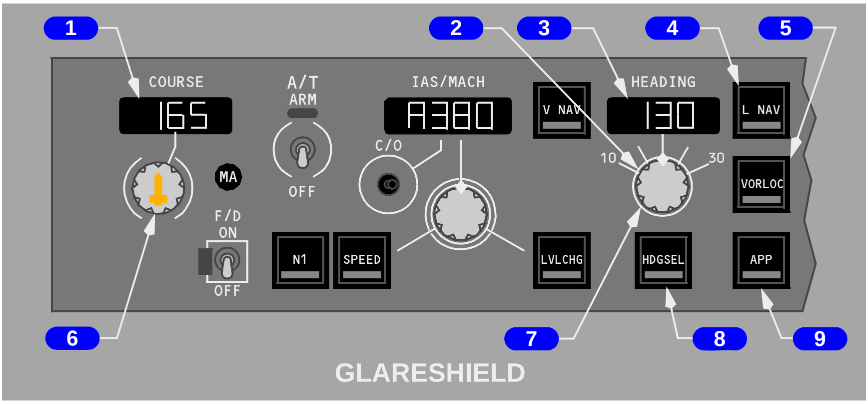
- the highest FMC altitude constraint above MCP altitude is deleted
- if airplane is currently at an FMC altitude constraint, deletion allows airplane to continue descent. MCP altitude must be set below current altitude
- if all FMC altitude constraints are deleted during VNAV path descent, an automatic transition to a VNAV speed descent is made.

Lateral Navigation

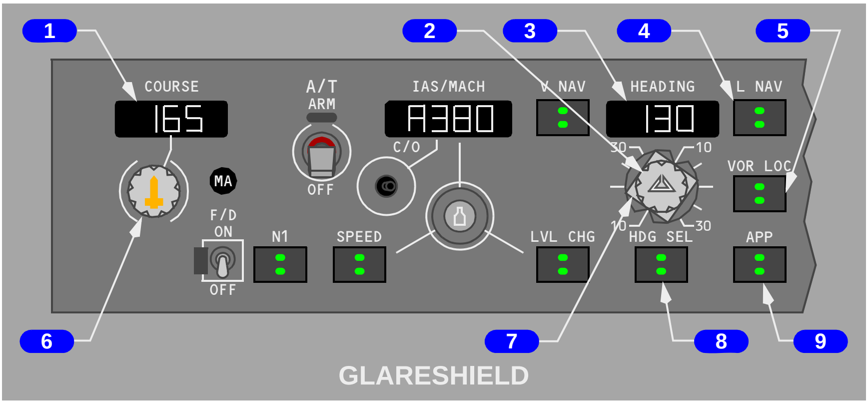
YF048 - YV754



YA709, YA710



YA701 - YA708



1 COURSE Display

Displays course set by course selector.

Note: Different courses and frequencies on two VHF NAV receivers can cause disagreement between Captain and FO F/D displays and affect A/P operation.

2 Heading Selector

Rotate –

- sets heading in HEADING display
- positions selected heading bugs on the DUs.

3 HEADING Display

Displays selected heading.

4 LNAV Switch

Push –

- commands AFDS roll to intercept and track the active FMC route
- annunciates LNAV as roll mode and illuminates LNAV switch light.

LNAV Mode

In LNAV mode, the FMC controls AFDS roll to intercept and track active FMC route. Active route is entered and modified through FMC CDUs and can include SIDs, STARs, and instrument approaches.

LNAV arming criteria on the ground:

- origin runway in flight plan
- active route entered in FMC
- track of first leg within 5 degrees of runway heading
- LNAV selected prior to TO/GA.
  - LNAV guidance becomes active at 50 feet AGL

  YA701 - YA706
  - bank angle is limited to 8 degrees from 50 feet to 200 feet and 15 degrees from 200 feet to 400 feet AGL.

  YA707 - YS194
  - bank angle is limited to 8 degrees below 200 feet and 30 degrees above 200 feet AGL.

  YT501 - YV754
  - bank angle is limited to 15 degrees below 200 feet and 30 degrees above 200 feet AGL.

LNAV engagement criteria in flight:

- active route entered in FMC
- within 3 NM of active route, LNAV engagement occurs with any airplane heading
- outside of 3 NM, airplane must:
  - be on intercept course of 90 degrees or less
  - intercept route segment before active waypoint.

LNAV automatically disconnects for following reasons:

- reaching end of active route
- reaching a route discontinuity
- intercepting a selected approach course in VOR LOC or APP modes (VOR/LOC armed)
- selecting HDG SEL
- loss of capture criteria.

5 VOR Localizer (LOC) Switch

Push –

- commands AFDS roll to capture and track selected VOR or LOC course
- annunciates VOR/LOC armed or engaged as roll mode and illuminates VOR LOC switch light.

VOR LOC Mode

Pushing the VOR LOC switch selects VOR mode if a VOR frequency is tuned or selects LOC mode if a localizer frequency is tuned.

The VOR mode provides roll commands to track selected VOR course.

The LOC mode provides roll commands to track selected localizer course along inbound front course bearing.

The selected course can be intercepted while engaged in:

- LNAV
- HDG SEL
- CWS R if an autopilot is engaged in CMD.

The capture point is variable and depends on intercept angle and closure rate. Localizer capture occurs not later than 1/2 dot deviation. Course capture is indicated when VOR/LOC annunciation changes from armed to engaged.

While engaged in VOR or LOC modes:

- A autopilot and Captain’s F/D use information from Captain’s course selector and No. 1 VHF NAV receiver
- B autopilot and First Officer’s F/D use information from First Officer’s course selector and No. 2 VHF NAV receiver
- different courses and/or frequencies for two VHF NAV receivers can cause disagreement between the Captain’s and First Officer’s F/D displays and affect A/P operation.

Note: When a localizer frequency is selected, VHF NAV radios automatically switch from tail antenna to nose antenna when VOR/LOC is annunciated (armed or engaged). If antenna switching does not occur, LOC mode is inhibited.

Note: Localizer backcourse tracking is not available.

6 Course Selector

Sets course in COURSE display for related VHF NAV receiver, AFDS and DU. Two course selectors and COURSE displays are located on the MCP.

Rotate Captain's course selector – provides selected course information to:

- A FCC
- No. 1 VHF NAV receiver
- Captain's course pointer and course deviation bar.

Note: In VOR LOC or APP mode, the A A/P and Captain's F/D use selected course and navigation data from the No. 1 VHF NAV receiver.

Rotate First Officer's course selector – provides selected course information to:

- B FCC
- No. 2 VHF NAV receiver
- First Officer's course pointer and course deviation bar.

Note: In VOR LOC or APP mode, B A/P and First Officer's F/D use selected course and navigation data from No. 2 VHF NAV receiver.

7 Bank Angle Selector

Rotate –

- sets maximum bank angle for AFDS operation in HDG SEL or VOR modes
- commanded bank angle can be selected at 10, 15, 20, 25, or 30 degrees.

8 Heading Select (HDG SEL) Switch

Push –

- engages HDG SEL command mode
- commands roll to follow selected heading
- annunciates HDG SEL as FMA roll mode and illuminates HDG SEL switch light.

Heading Select Command Mode

The HDG SEL mode commands roll to turn to and maintain heading shown in MCP HEADING display:

- initial selection commands turn in shortest direction toward selected heading bug
- after mode engagement, roll commands are given to turn in same direction as rotation of heading selector
- bank angle limit is established by bank angle selector
- HDG SEL mode automatically disengages upon capture of selected radio course in VOR LOC and APP modes (VOR/LOC armed).

9 Approach (APP) Switch

Push –

- illuminates APP switch light
- arms the AFDS for localizer and glideslope capture
- roll mode annunciates VOR/LOC armed
- pitch mode annunciates G/S armed
- enables engagement of both autopilots.

APP Mode

The approach mode arms AFDS to capture and track localizer and glideslope and can be engaged for dual or single autopilot operation.

One VHF NAV receiver must be tuned to an ILS frequency before approach mode can be engaged. With one VHF NAV receiver tuned, onside AFDS is enabled for guidance and operation.

For dual autopilot operation, both VHF NAV receivers must be tuned to the ILS frequency and both autopilots must be selected in CMD prior to 800 feet RA.

APP mode operation:

- localizer must be captured prior to glideslope
- localizer can be intercepted in HDG SEL, LNAV, or CWS R
- SINGLE CH annunciates in A/P Status Display after localizer capture
  - for single autopilot approach, SINGLE CH remains annunciated for entire approach
  - for dual autopilot approach, SINGLE CH annunciation extinguishes when second autopilot engages and FLARE armed is annunciated
- glideslope capture occurs at 2/5 dot below glideslope
- APP switch light extinguishes after localizer and glideslope capture.

After localizer and glideslope capture, APP mode can be disengaged by:

- pushing a TO/GA switch
- disengaging autopilot(s) and turning off both F/D switches
- retuning the VHF NAV receiver.

While engaged in the APP mode:

- the A autopilot and Captain’s F/D use information from Captain’s Course Selector and No. 1 VHF NAV receiver
- the B autopilot and First Officer’s F/D use information from First Officer’s Course Selector and No. 2 VHF NAV receiver
- different courses and/or frequencies for the two VHF NAV receivers can cause disagreement between Captain’s and First Officer’s F/D displays and affect A/P operation.

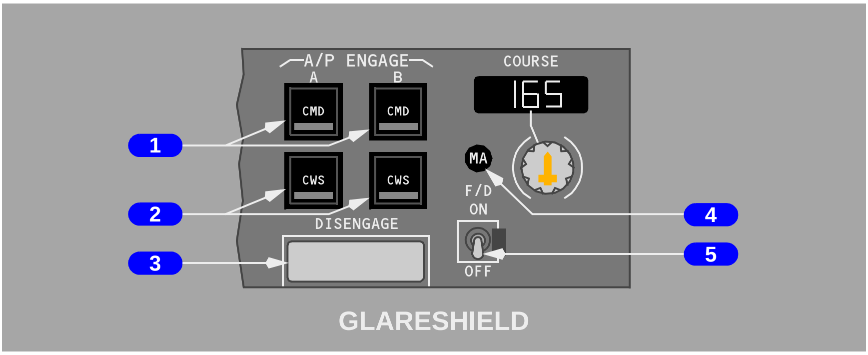
Note: After localizer or glideslope capture, during a single channel autopilot approach, CWS cannot be engaged by manually overriding pitch and/or roll control forces. Manually overriding pitch and/or roll will cause autopilot disconnect. At autopilot disconnect, the active Autopilot modes will remain engaged.

Note: During a dual autopilot approach and after FLARE ARM annunciation, any attempted manual override of the autopilots may result in an autopilot disconnect.

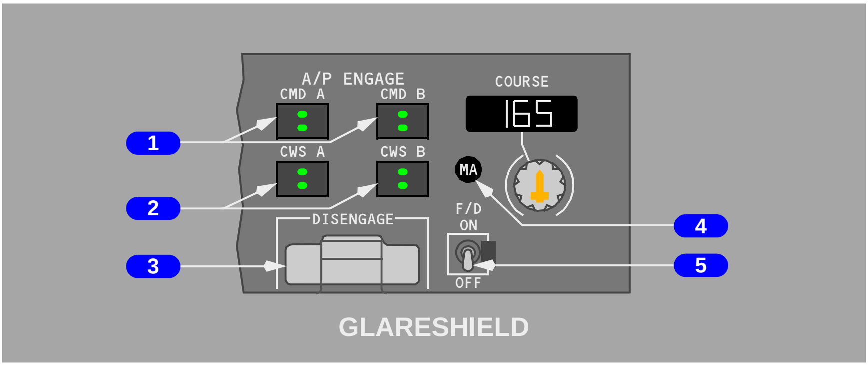
Autopilot / Flight Director

Pushing a CMD or CWS switch engages related A/P in CMD or CWS and illuminates switch lights. A/P can operate in CMD, CWS, or a combination of CMD and CWS.

YA709 - YV754



YA701 - YA708



1 Command Engage (CMD ENGAGE) Switch (A or B):

Push –

- engages A/P
- enables all command modes
- displays CMD in A/P status display
- pushing an engage switch for second A/P, while not in approach mode, engages second A/P and disengages first A/P
- enables CWS operation
- CWS engages if:
  - pitch or roll mode not selected
  - pitch or roll mode deselected

  YA701 - YS194
  - pitch or roll mode manually overridden with control column or wheel force
- CWS engaged displays:
  - CWS P and/or CWS R in A/P status display
  - blank in pitch and/or roll mode FMA
- when approaching a selected altitude in CWS P, the pitch mode engages in ALT ACQ and ALT HOLD when reaching selected altitude
- when approaching a selected radio course in CWS R with VOR/LOC or approach mode armed, VOR/LOC engages when course is intercepted

YA701 - YS194

- if pitch is manually overridden while in ALT HOLD and control force is released within 250 feet of selected altitude, A/P pitch mode engages in ALT ACQ and returns to selected altitude in ALT HOLD mode.

YA701 - YS194

Note: During F/D only operation, while pitch or roll commands are more than 1/2 scale from center, pushing a CMD A or B switch engages the A/P in CWS for pitch and/or roll and the related F/D bar(s) retract.

YT501 - YV754

Note: During F/D only operation, while a pitch command is more than 1/2 scale from center, pushing a CMD A or B switch engages the A/P in CWS for pitch and the related F/D bar(s) retract.

2 Control Wheel Steering Engage (CWS ENGAGE) Switch (A or B):

Push –

- engages A/P
- engages pitch and roll modes in CWS. Other pitch and roll modes not enabled
- displays CWS P and CWS R in A/P status display
- CMD not displayed in A/P status display
- F/Ds, if ON, display guidance commands and FD annunciates in A/P status display. A/P does not follow commands while in CWS
- A/P pitch and roll controlled by pilot with control wheel pressure
- when control pressure released, A/P holds existing attitude. If aileron pressure released with 6 degrees or less bank, the A/P rolls wings level and holds existing heading. Heading hold feature inhibited:
  - below 1500 feet RA with gear down
  - after LOC capture in APP mode
  - after VOR capture with TAS 250 knots or less.

3 Autopilot Disengage (DISENGAGE) Bar

Pull down –

- exposes yellow background
- disengages both A/Ps
- prevents A/P engagement.

Lift up –

- conceals yellow background
- enables A/P engagement.

4 Master (MA) Flight Director Indicators (white letters)

If a F/D switch is ON, the light indicates which FCC is controlling the F/D modes.

- illuminated – related FCC is controlling F/D modes.
- extinguished – F/D modes are controlled from opposite FCC
- both lights illuminated – each FCC is controlling modes for related F/D.

5 Flight Director (F/D) Switch

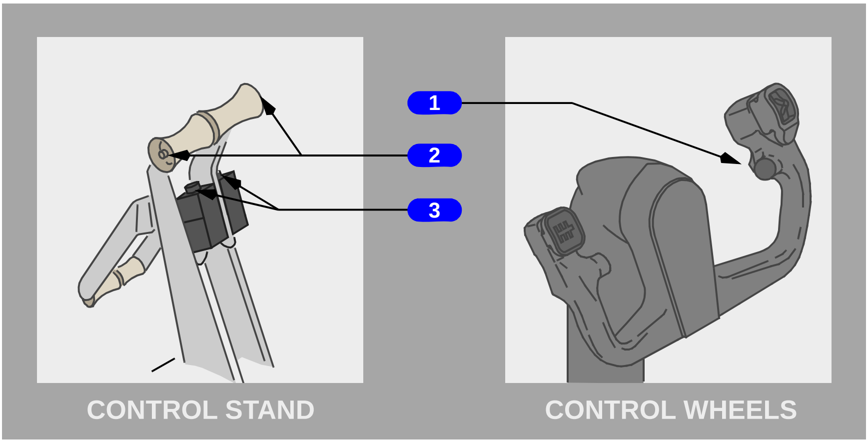
Left F/D switch activates the command bar on the Captain’s attitude indicator. Right F/D switch activates the command bar on the First Officer’s attitude indicator.

ON –

- in flight with A/P ON and F/Ds OFF, turning a F/D switch ON engages F/D in currently selected A/P modes
- displays FD in A/P status display if A/P is OFF or engaged in CWS
- enables command bar display on related pilot’s attitude indicator
- command bar is displayed if command pitch and roll modes are engaged
- on ground, arms pitch and roll modes for engagement in TO/GA and wings level when TO/GA switch is pushed.

OFF – command bar retracts from related pilot’s attitude indicator.

Autopilot / Autothrottle Controls



1 Autopilot Disengage Switch

Push –

- disengages both autopilots
- A/P disengage lights flash
- A/P disengage warning tone sounds for a minimum of two seconds
- second push extinguishes disengage lights and silences disengage warning tone
- if autopilot automatically disengages, extinguishes A/P Disengage lights and silences A/P warning tone.

2 Autothrottle Disengage Switches

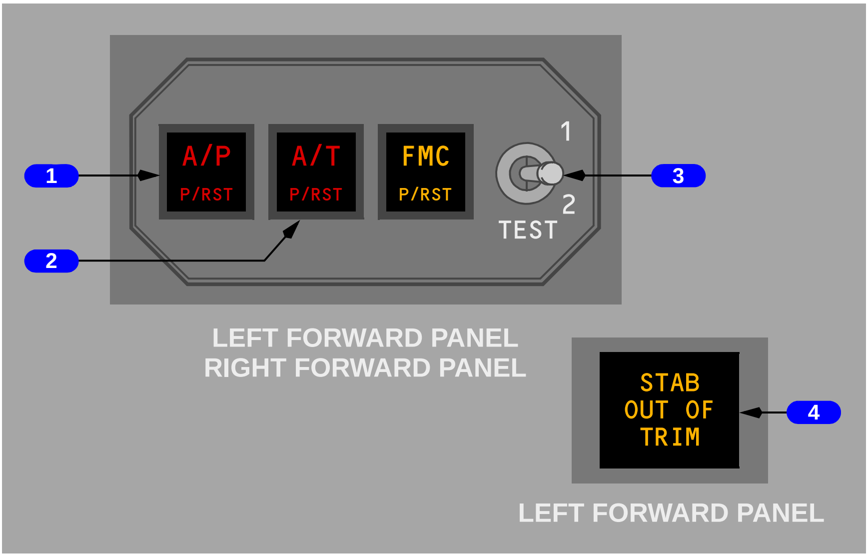
Push –

- disengages autothrottle
- A/T disengage lights flash
- A/T ARM switch trips OFF
- second press extinguishes A/T disengage lights
- extinguishes A/T disengage lights after automatic A/T disengagement.

3 Takeoff/Go–Around (TO/GA) Switches

Push – engages AFDS and A/T in takeoff or go–around mode if previously armed.

Autopilot / Autothrottle Indicators



1 Autopilot (A/P) Disengage Light

Illuminated (red) –

- flashes and tone sounds when autopilot has disengaged.

YT502 - YV754

- flashes and tone sounds when an autopilot engage attempt is made and is unsuccessful.
- reset by pushing either disengage light or either A/P disengage switch.

- steady for any of following conditions:
  - stabilizer out of trim below 800 feet RA on dual channel approach
  - ALT ACQ mode inhibited during A/P go–around if stabilizer not trimmed for single A/P operation
  - disengage light test switch held in position 2
  - automatic ground system tests fail.

Illuminated (amber) –

- steady – disengage light test switch held in position 1.
- flashing – A/P automatically reverts to CWS pitch or roll while in CMD. Resets by pushing either light or selecting another mode.

2 Autothrottle (A/T) Disengage Light

Illuminated (red) –

- flashing – autothrottle has disengaged
- steady – disengage light test switch held in position 2.

Illuminated (amber) –

- steady – disengage light test switch held in position 1

YA701 - YL551, YN531 - YV754

- flashing – indicates A/T airspeed error under following conditions:
  - inflight
  - flaps not up
  - airspeed differs from commanded value by +10 or -5 knots and is not approaching commanded value.

3 Disengage Light Test (TEST) Switch

TEST 1 – illuminates autopilot/autothrottle disengage and FMC alert lights steady amber.

TEST 2 – illuminates autopilot/autothrottle disengage lights steady red and FMC alert light steady amber.

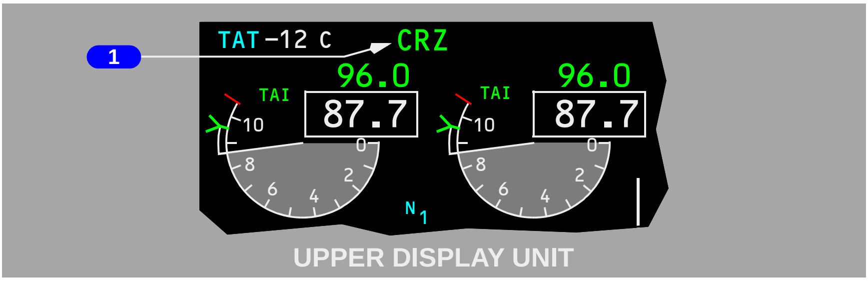
Spring–loaded to center position.

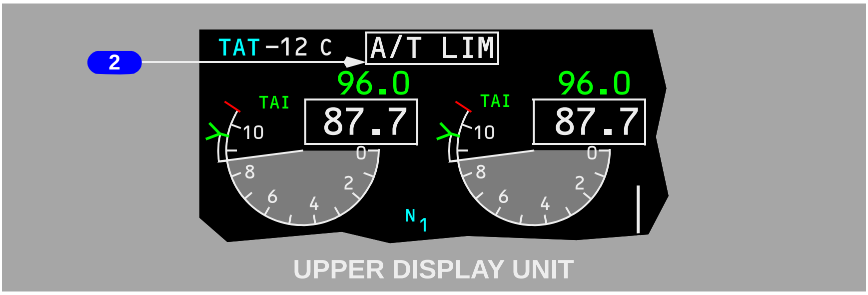
4 Stabilizer Out Of Trim (STAB OUT OF TRIM) Light

Operates only with autopilot engaged. Remains extinguished with autopilot not engaged.

Illuminated (amber) – autopilot not trimming stabilizer properly.

Thrust Mode Display





1 Thrust Mode Display

N1 limit reference is the active N1 limit for autothrottle and manual thrust control.

N1 limit reference is also displayed by N1 reference bugs with N1 SET control in AUTO position.

N1 limit reference is normally calculated by the FMC.

Thrust mode display annunciations are:

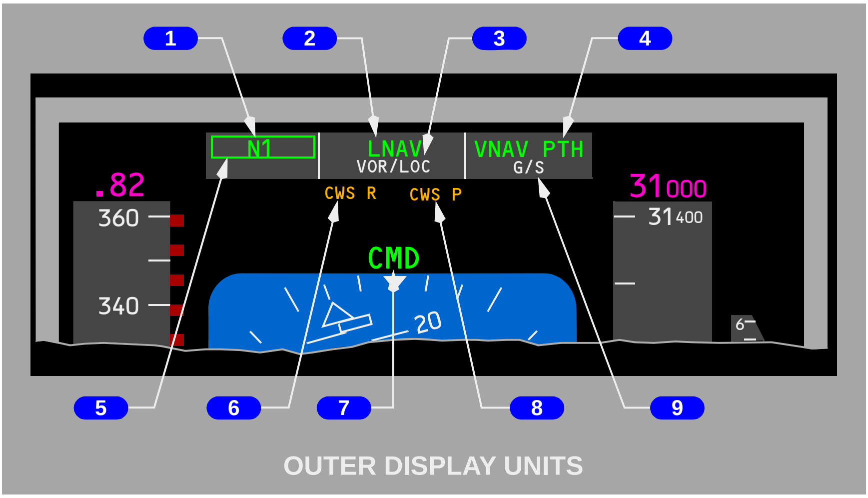
- TO – takeoff
- R-TO – reduced takeoff
- R-CLB – reduced climb
- CLB – climb
- CRZ – cruise
- G/A – go–around
- CON – continuous
- —— – FMC not computing thrust limit.

Note: R-TO does not indicate the type of reduced takeoff. The N1 limit may be reduced due to the entry of an assumed temperature, a takeoff thrust derate or a combination of both assumed temperature and takeoff thrust derate.

2 Autothrottle Limit (A/T LIM) Indication

Illuminated (white) – the FMC is not providing the A/T system with N1 limit values. The A/T is using a degraded N1 thrust limit from the related EEC.

Flight Mode Annunciations (FMAs)



1 Autothrottle (A/T) Engaged Mode

- N1 (green)
- GA (green)
- RETARD (green)
- FMC SPD (green)
- MCP SPD (green)
- THR HLD (green)
- ARM (white)

2 Roll Engaged Mode

- HDG SEL (green)
- VOR/LOC (green)
- LNAV (green)

3 Roll Armed Mode

- VOR/LOC (white)

YL545 - YL551, YN531 - YV754
- LNAV VOR/LOC (white)

YA709 - YV754
- LNAV (white)

4 Pitch Engaged Mode

- TO/GA (green)
- V/S (green)
- MCP SPD (green)
- ALT/ACQ (green)
- ALT HOLD (green)
- G/S (green)
- FLARE (green)
- VNAV SPD (green)
- VNAV PTH (green)
- VNAV ALT (green)

5 Mode Highlight Change Symbol

YA701 - YV750

A mode change highlight symbol (rectangle) is drawn around each pitch, roll, CWS, A/P status, and thrust engaged mode annunciation for a period of 10 seconds after each engagement.

YV751 - YV754

A mode change highlight symbol (rectangle) is drawn around each pitch, roll, A/P status, and thrust engaged mode annunciation for a period of 10 seconds after each engagement. The mode highlight change symbol for CWS Mode annunciations (CWS R and CWS P) will flash for 10 seconds when CWS mode engages.

6 CWS Roll Engaged

- CWS R (amber)

7 Autopilot Status

- CMD (green)
- SINGLE CH (amber)
- FD (green)

8 CWS Pitch Engaged

- CWS P (amber)

9 Pitch Armed Mode

- G/S (white)
- V/S (white)
- FLARE (white)
- G/S V/S (white)

YA709 - YV754

- VNAV (white)

Automatic Flight Chapter 4

System Description Section 20

General

The automatic flight system (AFS) consists of the autopilot flight director system (AFDS) and the autothrottle (A/T). The flight management computer (FMC) provides N1 limits and target N1 for the A/T and command airspeeds for the A/T and AFDS.

The AFDS and A/T are controlled using the AFDS mode control panel (MCP) and the FMC. Normally, the AFDS and A/T are controlled automatically by the FMC to fly an optimized lateral and vertical flight path through climb, cruise and descent.

AFS mode status is displayed on the flight mode annunciation on each pilot's primary display.

Autopilot Flight Director System (AFDS)

The AFDS is a dual system consisting of two individual flight control computers (FCCs) and a single mode control panel.

The two FCCs are identified as A and B. For A/P operation, they send control commands to their respective pitch and roll hydraulic servos, which operate the flight controls through two separate hydraulic systems.

For F/D operation, each FCC positions the F/D command bars on the respective attitude indicator.

MCP Mode Selector Switches

The mode selector switches are pushed to select desired command modes for the AFDS and A/T. The switch illuminates to indicate mode selection and that the mode can be deselected by pushing the switch again. While a mode is active, deselection can be automatically inhibited and is indicated by the switch being extinguished.

When engagement of a mode would conflict with current AFS operation, pushing the mode selector switch has no effect. All AFDS modes can be disengaged either by selecting another command mode or by disengaging the A/P and turning the F/Ds off.

Autopilot Engagement Criteria

Each A/P can be engaged by pushing a separate CMD or CWS engage switch. A/P engagement in CMD or CWS is inhibited unless both of the following pilot–controlled conditions are met:

- no force is being applied to the control wheel
- the STAB TRIM AUTOPILOT cutout switch is at NORMAL.

Only one A/P can be engaged at a given time unless the approach (APP) mode is engaged. Approach mode allows both A/Ps to be engaged at the same time. Dual A/P operation provides control through landing flare and touchdown or an automatic go–around.

In single A/P operation, full automatic flare and touchdown capability and A/P go–around capability are not available.

Autopilot Disengagement

The A/P automatically disengages when any of the following occurs:

- pushing either A/P disengage switch

YT501 - YV754

- column or wheel force override

YA701 - YA706

- pushing either Takeoff/Go–around (TO/GA) switch with a single A/P engaged in CWS or CMD below 2000 feet RA.

YA707 - YV754

- pushing either Takeoff/Go-around (TO/GA) switch with a single A/P engaged in CWS or CMD;
  - below 2000 feet RA or,
  - with flaps not up or,
  - G/S engaged

YA707 - YV754

- pushing either Takeoff/Go-around (TO/GA) switch with a single A/P engaged in CWS or CMD above 2000 feet RA with flaps not up or G/S engaged.
- pushing either TO/GA switch after touchdown with both A/Ps engaged in CMD
- pushing an illuminated A/P ENGAGE switch
- pushing the A/P DISENGAGE bar down
- activating either pilot’s control wheel trim switch
- moving the STAB TRIM AUTOPILOT cutout switch to CUTOUT

YT501 - YV754

- for a column and/or wheel force override of a single or dual channel CMD engaged autopilot, in approach or non-approach phase of flight. The AFDS will maintain the active pitch and roll modes with flight director guidance.
- either left or right IRS system failure or FAULT light illuminated
- loss of electrical power or a sensor input which prevents proper operation of the engaged A/P and mode
- loss of respective hydraulic system pressure.

Note: Loss of the system A engine-driven hydraulic pump, and a heavy demand on system A, may cause A/P A to disengage.

AFS Failures

Power interruption or loss may cause disengagement of the AFDS and/or A/T. Re–engagement is possible after power is restored.

Dual channel A/P operation is possible only when two generators are powering the busses.

Two independent radio altimeters provide radio altitude to the respective FCCs. With a radio altimeter inoperative, the autopilot will disconnect two seconds after LOC and GS capture.

Flight Director Display

Turning a F/D switch ON displays command bars on the respective pilot’s attitude indicator if command pitch and roll modes are engaged. If command pitch and roll modes are not engaged, the F/D command bars do not appear. The F/Ds can be operated with or without the A/P and A/T. F/D command modes can be used with an A/P engaged in CWS.

F/D commands operate in the same command modes as the A/P except:

- the takeoff mode is a F/D only mode
- dual F/D guidance is available for single engine operation
- the F/D has no landing flare capability. F/D command bars retract from view at approximately 50 feet RA on an ILS approach.

Normally, FCC A drives the captain’s command bars and FCC B drives the first officer’s command bars. With both F/D switches ON, the logic for both pilots’ F/D modes is controlled by the master FCC, and both FMA displays show the same mode status.

The master FCC is indicated by illumination of the respective master (MA) F/D indicator light. The master FCC is determined as follows:

- with neither A/P engaged in CMD, the FCC for the first F/D turned on is the master
- with one or both A/Ps engaged in CMD, the FCC for the first A/P in CMD is the master FCC, regardless of which F/D is turned on first.

F/D modes are controlled directly from the respective FCC under certain conditions. This independent F/D operation occurs when neither A/P is engaged in CMD, both F/D switches are ON and one of the following mode conditions exists:

- APP mode engaged with LOC and G/S captured
- GA mode engaged and below 400 feet RA
- TO mode engaged and below 400 feet RA.

YT501 - YV754
For non-approach modes, if the pilot is flying manually but not following the flight director guidance in the roll mode and then selects autopilot CMD engagement, the autopilot will engage into the current flight director role mode.

Independent F/D operation is indicated by illumination of both MA lights. When independent operation terminates, the MA light extinguishes on the slaved side.

If a generator is lost during a F/D TO or GA, or while in dual F/D APP mode below 800 feet, the FCC on the unaffected side positions the F/D command bars on both attitude indicators. If the F/D MA light on the affected side had been illuminated, it extinguishes upon electrical bus transfer.

AFDS Status Annunciation

The following AFDS status annunciations are displayed in the A/P status display located above the attitude indicator on the outboard display unit:

- CMD (one or both autopilots are engaged)
- FD (the flight director is ON and the autopilot is either OFF or engaged in CWS)
- CWS P (pitch mode engaged in CWS)
- CWS R (roll mode engaged in CWS)
- SINGLE CH (for single A/P ILS approach, annunciates after localizer capture and remains on for entire approach. For dual A/P ILS approach, annunciates after localizer capture and extinguishes after pitch monitor confidence test is successfully completed).

AFDS Flight Mode Annunciations

The flight mode annunciations are displayed just above the attitude indicator on the outboard display unit. The mode annunciations, from left to right, are:

- autothrottle
- roll
- pitch.

Engaged or captured modes are shown at the top of the flight mode annunciation boxes in large green letters. Armed modes are shown in smaller white letters at the bottom of the flight mode annunciation boxes.

Autothrottle Modes

- N1 – the autothrottle maintains thrust at the selected N1 limit displayed on the thrust mode display, including full go-around N1 limit
- GA – the autothrottle maintains thrust at reduced go–around setting
- RETARD – displayed while autothrottle moves thrust levers to the aft stop. RETARD mode is followed by ARM mode
- FMC SPD – the autothrottle maintains speed commanded by the FMC. The autothrottle is limited to the N1 value shown on the thrust mode display
- MCP SPD – the autothrottle maintains speed set in the MCP IAS/MACH display. The autothrottle is limited to the N1 value shown on the thrust mode display
- THR HLD – the thrust lever autothrottle servos are inhibited; the pilot can set the thrust levers manually
- ARM – no autothrottle mode engaged. The thrust lever autothrottle servos are inhibited; the pilot can set thrust levers manually. Minimum speed protection is provided

Pitch Modes

- TO/GA – Takeoff

  Engaged for takeoff by turning both F/D switches ON and pushing either TO/GA switch. Both F/Ds must be ON to engage TO/GA prior to starting takeoff.

  The AFDS commands pitch attitude in the following order:

  - 10 degrees nose down until 60 knots IAS
  - 15 degrees nose up after 60 knots IAS
  - 15 degrees nose up after lift–off until a sufficient climb rate is acquired. Then, pitch is commanded to maintain MCP speed plus 20 knots.

  TO/GA can also be engaged for takeoff with F/D switches OFF if a TO/GA switch is pushed after 80 knots IAS below 2000 feet AGL and prior to 150 seconds after lift–off.

- TO/GA – Go–around

  Engaged for go–around by pushing the TO/GA switch under the following conditions:

  - inflight below 2000 feet radio altitude

  YA707 - YV754

  - inflight above 2000 feet radio altitude with flaps not up or G/S captured
  - not in takeoff mode
  - either F/D ON or OFF.

  When engaged, the F/Ds command roll to hold the ground track, and 15 degrees nose up pitch. After reaching a programmed rate of climb, pitch commands the target airspeed for each flap setting based on maximum takeoff weight calculations.

YA709 - YV754

- VNAV (armed) - displayed when VNAV is armed prior to takeoff. After takeoff, VNAV automatically engages at 400 feet RA.
- VNAV (engaged) – VNAV is engaged by pushing the VNAV switch. With a VNAV mode engaged, the FMC commands AFDS pitch and A/T modes to fly the vertical profile
  - VNAV SPD – the AFDS maintains the FMC speed displayed on the airspeed indicator and/or the CDU CLIMB or DESCENT pages
  - VNAV PTH – the AFDS maintains FMC altitude or descent path with pitch commands.
  - VNAV ALT – when a conflict occurs between the VNAV profile and the MCP altitude, the airplane levels at the MCP altitude and the pitch flight mode annunciation becomes VNAV ALT. VNAV ALT maintains altitude.
- V/S (armed) – V/S mode can be engaged by moving Vertical Speed thumbwheel
- V/S (engaged) – commands pitch to hold selected vertical speed
- ALT ACQ – transition maneuver entered automatically from a V/S, LVL CHG, or VNAV climb or descent to selected MCP altitude. Engages but does not annunciate during VNAV transition
- ALT HOLD – commands pitch to hold MCP selected altitude or uncorrected barometric altitude at which ALT HOLD switch was pushed
- MCP SPD – pitch commands maintain IAS/MACH window airspeed or Mach
- G/S (armed) – the AFDS is armed for G/S capture
- G/S (engaged) – the AFDS follows the ILS glideslope

- FLARE (armed) – during a dual A/P ILS approach, FLARE is displayed after LOC and G/S capture and below 1500 feet RA. The second A/P couples with the flight controls and A/P go–around mode arms
- FLARE (engaged) – during a dual A/P ILS approach, flare engages at 50 feet radio altitude. FLARE accomplishes the autoland flare maneuver.

Roll Modes

YA709 - YV754

- LNAV (armed) – the AFDS is armed (prior to takeoff) to engage LNAV at 50 feet RA.

YL545 - YL551, YN531 - YV754

- LNAV (armed) – in the approach phase and a missed approach exists in the flight plan.
- LNAV (engaged) – the AFDS intercepts and tracks the active FMC route. Either of the following capture criteria must be met:
  - on any heading and within 3 NM of the active route segment
  - if outside of 3 NM of active route segment, airplane must be on an intercept course of 90 degrees or less and intercept the route segment before the active waypoint.
- HDG SEL – the airplane is turning to, or is on the heading selected in the MCP Heading Display
- VOR/LOC (armed) – AFDS is armed to capture selected VOR or LOC COURSE
- VOR/LOC (engaged) – AFDS tracks selected VOR course or tracks selected localizer course along the inbound front course bearing.

Autopilot Control Wheel Steering

CWS Engage Switch Selected

Pushing a CWS engage switch engages the A/P pitch and roll axes in the CWS mode and displays CWS P and CWS R on the FMAs.

With CWS engaged, the A/P maneuvers the airplane in response to control pressures applied by either pilot. The control pressure is similar to that required for manual flight. When control pressure is released, the A/P holds existing attitude.

If aileron pressure is released with 6 degrees or less bank, the A/P rolls the wings level and holds existing heading. This heading hold feature with bank less than 6 degrees is inhibited when any of the following conditions exists:

- below 1,500 feet RA with the landing gear down
- after F/D VOR capture with TAS 250 knots or less
- after F/D LOC capture in the APP mode.

Pitch CWS with a CMD Engage Switch Selected

The pitch axis engages in CWS while the roll axis is in CMD when:

- a command pitch mode has not been selected or was deselected

YA701 - YS194

- A/P pitch has been manually overridden with control column force. The force required for override is greater than normal CWS control column force.
- selecting CMD while not following a large deviation in the pitch flight director command.

CWS P is annunciated on the FMAs while this mode is engaged. Command pitch modes can then be selected.

When approaching a selected altitude in CWS P with a CMD engage switch selected, CWS P changes to ALT ACQ. When at the selected altitude, ALT HOLD engages.

YA701 - YS194
If pitch is manually overridden while in ALT HOLD at the selected altitude, ALT HOLD changes to CWS P. If control force is released within 250 feet of the selected altitude, CWS P changes to ALT ACQ, the airplane returns to the selected altitude, and ALT HOLD engages. If the elevator force is held until more than 250 feet from the selected altitude, pitch remains in CWS P.

Roll CWS with a CMD Engage Switch Selected

The roll axis engages in CWS while the pitch axis is in CMD when:

- a command roll mode has not been selected or was deselected

YA701 - YS194

- A/P roll has been manually overridden with control wheel force. The force required for override is greater than the normal CWS control wheel force.
- flying beyond FMS end of route or into a route discontinuity.

CWS R is annunciated on the FMAs while this mode is engaged.

CWS R with a CMD engage switch illuminated can be used to capture a selected radio course while the VOR/LOC or APP mode is armed. Upon intercepting the radial or localizer, the F/D and A/P annunciations change from CWS R to VOR/LOC engaged, and the A/P tracks the selected course.

Autothrottle System

The A/T system provides automatic thrust control from the start of takeoff through climb, cruise, descent, approach and go–around or landing. In normal operation, the FMC provides the A/T system with N1 limit values.

The A/T moves the thrust levers with a separate servo motor on each thrust lever. Following manual positioning, the A/T may reposition the thrust levers to comply with computed thrust requirements except while in the THR HLD and ARM modes.

The A/T system operates properly with the EECs ON or in ALTN. In either case, the A/T uses the FMC N1 limits. During A/T operation, it is recommended that both EECs be ON or both be in ALTN, as this produces minimum thrust lever separation.

Autothrottle Engagement

Moving the A/T Arm switch to ARM, arms the A/T for engagement in the N1, MCP SPD or FMC SPD mode. The A/T Arm switch is magnetically held at ARM and releases to OFF when the A/T becomes disengaged.

A general summary of A/T mode engagement is as follows:

- A/T SPD or N1 modes automatically engage when AFDS command pitch modes become engaged
- engaging LVL CHG or VNAV climb modes automatically engages the A/T N1 mode
- engaging LVL CHG or VNAV descent modes automatically engages the A/T in RETARD and then ARM when thrust is at idle
- if not in a VNAV mode, engagement of ALT ACQ or ALT HOLD automatically engages the A/T in the MCP SPD mode; otherwise the A/T remains in FMC SPD
- engagement of G/S capture automatically engages the A/T in the MCP SPD mode
- alpha floor automatically engages the A/T when armed.

Autothrottle Disengagement

Any of the following conditions or actions disengages the A/T:

- moving the A/T Arm switch to OFF
- pushing either A/T Disengage switch
- an A/T system fault is detected
- two seconds have elapsed since landing touchdown

The thrust levers should normally be aligned to no more than one full knob width difference during all ranges of normal operation with symmetrical thrust.

The autothrottle also disengages if it is engaged in a Speed mode, Retard for descent mode, or an N1 mode other than A/T GA mode AND;

YA701 - YA708

- thrust levers become separated more than 10 degrees during a dual channel approach after FLARE armed is annunciated

YA709 - YV754

- thrust levers become separated more than 10 degrees

YA701 - YA708

- significant thrust difference along with control wheel roll input of 10 degrees or more, and flap position up through 10

YA709 - YV754

- significant thrust difference along with control wheel roll input of 10 degrees or more at any point throughout the entire flight envelope

A/T disengagement is followed by A/T Arm switch releasing to OFF and flashing red A/T Disengage lights. The A/T Disengage lights do not illuminate when the A/T automatically disengages after landing touchdown.

Automatic Flight Operations

The phases of flight for automatic flight operations are:

- Takeoff and climb
- Enroute
- Approach and landing
- Go–around

Automatic Flight Takeoff and Climb

Takeoff is a flight director only function of the TO/GA mode. Flight director pitch and roll commands are displayed and the autothrottle maintains takeoff N1 thrust limit as selected from the FMC. The autopilot may be engaged after takeoff.

Both F/Ds must be ON to engage the takeoff mode prior to starting the takeoff. The F/D takeoff mode is engaged by pushing the TO/GA switch on either thrust lever. The FMAs display FD as the A/P status, TO/GA as the pitch mode, and blank for the roll mode.

During takeoff, pushing a TO/GA switch engages the autothrottle in the N1 mode. The A/T annunciation changes from ARM to N1 and thrust levers advance toward takeoff thrust.

The F/D can also be engaged in the takeoff mode with the F/D switches off. If a TO/GA switch is pushed after 80 knots below 2000 feet AGL and prior to 150 seconds after lift–off, the F/D command bars automatically appear for both pilots.

During takeoff, prior to 60 KIAS:

- the pitch command is 10 degrees nose down
- the roll command is wings level
- the autothrottle is engaged in the N1 mode
- thrust levers advance until the engines reach takeoff thrust
- the FMAs display N1 for the autothrottle mode, TO/GA for the pitch mode, and blank for the roll mode.

At 60 knots, the F/D pitch commands 15 degrees nose up.

At 84 knots, the A/T mode annunciates THR HLD.

At LIFT-OFF:

- the pitch command continues at 15 degrees until sufficient climb rate is acquired. Pitch then commands MCP speed (normally V2) plus 20 knots
- if an engine failure occurs during takeoff, the pitch command target speed is:
    - V2, if airspeed is below V2
    - existing speed, if airspeed is between V2 and V2 + 20
    - V2 + 20, if airspeed is above V2 + 20
- the roll command maintains wings level.

After LIFT-OFF:

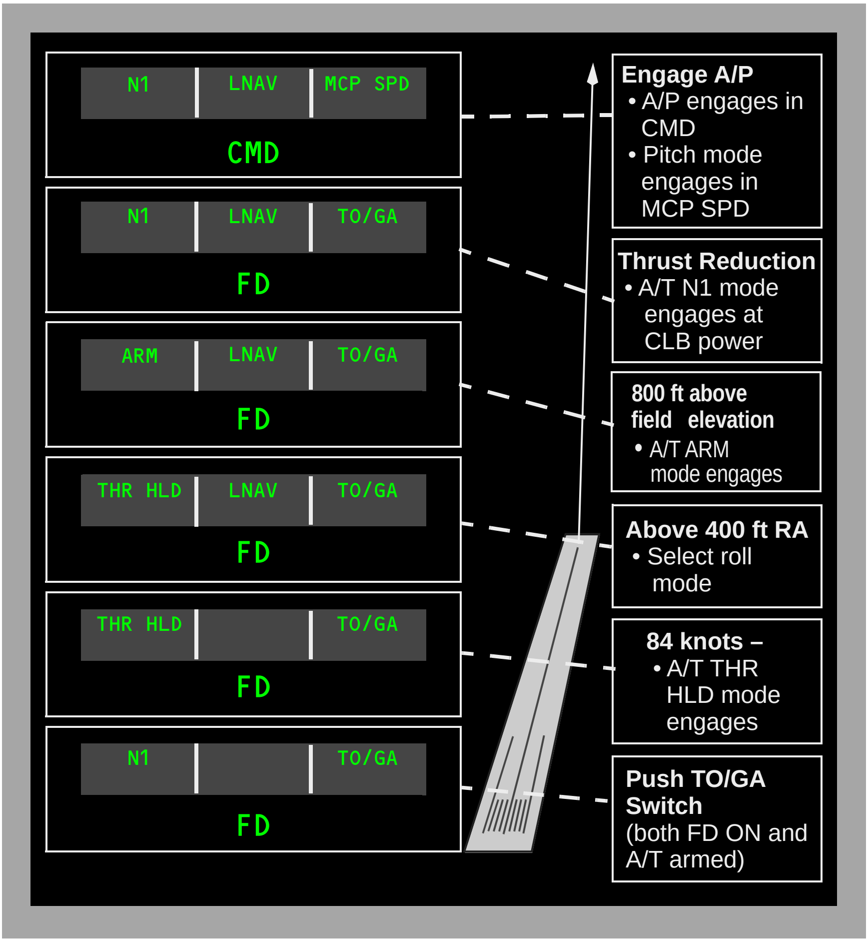
- the A/T remains in THR HLD until 800 feet above field elevation. A/T annunciation then changes from THR HLD to ARM and reduction to climb thrust can be made by pushing the N1 switch.

  Note: During a reduced thrust takeoff, a second press of the TO/GA switch below 800 feet above field elevation will change the thrust limit mode to GA and N1 reference bugs to increase to full GA thrust, thrust levers will not be in motion. A second press of the TO/GA switch above 800 feet above field elevation, thrust levers advance toward full GA thrust.

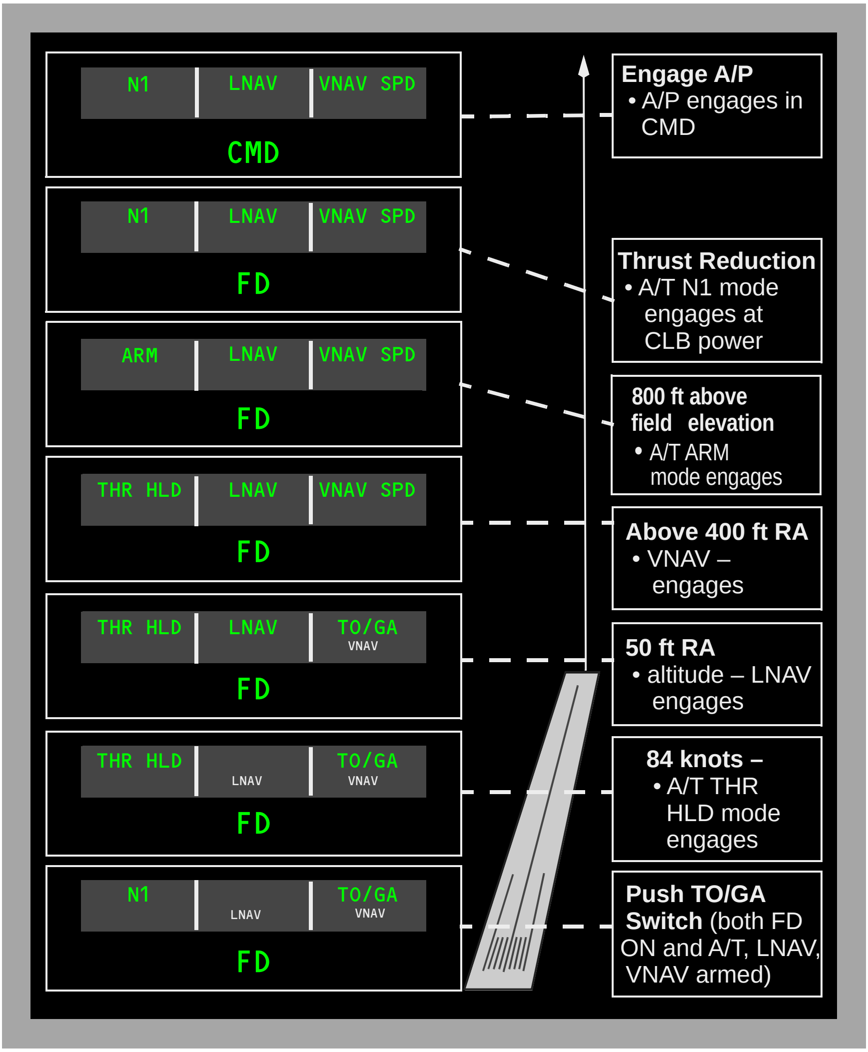
- automatic reduction to climb thrust occurs upon reaching the selected thrust reduction altitude which is shown on the FMC CDU TAKEOFF REF page 2/2 during preflight, or when the airplane levels off in ALT HOLD or VNAV PTH. Pilot entries can be made to override the default value. Allowable entries are 800 feet to 9999 feet
- flight director engaged status is terminated by engaging an autopilot in CMD (CMD replaces FD in A/P status display)
    - pitch engages in LVL CHG and pitch mode FMA is MCP SPD unless another pitch mode has been selected
    - MCP IAS/Mach display and airspeed cursor change to V2 + 20 knots
    - roll mode engages in HDG SEL unless another roll mode has been selected.

To terminate the takeoff mode below 400 feet RA, both F/D switches must be turned OFF. Above 400 feet RA, selection of another pitch mode or engaging an autopilot will terminate the takeoff mode; other F/D roll modes can be also selected.

Automatic Flight Takeoff Profile



YA709 - YV754



Automatic Flight En Route

The autopilot and/or the flight director can be used after takeoff to fly a lateral navigation track (LNAV) and a vertical navigation track (VNAV) provided by the FMC.

Other roll modes available are:

- VOR course (VOR/LOC)
- heading select (HDG SEL).

Other pitch modes available are:

- altitude hold (ALT HOLD)
- level change (MCP SPD)
- vertical speed (V/S).

Automatic Flight Approach and Landing

The AFDS provides guidance for single A/P non–precision approaches. The VOR/LOC switch arms the AFDS for VOR or localizer tracking. Descent may be accomplished using VNAV, LVL CHG, or V/S. VOR/LOC, LNAV, or HDG SEL may be used for the roll mode.

The AFDS provides guidance for single or dual A/P precision approaches. The approach mode arms the AFDS to capture and track the localizer and glideslope.

Approach (APP) Mode Dual A/Ps

Approach mode allows both A/Ps to be engaged at the same time. Dual A/P operation provides fail–passive operation through landing flare and touchdown or an automatic go–around. During fail passive operation, the flight controls respond to the A/P commanding the lesser control movement. If a failure occurs in one A/P, the failed channel is counteracted by the second channel such that both A/Ps disconnect with minimal airplane maneuvering and with aural and visual warnings to the pilot.

One VHF NAV receiver must be tuned to an ILS frequency before the approach mode can be selected. For a dual A/P approach, the second VHF NAV receiver must be tuned to the ILS frequency and the corresponding A/P engaged in CMD prior to 800 feet RA.

YA701 - YS194
If the pilot is flying manually but not following the approach flight director guidance and then selects an autopilot CMD engagement, the autopilot reverts to CWS for the pitch and roll mode.

YT501 - YV754
If the pilot is flying manually but not following the approach flight director guidance and then selects an autopilot CMD engagement, the autopilot reverts to CWS for the pitch and roll mode. The approach mode(s) will then re-arm.

Localizer and Glideslope Armed

After setting the localizer frequency and course, pushing the APP switch selects the APP mode. The APP switch illuminates and VOR/LOC and G/S annunciate armed. The APP mode permits selecting the second A/P to engage in CMD. This arms the second A/P for automatic engagement after LOC and G/S capture and when descent below 1500 RA occurs.

The localizer can be intercepted in the HDG SEL, CWS R or LNAV mode.

Glideslope (G/S) capture is inhibited prior to localizer capture.

Localizer Capture

The LOC capture point is variable and depends on intercept angle and rate of closure. Capture occurs no later than 1/2 dot. Upon LOC capture, VOR/LOC annunciates captured, SINGLE CH is annunciated for A/P status, the previous roll mode disengages and the airplane turns to track the LOC.

Glideslope Capture

Glideslope capture is inhibited prior to localizer capture.

The G/S can be captured from above or below. Capture occurs at 2/5 dot and results in the following:

- G/S annunciates captured
- previous pitch mode disengages
- APP light extinguishes if localizer has also been captured
- airplane pitch tracks the G/S
- GA displayed on thrust mode display (N1 thrust limit).

After VOR/LOC and G/S are both captured, the APP mode can be exited by:

- pushing a TO/GA switch
- disengaging A/P and turning off both F/D switches
- retuning a VHF NAV receiver.

After LOC and G/S Capture

Shortly after capturing LOC or G/S and below 1500 feet RA:

- the second A/P couples with the flight controls
- test of the ILS deviation monitor system is performed and the G/S or LOC display turns amber and flashes
- FLARE armed is annunciated
- the SINGLE CH annunciation extinguishes
- A/P go–around mode arms but is not annunciated.

Note: During a dual autopilot approach and after FLARE ARM annunciation, any attempted manual override of the autopilots may result in an autopilot disconnect.

The A/Ps disengage and the F/D command bars retract to indicate an invalid ILS signal.

800 Feet Radio Altitude

The second A/P must be engaged in CMD by 800 feet RA to execute a dual channel A/P approach. Otherwise, CMD engagement of the second A/P is inhibited.

400 Feet Radio Altitude

The stabilizer is automatically trimmed an additional amount nose up. If the A/Ps subsequently disengage, forward control column force may be required to hold the desired pitch attitude.

If FLARE is not armed by approximately 350 feet RA, both A/Ps automatically disengage.

Flare

The A/P flare maneuver starts at approximately 50 feet RA and is completed at touchdown:

- FLARE engaged is annunciated and F/D command bars retract.
- the A/T begins retarding thrust at approximately 27 feet RA so as to reach idle at touchdown. A/T FMA annunciates RETARD.
- the A/T automatically disengages approximately 2 seconds after touchdown.
- the A/P must be manually disengaged after touchdown. Landing roll-out is executed manually after disengaging the A/P.

Approach (APP) Mode Single A/P

A single A/P ILS approach can be executed by engaging only one A/P in CMD after pushing the APP mode select switch. Single A/P approach operation is the same as dual, with the following exceptions:

- full automatic flare and touchdown capability is not available. FLARE is not annunciated and stabilizer trim bias is not applied

YA701 - YS194

- if the pilot is flying manually but not following the approach flight director guidance and then selects an autopilot CMD engagement, the autopilot reverts to CWS for the pitch and/or roll mode.

YT501 - YV754

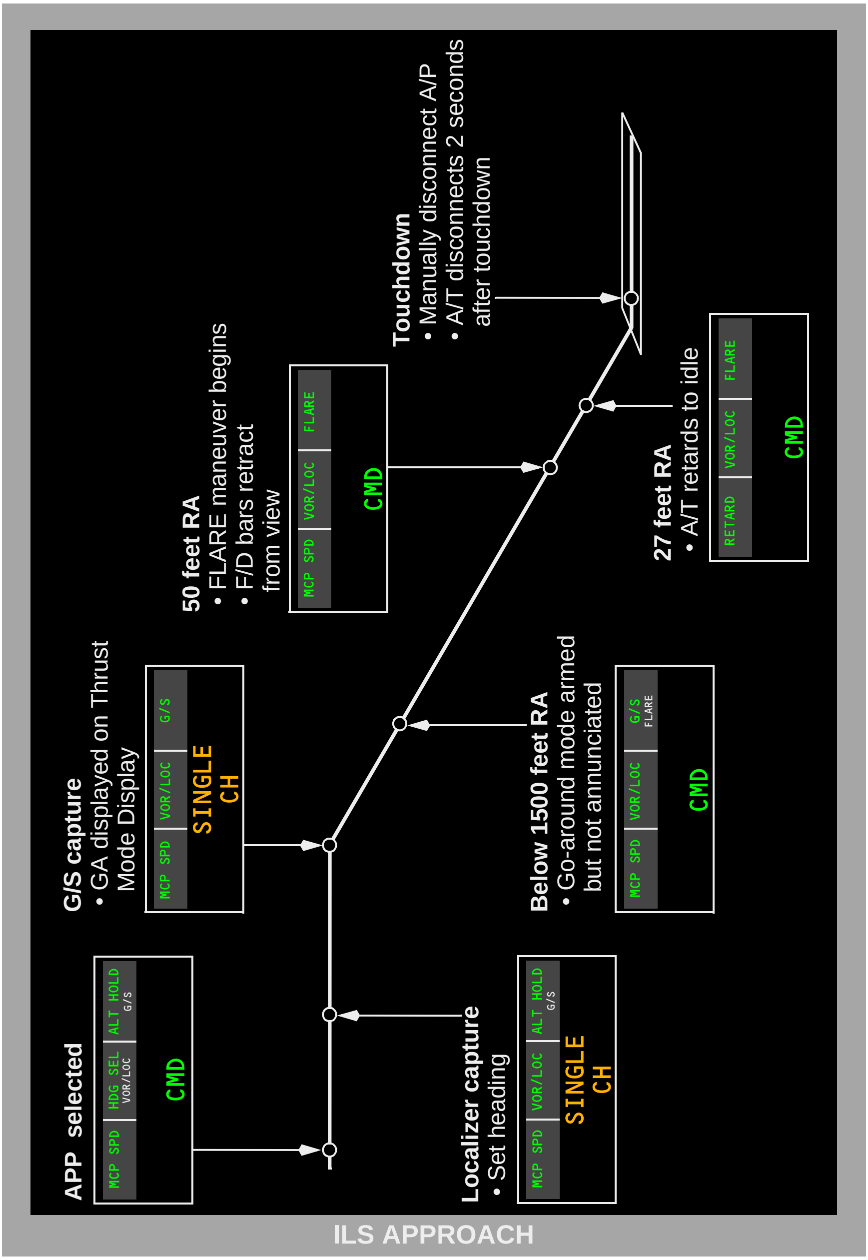
- if the pilot is flying manually but not following the approach flight director guidance and then selects an autopilot CMD engagement, the autopilot reverts to CWS for the pitch and/or roll mode. The approach mode(s) will then re-arm.
- A/P status of SINGLE CH is annunciated for the entire approach after localizer capture
- an A/P go–around is not available.
- after localizer or glideslope capture CWS cannot be engaged by manually overriding pitch and/or roll control forces. Manually overriding pitch and/or roll will cause autopilot disconnect. At autopilot disconnect, the active Autopilot modes will remain engaged.

ILS Beam Anomaly/Ground Station Failure Detection

For a single channel or F/D only approach, the autopilot will disconnect and/or the F/D bars will be removed if a persistent localizer/glideslope beam anomaly or ground station failure is detected.

Automatic Flight Approach Profile

YA701 - YL544, YM482 - YM484



APP selected

Localizer capture
- Set heading

G/S capture
- GA displayed on Thrust Mode Display

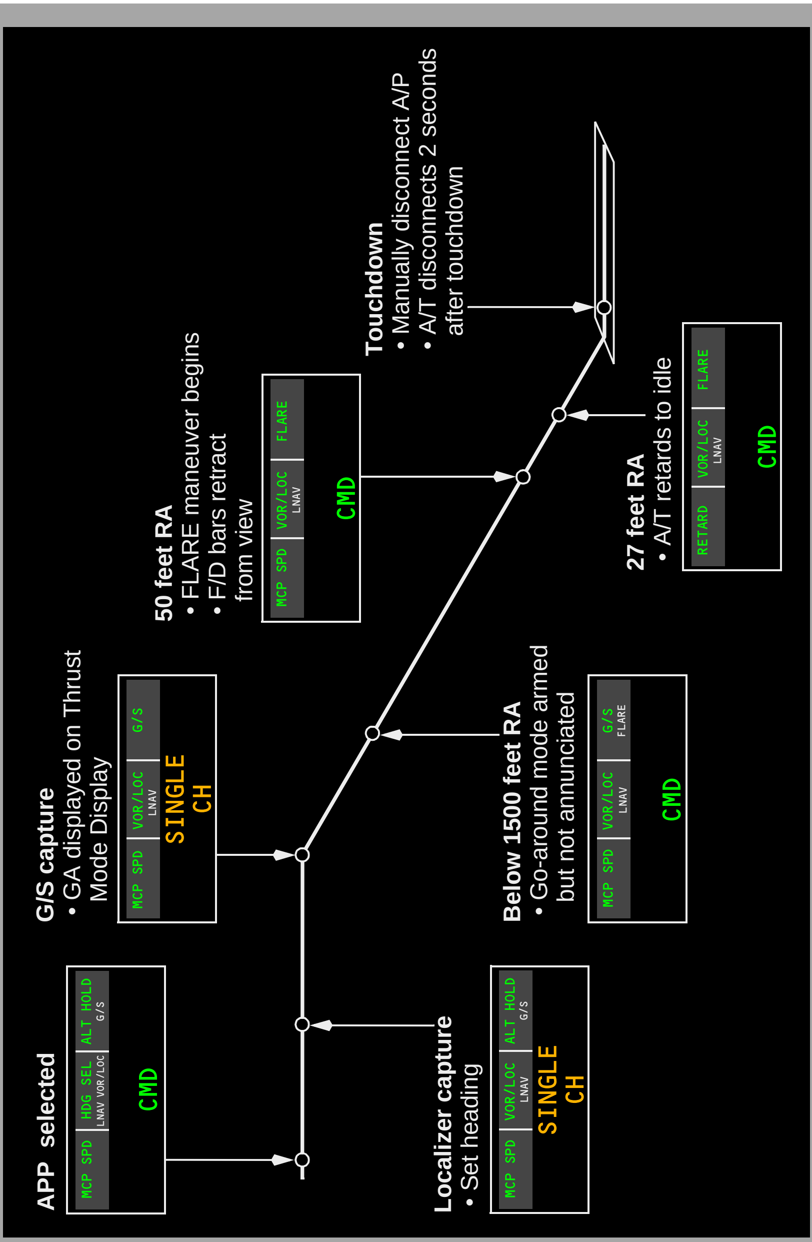
Below 1500 feet RA
- Go-around mode armed but not annunciated

50 feet RA
- FLARE maneuver begins
- F/D bars retract from view

27 feet RA
- A/T retards to idle

Touchdown
- Manually disconnect A/P
- A/T disconnects 2 seconds after touchdown

YL545 - YL551, YN531 - YV754



ILS APPROACH

Go–Around

Go–Around (GA) mode is engaged by pushing either TO/GA switch. An A/P go–around requires dual A/P operation and is armed when FLARE armed is annunciated. If both A/Ps are not operating, a manual F/D go–around is available.

With the A/T Arm switch at ARM, the A/T go–around mode is armed:

- when descending below 2000 feet RA

YA707 - YV754

- when above 2000 feet RA with flaps not up or G/S captured
- with or without the AFDS engaged.

A/P Go–Around

The A/P GA mode requires dual A/P operation and is available after FLARE armed is annunciated and prior to the A/P sensing touchdown.

With the first push of either TO/GA switch:

- A/T (if armed) engages in GA and the A/T Engaged Mode annunciation on the FMA indicates GA
- thrust advances toward the reduced go–around N1 to produce 1000 to 2000 fpm rate of climb
- pitch mode engages in TO/GA and the Pitch Engaged Mode annunciation on the FMA indicates TO/GA
- F/D pitch commands 15 degrees nose up until reaching programmed rate of climb. F/D pitch then commands target airspeed for each flap setting based on maximum takeoff weight calculations

YA701 - YL544, YM482 - YM484

- F/D roll commands hold current ground track. The Roll Engaged Mode annunciation on the FMA is blank

YL545 - YL551, YN531 - YV754

- F/D roll commands hold current ground track at or below 400 feet RA. Above 400 feet RA LNAV will engage. The Roll Mode annunciation will display LNAV armed at or below 400 feet RA and LNAV engaged above 400 feet RA.
- the IAS/Mach display blanks
- the command airspeed cursor automatically moves to a target airspeed for the existing flap position based on maximum takeoff weight calculations.

If the TO/GA switch is pressed after touchdown and prior to A/T disengagement, A/P disengages and the A/T may command GA thrust.

With the second push of either TO/GA switch after A/T reaches reduced go–around thrust, the A/T advances to the full go–around N1 limit.

TO/GA mode termination from A/P go–around:

- below 400 feet RA, the AFDS remains in the go–around mode unless both A/Ps and F/Ds are disengaged
- above 400 feet RA, select a different pitch or roll mode.
  - if the roll mode is changed first:
    - the selected mode engages in single A/P roll operation and is controlled by the A/P which was first in CMD
    - pitch remains in dual A/P control in TO/GA mode.
  - if the pitch mode is changed first:
    - the selected mode engages in single A/P pitch operation and is controlled by the A/P which was first in CMD
    - the second A/P disengages
    - the roll mode engages in CWS R.
  - the A/T GA mode is terminated when:
    - another pitch mode is selected
    - ALT ACQ annunciates engaged.

Note: The pitch mode cannot be changed from TO/GA until sufficient nose–down trim has been input to allow single channel A/P operation. This nose–down trim is automatically added by the A/P to reset the trim input made by the A/P at 400 feet RA and at 50 feet RA during the approach.

With pitch mode engaged in TO/GA, ALT ACQ engages when approaching the selected altitude and ALT HOLD engages at the selected altitude if the stabilizer position is satisfactory for single A/P operation.

- if stabilizer trim position is not satisfactory for single A/P operation:
  - ALT ACQ is inhibited
  - A/P disengage lights illuminate steady red
  - pitch remains in TO/GA.

Note: To extinguish A/P disengage lights, disengage A/Ps or select higher altitude on MCP.

F/D Go–Around

If both A/Ps are not engaged, a manual F/D only go–around is available under the following conditions:

- inflight below 2000 feet RA

YA707 - YV754

- inflight above 2000 feet RA with flaps not up or G/S captured
- not in takeoff mode.

With the first push of either TO/GA switch:

- A/T (if armed) engages in GA and advances thrust toward the reduced go–around N1 to produce 1000 to 2000 fpm rate of climb. The A/T Engaged Mode annunciation on the FMA indicates GA
- autopilot (if engaged) disengages
- pitch mode engages in TO/GA and the Pitch Engaged Mode annunciation on the FMA indicates TO/GA
- F/D pitch commands 15 degrees nose up until reaching programmed rate of climb. F/D pitch then commands target airspeed for each flap setting based on maximum takeoff weight calculations

YA701 - YL544, YM482 - YM484

- F/D roll commands approach ground track at time of engagement. The Roll Engaged Mode annunciation on the FMA is blank

YL545 - YL551, YN531 - YV754

- F/D roll commands hold current ground track at or below 50 feet AGL. Above 50 feet AGL, LNAV will engage. The Roll Mode annunciation will display LNAV engaged above 50 feet AGL.
- the IAS/Mach display blanks
- the command airspeed cursor automatically moves to a target airspeed for the existing flap position based on maximum takeoff weight calculations.

With the second push of either TO/GA switch (if A/T engaged and after A/T reaches reduced go–around thrust):

- the A/T advances to the full go–around N1 limit

TO/GA mode termination from F/D go–around:

- below 400 feet RA, both F/D switches must be turned off.
- above 400 feet RA, select a different pitch or roll mode.
  - if the roll mode is changed first:
    - F/D roll engages in the selected mode
    - F/D pitch mode remains in TO/GA.
  - if the pitch mode is changed first:
    - F/D pitch engages in the selected mode.
    - F/D roll mode automatically changes to HDG SEL
  - the A/T GA mode (if engaged) is terminated when:
    - another pitch mode is selected
    - ALT ACQ annunciates engaged

Single Engine F/D Go–Around

With a push of either TO/GA switch:

YA701 - YL544, YM482 - YM484

- F/D roll commands hold current ground track. The Roll Engaged Mode annunciation on the FMA is blank

YL545 - YL551, YN531 - YV754

- F/D roll commands hold current ground track at or below 50 feet AGL. Above 50 feet AGL, LNAV will engage. The Roll Mode annunciation will display LNAV engaged above 50 feet AGL.
- pitch mode engages in TO/GA and the Pitch Engaged Mode annunciation on the FMA indicates TO/GA
- the F/D target speed is displayed on IAS/Mach display
- the F/D target speed is displayed on the airspeed cursor
- F/D pitch commands 13 degrees nose up. As climb rate increases, F/D pitch commands maintain a target speed.
  - if engine failure occurs prior to go–around engagement, then F/D target speed is the selected MCP speed.
  - if engine failure occurs after go–around engagement, then F/D target speed depends on whether ten seconds have elapsed since go–around engagement:
    - if prior to ten seconds, the MCP selected approach speed becomes target speed
    - if after ten seconds and the airspeed at engine failure is within five knots of the go–around engagement speed, the airspeed that existed at go–around engagement becomes target speed
    - if after ten seconds and the airspeed at engine failure is more than five knots above go–around engagement speed, then the current airspeed becomes target speed.

      Note: The target speed is never less than V2 speed based on flap position unless in windshear conditions.

F/D commanded acceleration cannot occur until a higher speed is selected on the MCP IAS/Mach display.

Go-Around Roll Mode – LNAV in Lieu of Track Hold

YL545 - YL551, YN531 - YV754

When multiple arm modes such as LNAV and VOR/LOC are set, they will appear on the FMA side by side in white.

When a missed approach exists in the flight plan and the FCCs are capable of entering go-around, LNAV arm will be annunciated on the FMA. The roll go-around track hold mode will automatically transition to LNAV during a missed approach.

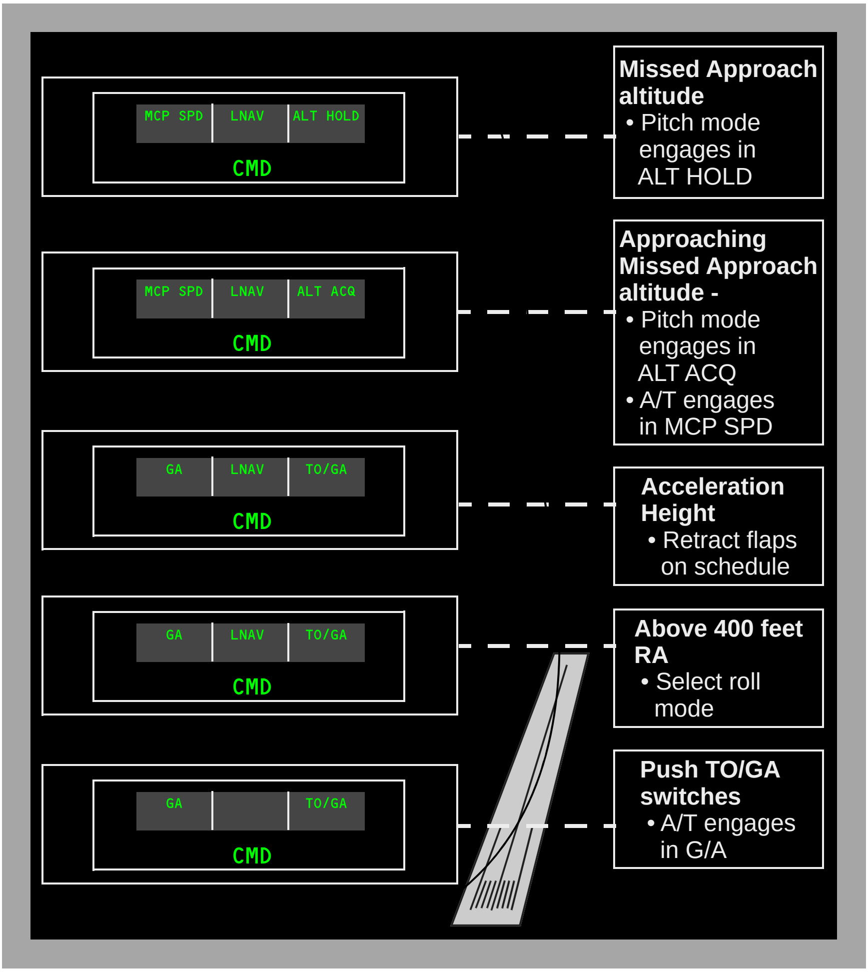
During autoland operations with FLARE arm or FLARE engage displayed, if TO/GA is pressed with LNAV arm annunciated on the FMA, then LNAV will engage when the airplane is above 400 feet. Below that altitude the roll mode will be track hold.

During an approach without FLARE arm or FLARE engage displayed, if TO/GA is pressed with LNAV arm annunciated on the FMA, the flight director LNAV mode will engage when the airplane is above 50 feet. Below that altitude the mode will be track hold.

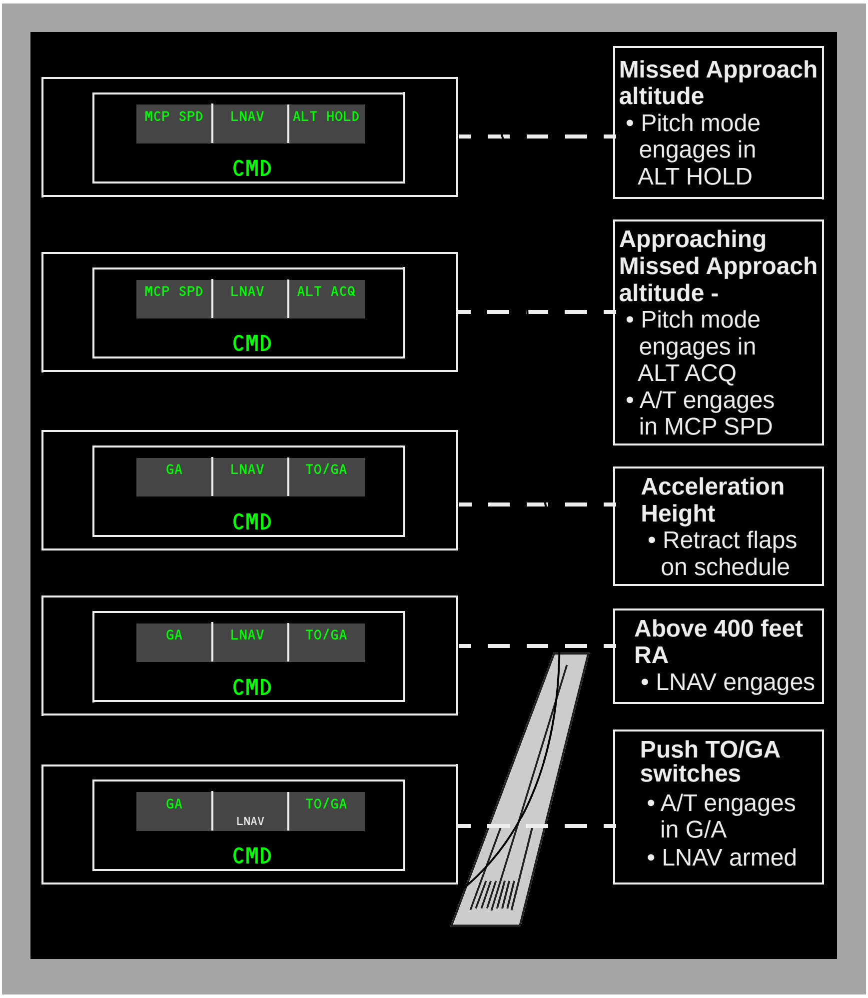
Single channel autopilot minimum engage and use heights are not affected. This feature is recommended to support RNP RNAV operations for terminal procedures requiring definitive course guidance.

Automatic Flight Go–Around Profile

YA701 - YL544, YM482 - YM484



YL545 - YL551, YN531 - YV754



AFS Operation in Windshear

General

The autopilot and flight director provide positive corrective action to counteract most windshears. The autothrottle system also aids in windshear recovery by providing quick response to any increase or decrease in speed. The commanded levels of power may be beyond what the average pilot considers necessary but, in fact, are required by the situation.

Takeoff or Go–Around

If windshear is encountered during F/D takeoff or go–around, the F/D pitch command bar provides commands to maintain the target speed until vertical speed decreases to approximately +600 fpm. At this point, the F/D pitch bar commands a 15 degree nose–up pitch attitude. If vertical speed continues to decrease, the F/D continues to command a 15 degree pitch attitude until a speed of approximately stick shaker is reached. It then commands pitch attitudes which result in intermittent activation of the stick shaker. As the airplane transits the windshear condition, the F/D programming reverses. As climb rate increases above approximately +600 fpm, the F/D commands pitch attitudes which result in acceleration back to the target speed. The A/P and F/D both operate in a similar manner during A/P or F/D go–around.

Approach and Landing

If windshear is encountered during an ILS approach, both the F/D and A/P attempt to hold the airplane on altitude, or on glideslope after glideslope capture, without regard to angle of attack or stick shaker limitations. Airspeed could decrease below stick shaker and into a stall if the pilot does not intervene by pushing the TO/GA switch or disconnecting the A/P and flying manually.

WARNING: Although the F/D, A/P and A/T may be performing as previously described, severe windshear may exceed the performance capability of the system and/or the airplane. In this situation, the flight crew must, if necessary to avoid ground contact, be prepared to disconnect the autothrottle, advance thrust levers to the forward stop, disconnect the autopilot and manually fly the airplane.

Command Speed Limiting and Reversion Modes

AFS command limiting and reversion operation is independent of the stall warning and mach warning systems.

Command Speed Limiting

The AFS provides speed, pitch and thrust commands to avoid exceeding the following limit speeds:

- Vmo/Mmo
- wing flap placards
- landing gear placard
- minimum speed.

The commanded speed can be equal to, but does not exceed a limit speed.

Speeds greater than Vmo/Mmo cannot be selected from the MCP. Speeds can be selected which exceed flap and gear placards or are less than minimum speed.

Minimum speed is based on angle of attack and is approximately 1.3 Vs for the current flap configuration. It is sensed by the angle of attack vanes, one on either side of the forward fuselage.

If a speed greater than a placard speed, or less than minimum speed is selected, the AFS allows acceleration or deceleration to slightly short of the limit, then commands the limit speed. The overspeed or underspeed limiting symbol appears in the MCP IAS/Mach display when the commanded speed cannot be reached.

Either pitch or thrust, whichever is engaged in a speed mode, attempts to hold the limit speed. The commanded limit speed and MCP speed condition symbol, remain until another speed is selected which does not exceed the limit. A speed 15 knots greater than the minimum speed must be selected to remove the underspeed limiting symbol.

Reversion Modes

During some flight situations, speed control by the AFDS or A/T alone could be insufficient to prevent exceeding a limit speed. If this occurs, AFDS or A/T modes automatically revert to a more effective combination. The reversion modes are:

- placard limit reversion
- minimum airspeed reversion.

Mode reversion occurs slightly before reaching the limit speed. Both the AFDS and A/T have reversion modes which activate according to the condition causing the reversion.

Placard Limit Reversion

When one of the placard limit reversions (gear, flap or Vmo/Mmo) is reached, the overspeed limiting symbol appears in the MCP IAS/Mach display and the following occurs:

- if the AFDS is engaged but not in speed or CWS mode, and the A/T is armed but not in speed control, the A/T reverts to SPEED and controls speed to slightly below the placard limit
- if the AFDS or A/T is in speed control, speed is maintained slightly below the placard limit

YA701 - YS194

- for VMO/MMO only, if the A/T is engaged in a speed mode and the thrust levers are at idle, the AFDS, if in a V/S mode, will automatically engage to LVL CHG mode.

YT501 - YV754

- for VMO/MMO only, if the A/T is engaged in a speed mode and the thrust levers are at idle, the AFDS, if in a V/S mode or CWS P, will automatically engage to LVL CHG mode.
- if the A/T is not available, no reversion response to gear or flap placard speeds is available. The AFDS reverts to speed control for Vmo/Mmo speed limiting.

Minimum Speed Reversion

YA701 - YA706

The AFDS and A/T do not control to a speed which is less than minimum speed for the current flap configuration. This speed is approximately 1.3 Vs. Minimum speed, FMC speed, or selected speed, whichever is higher, becomes the AFS commanded speed. If actual speed becomes equal to or slightly less than the minimum speed, the underspeed limiting symbol appears in the MCP IAS/Mach Display, and if operating in the V/S mode, the AFDS reverts to LVL CHG. The AFDS will also revert to LVL CHG from VNAV PTH, except when flying a level segment.

YA707 - YS194

The AFDS and A/T do not control to a speed which is less than minimum speed for the current flap configuration. This speed is approximately 1.3 Vs. Minimum speed, FMC speed, or selected speed, whichever is higher, becomes the AFS commanded speed. If actual speed becomes equal to or slightly less than the minimum speed, the underspeed limiting symbol appears in the MCP IAS/Mach Display, and if operating in the V/S mode, the AFDS reverts to LVL CHG. The AFDS will also revert to LVL CHG from VNAV PTH, except when flying a level segment. There is no reversion from Vertical Speed Modes (VNAV or MCP) to level change mode when MIN speed is reached and the flaps are greater than 12.5.

YT501 - YV754

The AFDS and A/T do not control to a speed which is less than minimum speed for the current flap configuration. This speed is approximately 1.3 Vs. Minimum speed, FMC speed, or selected speed, whichever is higher, becomes the AFS commanded speed. If actual speed becomes equal to or slightly less than the minimum speed, the underspeed limiting symbol appears in the MCP IAS/Mach Display, and if operating in the V/S mode or CWS P, the AFDS reverts to LVL CHG. The AFDS will also revert to LVL CHG from VNAV PTH, except when flying a level segment. There is no reversion from Vertical Speed Modes (VNAV or MCP) to level change mode when MIN speed is reached and the flaps are greater than 12.5.

The AFS commands a speed 5 knots greater than minimum speed. Reaching a speed 5 knots greater than minimum speed reactivates normal MCP speed selection control. The AFDS commands nose down pitch to increase airspeed if the thrust levers are not advanced. When actual speed becomes 5 knots greater than minimum speed, the underspeed limiting symbol disappears.

The A/P disengages and the F/D command bars retract when in a LVL CHG climb with a command speed equal to minimum speed and a minimum rate of climb cannot be maintained without decelerating.

Minimum speed reversion is not available when the A/T is OFF and the AFDS is in ALT HOLD or after G/S capture. Minimum speed reversion is also not available when in VNAV PTH and flying a level segment.

Communications Chapter 5

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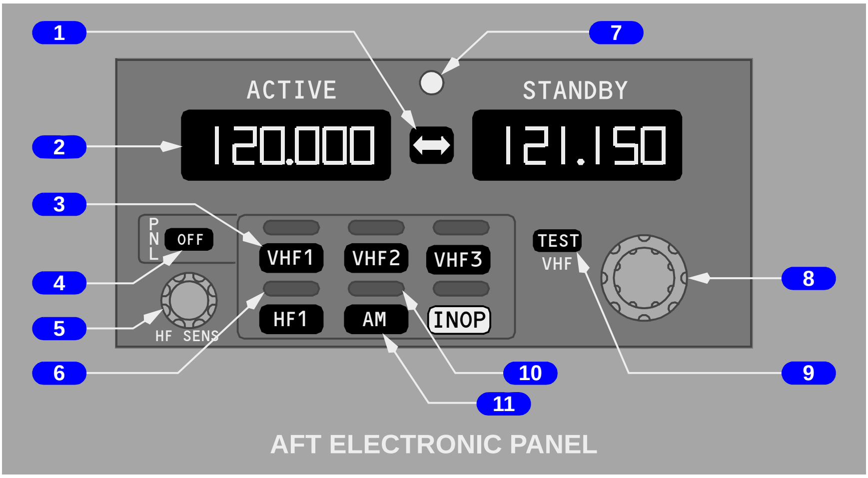
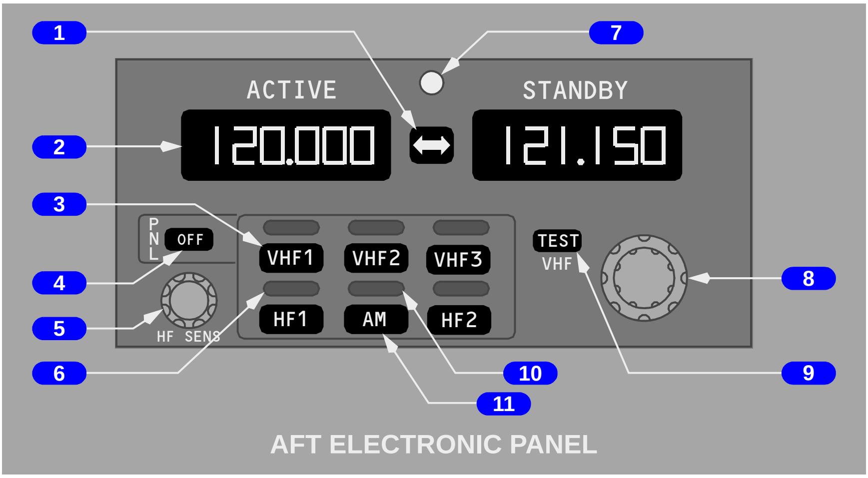
Radio Tuning Panel

YA701 - YA706



YA707 - YV754



1 Frequency Transfer Switch

Push –

- transfers the STANDBY window frequency to the ACTIVE window and tunes the selected radio to the new active frequency
- transfers the ACTIVE window frequency to the STANDBY window.

2 Frequency Indicator

ACTIVE – displays the tuned frequency of the selected radio.

STANDBY – displays the preselected or previously tuned frequency of the selected radio

- displays DATA if the selected radio is in the data mode.

YA701 - YA710

- displays five digit frequency in 25 KHz spacing.

YF048 - YV754

- displays six digit frequency in 8.33 KHz spacing.

Note: Illustration Typical

3 Radio Tuning Switch

Push –

- selects the VHF or HF radio to be tuned
- the tuned frequency is displayed in the ACTIVE frequency indicator
- the standby frequency is displayed in the STANDBY frequency indicator

4 Radio Tuning Panel OFF Switch

Push –

- disconnects the panel from the communication radios
- switch illuminates (white).

5 HF Sensitivity Control

Rotate – adjusts the sensitivity of the on–side HF receiver.

6 Radio Tuning Light

Illuminated (white) - indicates the selected radio.

7 Offside Tuning Light

Illuminated (white) –

- the radio normally associated with this panel is being tuned by another radio tuning panel, or
- the radio tuning panel is being used to tune a radio not normally associated with this radio tuning panel.

8 Frequency Selector

Rotate - selects frequency in the STANDBY frequency indicator:

- first digit is always 1
- outer selector changes second and third digits in 1 MHz increments

YA701 - YA710

- inner selector changes fourth and fifth digits in 25 KHz increments.

YF048 - YV754

- inner selector changes fourth, fifth, and sixth digits in 8.33 KHz increments.
- For airplanes with ACARS, tuning above maximum or below minimum frequency displays DATA in Frequency Indicator.

9 VHF TEST Switch

Push –

- removes automatic squelch feature, permitting reception of background noise and thereby testing receiver operation
- improves reception of weak signals.

10 AM Light

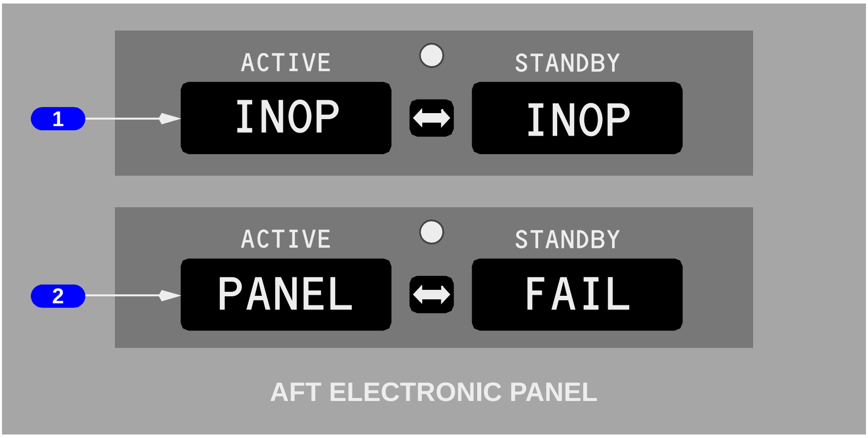
Illuminated (white) – HF AM is selected.

Extinguished – HF USB is selected.

11 AM Switch

Push – sets the AM (amplitude modulation) or USB (upper side band) mode for the selected HF.

Radio Tuning Panel Fail Modes



1 INOP Indication

The selected radio is not available.

2 PANEL FAIL

The radio tuning panel has failed.

Note: The selected frequencies may continue to be displayed in the frequency indicator when the radio is not available.

Audio Control Panel (ACP)

YA707 - YA710, YF921 - YM484, YS151 - YS178, YS191 - YS194

YA701 - YA706

FLIGHT DECK CREW STATIONS

YF048, YF049

FLIGHT DECK CREW STATIONS

YT503 - YV754

YN531 - YN534, YS179 - YS190, YT501, YT502

1 Transmitter Selector (MIC SELECTOR) Switches

Illuminated – related switch is active

Push –

- selects related communication system for subsequent transmission
- only one switch may be selected at a time; pushing a second switch deselects first switch
- reception possible over selected system regardless of whether related receiver switch is on.

2 Receiver Switches

Illuminated (white) – related switch is active

Rotate – adjusts volume

Push –

- allows reception of related communication system or navigation receiver
- multiple switches may be selected

Push again – deselects related system or receiver.

YA701 - YA710, YF921 - YM484, YS151 - YS178, YS191 - YS194

3 Push–to–Talk Switch

(spring–loaded to neutral position)

R/T (radio–transmit) – keys oxygen mask or boom microphone for transmission as selected by transmitter selector.

YS154 - YS178, YS191 - YS194

Note: The keyline timer limits VHF transmission to approximately 35 seconds. Approximately 25 to 30 seconds after any PTT is selected, the transceiver makes an aural tone (or, side-tone) in the headset. This tone continues for approximately five seconds. When the tone stops, the RF transmission also stops, and the radio is set to receive mode automatically. The radio remains in receive mode until the PTT is released, and selected again.

I/C (Intercom) – keys oxygen mask or boom microphone for direct transmission over flight interphone and bypasses transmitter selector.

YF048, YF049, YN531 - YN534, YS179 - YS190, YT501, YT502

3 Push–to–Talk Switch

(spring–loaded to neutral position)

RADIO (radio–transmit) – keys oxygen mask or boom microphone for transmission as selected by transmitter selector.

YF048, YF049, YS179 - YS190, YT501, YT502

Note: The keyline timer limits VHF transmission to approximately 35 seconds. Approximately 25 to 30 seconds after any PTT is selected, the transceiver makes an aural tone (or, side-tone) in the headset. This tone continues for approximately five seconds. When the tone stops, the RF transmission also stops, and the radio is set to receive mode automatically. The radio remains in receive mode until the PTT is released, and selected again.

INT (Intephone) – keys oxygen mask or boom microphone for direct transmission over flight interphone and bypasses transmitter selector.

YT503 - YV754

3 Push–to–Talk Switch

(Radio-Interphone switch latched in the Interphone position)

RADIO (radio–transmit) – keys oxygen mask or boom microphone for transmission as selected by transmitter selector.

Note: The keyline timer limits VHF transmission to approximately 35 seconds. Approximately 25 to 30 seconds after any PTT is selected, the transceiver makes an aural tone (or, side-tone) in the headset. This tone continues for approximately five seconds. When the tone stops, the RF transmission also stops, and the radio is set to receive mode automatically. The radio remains in receive mode until the PTT is released, and selected again.

INT (Interphone) – keys oxygen mask or boom microphone for direct transmission over flight interphone and bypasses transmitter selector.

YF048, YF049, YN531 - YN534, YS179 - YS190, YT501 - YV754

4 Filter Switch

V (Voice) – receive NAV and ADF voice audio.

B (Both) – receive NAV and ADF voice and range audio.

R (Range) – receive NAV and ADF station identifier range (code) audio.

YA701 - YA710, YF921 - YM484, YS151 - YS178, YS191 - YS194

4 MASK–BOOM Switch

MASK – selects oxygen mask microphone for transmissions.

BOOM – selects boom microphone for transmissions.

YA701 - YA710, YF921 - YM484, YS151 - YS178, YS191 - YS194

5 Speaker (SPKR) Switch

Illuminated (white) – SPKR switch is active.

Push – audio from selected receiver is heard on overhead speaker.

Rotate – adjusts overhead speaker volume.

Push again – deselects audio from selected receiver to be heard on overhead speaker.

YA701 - YA710, YF921 - YM484, YS151 - YS178, YS191 - YS194

6 Alternate–Normal (ALT–NORM) Switch

NORM (Normal) – ACP operates normally.

ALT (Alternate) – ACP operates in degraded mode.

YF048, YF049, YN531 - YN534, YS179 - YS190, YT501 - YV754

6 Speaker (SPKR) Switch

Illuminated (white) – SPKR switch is active.

Push – audio from selected receiver is heard on overhead speaker.

Rotate – adjusts overhead speaker volume.

Push again – deselects audio from selected receiver to be heard on overhead speaker.

YA701 - YA710, YF921 - YM484, YS151 - YS178, YS191 - YS194

7 Filter Switch

V (Voice) – receive NAV and ADF voice audio.

B (Both) – receive NAV and ADF voice and range audio.

R (Range) – receive NAV and ADF station identifier range (code) audio.

YF048, YF049, YN531 - YN534, YS179 - YS190, YT501 - YV754

7 SAT Switch

Push - Terminates the SATCOM call connection.

YF048, YF049, YN531 - YN534, YS179 - YS190, YT501 - YV754

8 Alternate-Normal (ALT-NORM) Switch

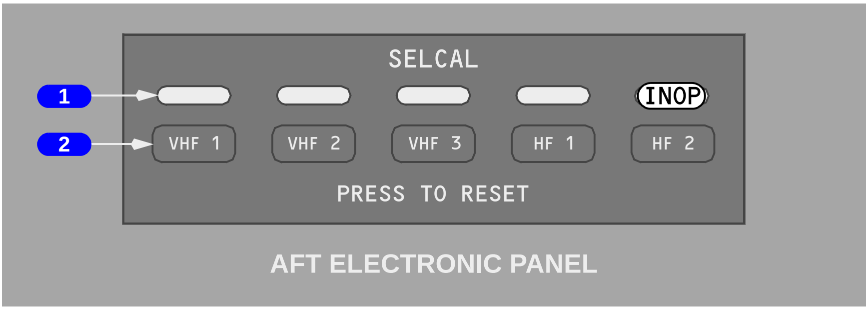
NORM (Normal) – ACP operates normally.

ALT (Alternate) – ACP operates in degraded mode.

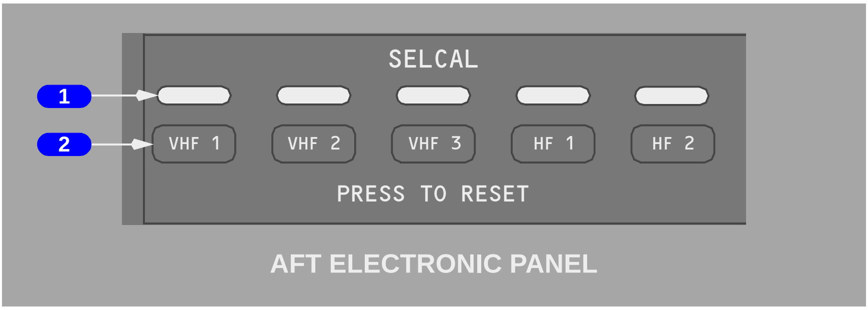
SELCAL Panel

YA701 - YA710, YF921 - YM484, YS151 - YS178, YS191 - YS194

YA701 - YA706



YA707 - YA710, YF921 - YM484, YS151 - YS178, YS191 - YS194



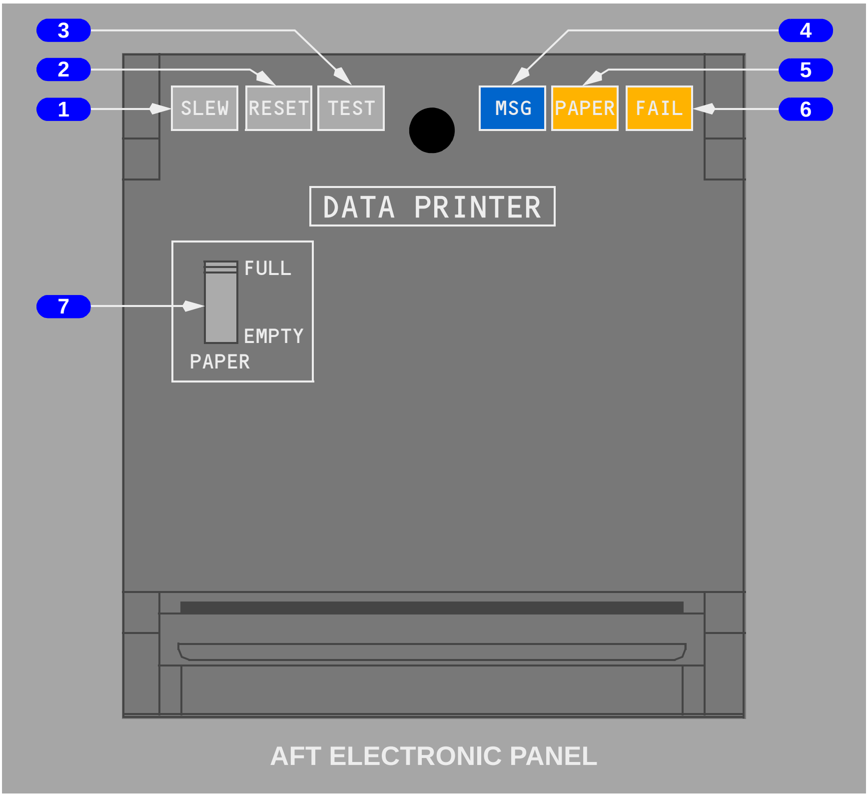
1 SELCAL Light

Illuminated (white) - alerts crew to incoming communication on indicated radio.

2 Reset Switch

Push - extinguishes and resets SELCAL light.

ACARS Printer



1 Slew Switch

Push - advances paper as long as switch is depressed.

2 Reset Switch

Push - resets message light.

3 Test Switch

Push -

- produces character test pattern
- illuminates MSG and FAIL lights.

4 Message Light

Illuminated (blue) -

- incoming message to printer or
- test in progress

5 Paper Light

Illuminated (amber) - paper quantity low.

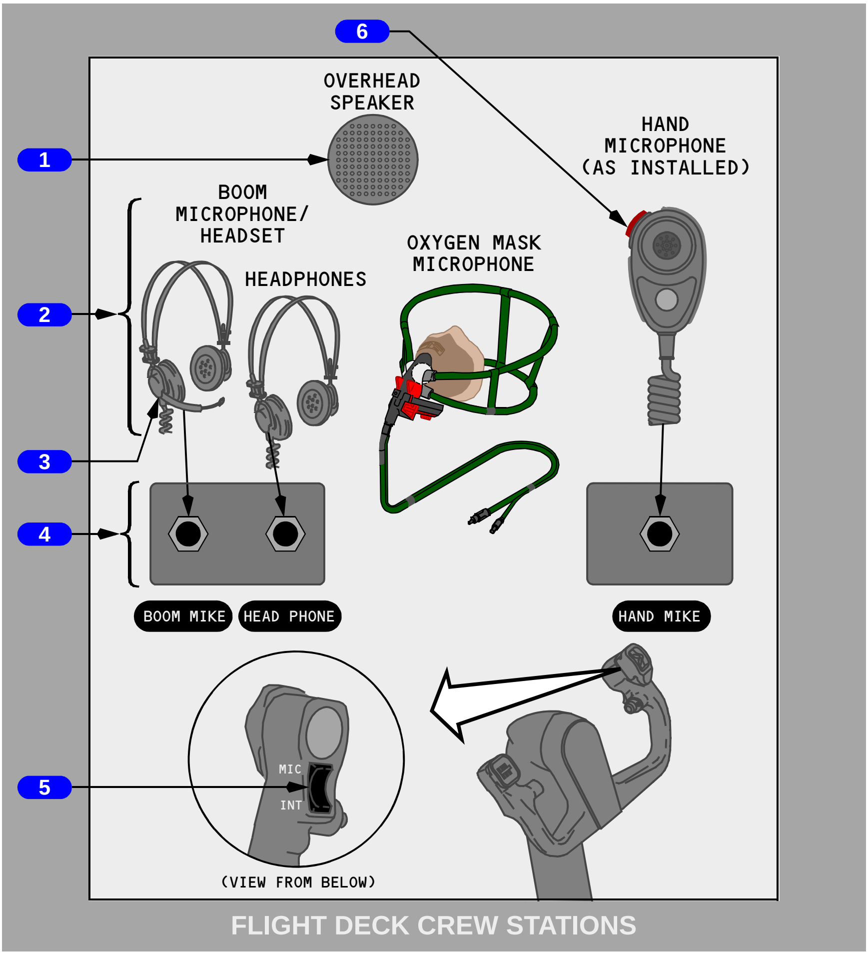
6 Fail Light

Illuminated (amber) - printer failure or test in progress.

7 Paper Quantity Indicator

Indicates amount of paper remaining.

Miscellaneous Communication Controls (Typical)



1 Overhead Speaker

Monitors audio from related pilot’s ACP.

2 Headset or Headphones

Monitors audio from related ACP.

3 Standard Microphones

Choose desired microphone for voice transmission through selected radio, interphone system, or passenger address (PA).

4 Communication Jacks

Used for appropriate microphone or headphone plugs.

YA701 - YA710, YF921 - YM484, YS151 - YS178, YS191 - YS194, YT503 - YV754

5 Push–To–Talk Switch

MIC (microphone) –

- selects oxygen mask or boom microphone for transmission, as selected by ACP transmitter selector.
- same as using ACP PTT switch (R/T position).

YS154 - YS178, YS191 - YS194, YT503 - YV754

Note: The keyline timer limits VHF transmission to approximately 35 seconds. Approximately 25 to 30 seconds after any PTT is selected, the transceiver makes an aural tone (or, side-tone) in the headset. This tone continues for approximately five seconds. When the tone stops, the RF transmission also stops, and the radio is set to receive mode automatically. The radio remains in receive mode until the PTT is released, and selected again.

OFF – center position.

INT (interphone) –

- selects oxygen mask or boom microphone for direct transmission over flight interphone
- bypasses ACP transmitter selector
- same as using ACP PTT switch (I/C position)

YF048, YF049, YN531 - YN534, YS179 - YS190, YT501, YT502

5 Push–To–Talk Switch

MIC (microphone) –

- selects oxygen mask or boom microphone for transmission, as selected by ACP transmitter selector.
- same as using ACP PTT switch (RADIO position).

YF048, YF049, YS179 - YS190, YT501, YT502

Note: The keyline timer limits VHF transmission to approximately 35 seconds. Approximately 25 to 30 seconds after any PTT is selected, the transceiver makes an aural tone (or, side-tone) in the headset. This tone continues for approximately five seconds. When the tone stops, the RF transmission also stops, and the radio is set to receive mode automatically. The radio remains in receive mode until the PTT is released, and selected again.

OFF – center position.

INT (interphone) –

- selects oxygen mask or boom microphone for direct transmission over flight interphone
- bypasses ACP transmitter selector
- same as using ACP PTT switch (INT position)

6 Push–To–Talk Switch

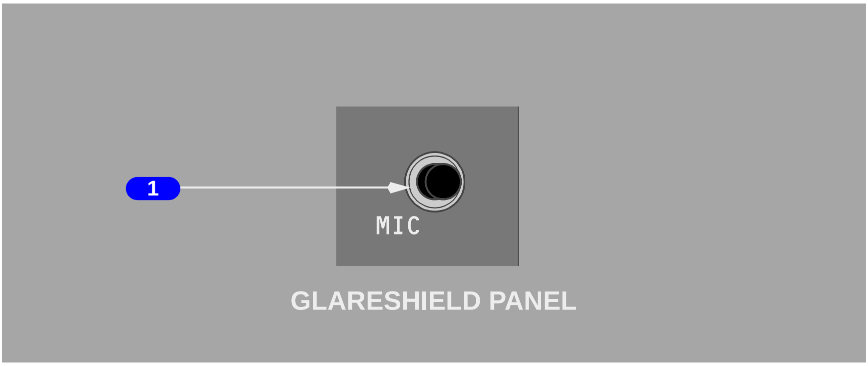
Push – keys hand microphone for transmission, as selected by ACP transmitter selector.

YF048, YF049, YS154 - YV754

Note: The keyline timer limits VHF transmission to approximately 35 seconds. Approximately 25 to 30 seconds after any PTT is selected, the transceiver makes an aural tone (or, side-tone) in the headset. This tone continues for approximately five seconds. When the tone stops, the RF transmission also stops, and the radio is set to receive mode automatically. The radio remains in receive mode until the PTT is released, and selected again.

Glareshield Microphone Switch

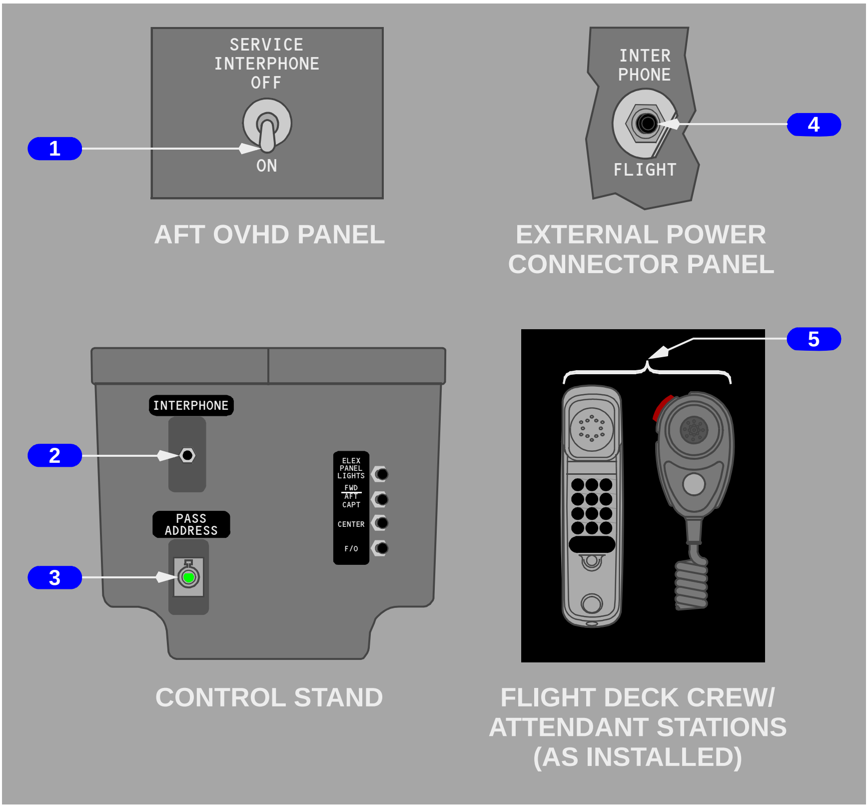
YF048 - YV754



1 Glareshield MIC Switch

Push - allows oxygen mask or boom microphone transmission on the selected transmitter.

Interphone and Passenger Address Controls



1 SERVICE INTERPHONE Switch

OFF –

- external jacks are deactivated
- communication between flight deck and flight attendants is still possible.

ON – adds external jacks to service interphone system.

2 Service INTERPHONE Handset Jack

With microphone installed, used to communicate with flight attendant stations:

- with SERVICE INTERPHONE switch ON, also used to communicate with any external jack location
- bypasses ACP.

3 Passenger Address (PASS ADDRESS) Hand Microphone Jack

With microphone installed:

- used to make PA announcements
- bypasses ACPs.

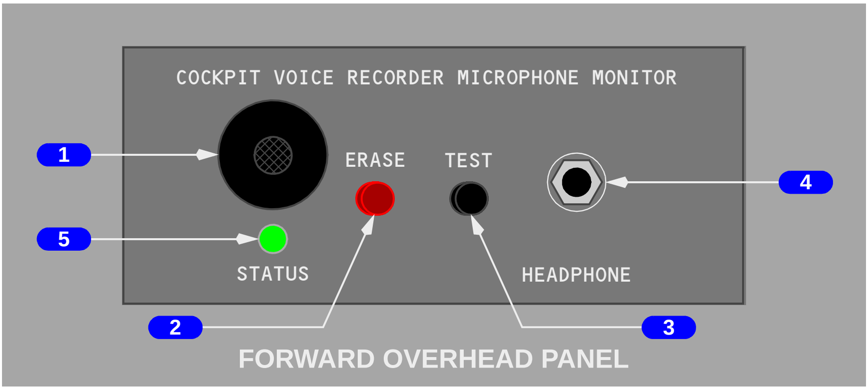
4 INTERPHONE FLIGHT Jack

Connects ground crew to flight interphone system.

5 Flight Deck / Attendant PA Hand Microphone

Used to make PA announcements.

Cockpit Voice Recorder



1 Area Microphone

Active anytime 115V AC is applied to airplane.

2 ERASE Switch (red)

Push (2 seconds) –

- all four channels are erased
- operative only when airplane is on ground and parking brake is set.

3 TEST Switch

Push – for 5 seconds:

- STATUS light flashes once
- a tone may be heard through a headset plugged into HEADPHONE jack.

4 HEADPHONE Jack

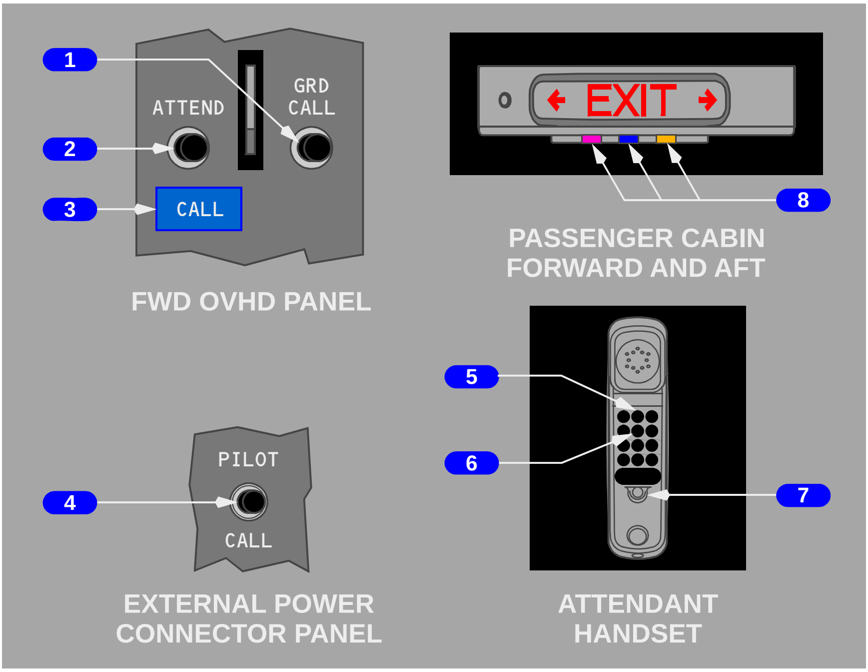
Headphone may be plugged into jack to monitor tone transmission during test, or to monitor playback of voice audio.

5 STATUS Light

Illuminated (momentary green) – no faults are detected during recorder TEST.

Call System

YA701 - YA710, YF921 - YM484, YS151 - YS178, YS191 - YS194



1 Ground Call (GRD CALL) Switch

Push – sounds a horn in nose wheel well until released.

2 Attendant Call (ATTEND) Switch

Push –

- sounds a two–tone chime in passenger cabin
- illuminates both pink master call lights.

3 Flight Deck CALL Light

Illuminated (blue) – flight deck is being called by flight attendants or ground crew.

4 PILOT CALL Switch

Push – sounds a single–tone chime in flight deck.

5 CAPTAIN Call Switch

Push – sounds a single–tone chime in flight deck.

6 ATTENDANT Call Switch

Push –

- sounds a two–tone chime in passenger cabin
- illuminates both pink master call lights.

7 Call RESET Switch

Push –

- extinguishes both pink master call lights
- cancels call
- disconnects the handset from the public address system.

YM482 - YM484

8 Master Call Lights

Illuminated –

- amber – a lavatory call switch is activated or smoke is detected in a lavatory.
- pink – flight deck or other flight attendant station is calling.
- blue – a passenger seat call switch is activated.

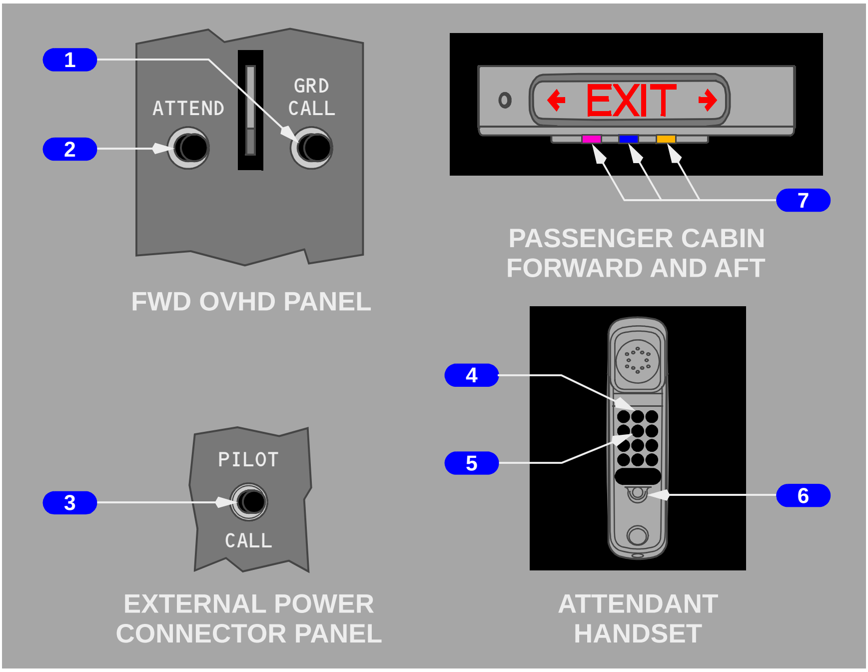
YA701 - YA710, YF921 - YL551, YS151 - YS178, YS191 - YS194

8 Master Call Lights

Illuminated –

- amber – a lavatory call switch is activated.
- pink – flight deck or other flight attendant station is calling.
- blue – a passenger seat call switch is activated.

YF048, YF049, YN531 - YN534, YS179 - YS190, YT501 - YV754



1 Ground Call (GRD CALL) Switch

Push – sounds a horn in nose wheel well until released.

2 Attendant Call (ATTEND) Switch

Push –

- sounds a two–tone chime in passenger cabin
- illuminates both pink master call lights.

3 PILOT CALL Switch

Push – sounds a single–tone chime in flight deck.

4 CAPTAIN Call Switch

Push – sounds a single–tone chime in flight deck.

5 ATTENDANT Call Switch

Push –

- sounds a two–tone chime in passenger cabin
- illuminates both pink master call lights.

6 Call RESET Switch

Push –

- extinguishes both pink master call lights
- cancels call
- disconnects the handset from the public address system.

7 Master Call Lights

Illuminated –

- amber – a lavatory call switch is activated.
- pink – flight deck or other flight attendant station is calling.
- blue – a passenger seat call switch is activated.

Intentionally
Blank

Introduction

The communication system includes:

- radio communication system
- interphone communication system
- cockpit voice recorder system
- communication crew alerting system

The communication systems are controlled using the:

- audio control panels
- radio tuning panels

Audio Systems and Audio Control Panels

An ACP is installed at the Captain, First Officer, and Observer stations. Each panel controls an independent crew station audio system and allows the crewmember to select the desired radios, navigation aids, interphones, and PA systems for monitoring and transmission.

Transmitter selectors on each ACP select one radio or system for transmission by that crewmember. Any microphone at that crew station may then be keyed to transmit on the selected system.

Receiver switches select the systems to be monitored. Any combination of systems may be selected. Receiver switches also control the volume for the headset and speaker at the related crew stations. Audio from each ACP is monitored using a headset/headphones or the related pilot's speaker.

Audio warnings for altitude alert, ground proximity warning, collision avoidance, and windshear are also heard through the speakers and headsets at preset volumes. They cannot be controlled or turned off by the crew.

Speakers and Headsets

Each crew station has a headset or headphone jack. The Captain and First Officer have speakers on the ceiling above their seats. There is no speaker at the observer station. Headset volume is controlled by the receiver switches. Speaker volume is controlled by the receiver switches and also the speaker switch.

Microphones

Hand microphones and boom microphones may be plugged into the related jacks at the flight deck crew stations. Each oxygen mask also has an integral microphone.

YA701 - YA710, YF921 - YM484, YS151 - YS178, YS191 - YS194
The MASK-BOOM switch allows selection of the oxygen mask microphone or the boom microphone. The MASK–BOOM switch does not affect the operation of the hand microphone.

YF048, YF049, YN531 - YN534, YS179 - YS190, YT501 - YV754
An oxygen mask microphone is enabled and the boom microphone is disabled when the left oxygen mask panel door is open. The oxygen mask microphone is disabled and the boom microphone is enabled when the left oxygen mask panel door is closed and the RESET/TEST Switch is pushed.

YA701 - YA710, YF921 - YM484, YS151 - YS178, YS191 - YS194
Each hand microphone has a PTT switch to key the selected audio system. The PTT switches on the control wheel or ACP are used to key the oxygen mask or boom microphone, as selected by the R/T and I/C switch. The R/T and I/C switch does not affect the operation of the hand microphone.

YF048, YF049, YN531 - YN534, YS179 - YS190, YT501 - YV754
Each hand microphone has a PTT switch to key the selected audio system. The PTT switches on the control wheel or ACP are used to key the oxygen mask or boom microphone, as selected by the RADIO/INT switch. The RADIO/INT switch does not affect the operation of the hand microphone.

YF048 - YV754
A MIC switch mounted on the captain’s and first officer’s glareshield panel is used to key the oxygen mask or boom microphone, as selected by the transmitter switch on that pilot’s ACP. Pushing the glareshield MIC switch is the same as pushing the control wheel MIC switch.

Normal Audio System Operation

The Captain, First Officer, and Observer audio systems are located in a common remote electronics unit in the E/E compartment. They function independently and have separate circuit breakers. The audio systems are normally controlled by the related ACPs through digital or computerized control circuits.

Degraded Audio System Operation

If the remote electronics unit or ACP malfunctions, the ACP cannot control the remote electronics unit. Audio system operation can be switched to a degraded mode by placing the ALT–NORM switch to ALT. In this mode, the ACP at that station is inoperative and the crewmember can only communicate on one radio.

YF048, YF049, YN531 - YN534, YS179 - YS190, YT501 - YV754
The ACP transmitter selectors are not functional. Any transmission from that station must be from the radio shown on the chart below. The transmitter selector for the usable radio illuminates when a station is operating in the degraded mode. The receiver switches are not functional, and only the usable radio is heard at a preset volume, through the headset. The speaker and speaker switch are not functional at that station. In addition, the flight interphone and service interphone cannot be used. The control wheel PTT switch INT position and the ACP PTT switch INT position are not functional since the flight interphone is not functional.

YA701 - YA710, YF921 - YM484, YS151 - YS178, YS191 - YS194
The ACP transmitter selectors are not functional. Any transmission from that station must be from the radio shown on the chart below. The transmitter selector for the usable radio illuminates when a station is operating in the degraded mode. The receiver switches are not functional, and only the usable radio is heard at a preset volume, through the headset. The speaker and speaker switch are not functional at that station. In addition, the flight interphone and service interphone cannot be used. The control wheel PTT switch INT position and the ACP PTT switch I/C position are not functional since the flight interphone is not functional.

YA701 - YA710, YF921 - YM484, YS151 - YS178, YS191 - YS194
The mask and boom microphones can be used for transmission on the usable radio. The MASK–BOOM switch works normally in the degraded mode. The mask and boom microphones can be keyed with the control wheel PTT switch MIC position or the ACP PTT switch R/T position. The hand microphone is not usable in the degraded mode of operation.

YF048, YF049, YN531 - YN534, YS179 - YS190, YT501 - YV754
The mask and boom microphones can be used for transmission on the usable radio. The mask and boom microphones can be keyed with the control wheel PTT switch in the MIC position or the ACP PTT switch in the RADIO position. The hand microphone is not usable in the degraded mode of operation

Audio warnings for altitude alert, GPWS, and windshear are not heard on an audio system operating in the degraded mode.

An audio system operating in the degraded mode cannot access the passenger address system through the audio control panel. The crewmember can still use the service interphone handset and PA microphone if they are installed on the control stand.

CREW STATION AUDIO SYSTEM IN DEGRADED MODE	RADIO AVAILABLE FOR TRANSMISSION AND RECEPTION AT DEGRADED STATION
CAPTAIN	VHF–1
FIRST OFFICER	VHF–2
OBSERVER	VHF–1

Flight Interphone System

The flight interphone system is an independent communication network. Its primary purpose is to provide private communication between flight deck crewmembers without intrusion from the service interphone system. The ground crew may also use the flight interphone through a jack at the external power receptacle.

YA701 - YA710
The pilots can transmit directly over the flight interphone by using the control wheel PTT switch. Alternately, any crewmember with an ACP can transmit/receive over the flight interphone by using their related ACP and normal PTT switches. Any standard microphone may be used with the flight interphone system.

YF048 - YV754
The pilots can transmit directly over the flight interphone by using the control wheel or glareshield PTT switches. Alternately, any crewmember with an ACP can transmit/receive over the flight interphone by using their related ACP and normal PTT switches. Any standard microphone may be used with the flight interphone system.

Service (Attendant) Interphone System

The service interphone system provides intercommunication between the flight deck, Flight Attendants, and ground personnel. Flight deck crewmembers communicate using either a separate handset (if installed) or their related ACP and any standard microphone.

The Flight Attendants communicate between flight attendant stations or with the flight deck using any of the attendant handsets. Anyone who picks up a handset/microphone is automatically connected to the system.

External jacks for use by maintenance or service personnel can be added to the system by use of the service interphone switch.

Passenger Address System

The passenger address (PA) system allows flight deck crewmembers and flight attendants to make announcements to the passengers. Announcements are heard through speakers located in the cabin and in the lavatories.

The flight deck crewmembers can make announcements using a PA handset or by using any standard microphone and the related ACP. Flight Attendants make announcements using PA handset located at their stations. The attendants use the PA to play recorded music for passenger entertainment.

PA system use is prioritized. Flight deck announcements have first priority and override all others. Flight Attendant announcements override the music system.

Call System

The call system is used as a means for various crewmembers to gain the attention of other crewmembers and to indicate that interphone communication is desired. Attention is gained through the use of lights and aural signals (chimes or horn). The system can be activated from the flight deck, either flight attendant station, or from the external power receptacle. Passengers may also use the system to call an attendant, through the use of individual call switches at each seat.

The flight deck may be called from either flight attendant station or by the ground crew. The ground crew may only be called from the flight deck. Flight Attendants may be called from the flight deck, the other attendant station, or from any passenger seat or lavatory. Master call lights in the passenger cabin identify the source of incoming calls to the attendants.

Call system chime signals are audible in the passenger cabin through the PA system speakers. The PA speakers also provide an alerting chime signal whenever the NO SMOKING or FASTEN SEAT BELT signs illuminate or extinguish.

YA701 - YA710, YF921 - YM484, YS151 - YS178, YS191 - YS194

Location of Call Originator	Called Position	Visual Signal at Called Position	Aural Signal at Called Position
Flight deck	Attendant station	Pink master call light	Two–tone chime
Flight deck	Nose wheel well		Horn in nose wheel well
Attendant station	Flight deck	Blue flight deck call light	Single high–tone chime
External Power Connector Panel	Flight deck	Blue flight deck call light	Single high–tone chime
Flight deck	Passenger cabin	NO SMOKING or FASTEN BELT signs illuminate/ extinguish	Single low–tone chime

YF048, YF049, YN531 - YN534, YS179 - YS190, YT501 - YV754

Location of Call Originator	Called Position	Visual Signal at Called Position	Aural Signal at Called Position
Flight deck	Attendant station	Pink master call light	Two–tone chime
Flight deck	Nose wheel well		Horn in nose wheel well
Attendant station	Flight deck	Call light on the integrated audio control panel	Single high–tone chime
External Power Connector Panel	Flight deck	Call light on the integrated audio control panel	Single high–tone chime
Flight deck	Passenger cabin	NO SMOKING or FASTEN BELT signs illuminate/ extinguish	Single low–tone chime

VHF Communications

Primary short–range voice communications is provided in the VHF range by three independent radios. Each radio provides for selection of an active frequency and an inactive (preselected) frequency. Voice transmission and reception are controlled at the related ACP.

The VHF/HF RTP-1 is located on the forward left side of the aft electronic panel, VHF/HF RTP–2 is on the forward right side and VHF/HF RTP–3 is on the aft portion of the panel. The VHF–2 and VHF-3 antennae are located on the lower fuselage, VHF–1 is on the upper fuselage.

Note: VHF antennae located on the lower fuselage are susceptible to multipath interference from nearby structures or vehicles. This may disrupt VHF communications. VHF antennae located on the upper fuselage are not as susceptible to this interference.

HF Communications

YA701 - YA706
The HF communication radio can be tuned by any radio tuning panel. HF radio sensitivity can only be set on the on-side radio tuning panel.

YA707 - YV754
There are two independent HF communication radios, designated HF 1 and HF 2. 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. When an HF transmitter is keyed after a frequency change, the antenna tunes. A steady or intermittent tone may be heard through the audio system. While tuning, the tone can last as long as 7 seconds. If the system fails to tune, the tone will last more than 7 seconds, to a maximum of 15 seconds. The antenna is located in the vertical stabilizer.

Note: Data for the last 100 tuned frequencies is stored in memory. Tuning duration for these stored frequencies will be very short and a tune tone may not be noticeable.

YA707 - YV754
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.

Selective Calling (SELCAL)

YA701 - YA710, YF921 - YM484, YS151 - YS178, YS191 - YS194

A ground station desiring communications with the flight deck can use the SELCAL system. SELCAL monitors selected frequencies on VHF and HF radios. Each airplane is assigned a unique four–letter SELCAL code. When the system receives an incoming call from a ground station, a two–tone chime sounds and the respective SELCAL light illuminates.

Cockpit Voice Recorder

The cockpit voice recorder uses four independent channels to record flight deck audio for 120 minutes. Recordings older than 120 minutes are automatically erased. One channel records flight deck area conversations using the area microphone. The other channels record individual ACP output (headset) audio and transmissions for the pilots and observer.

YF048, YF049, YF923 - YF928, YL545 - YL551, YN531 - YV754
The RIPS (Recorder Independent Power Supply) provides power to the cockpit voice recorder for 10 minutes after aircraft power is interrupted either by normal shutdown or by any other loss of power.

ACARS System

The ARINC Communications Addressing and Reporting System (ACARS) is an addressable digital data link system which permits exchange of data and messages between an airplane and a ground-based operation center utilizing an onboard VHF communications system.

The ACARS airborne subsystem provides for the manual entry of routine data such as departure/arrival information. Also possible is manual entry of addresses (telephone codes) of parties on the ground for voice communications.

The airborne system consists of a management unit in the E/E compartment, either an interactive display unit or multipurpose control display unit (MCDU), and frequently a printer. Data is entered and transmitted to the ground operations center.

Satellite Communications (SATCOM) System

YN531 - YN534, YS179 - YS190, YT501 - YV754

The SATCOM system provides both data and voice communications. The satellite data unit is controlled through the control display units (CDUs). Voice transmission is controlled using CDUs and the audio control panels.

Calls can be initiated using the CDU. Directories of airline defined numbers are line selectable or manual numbers can be entered. The SATCOM CDU control pages are displayed by selecting SAT on the MENU page.

SATCOM menu configuration is defined by the airline and is not presented here.

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Electrical Chapter 6

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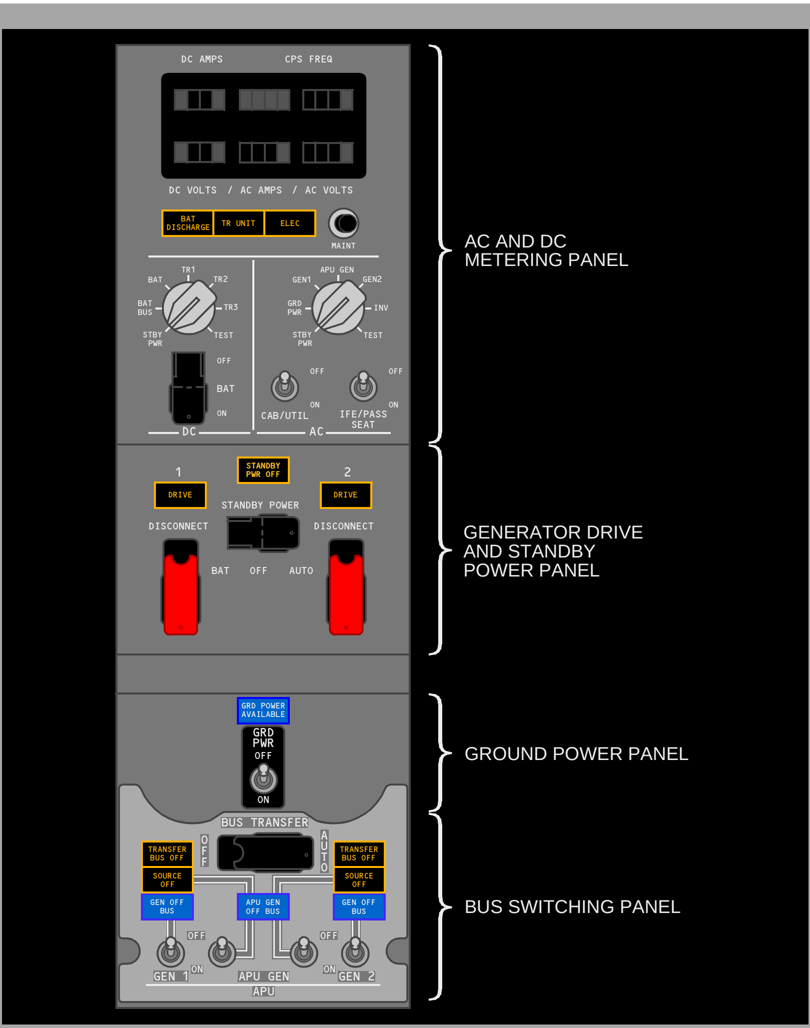
Controls and Indicators — Section 10

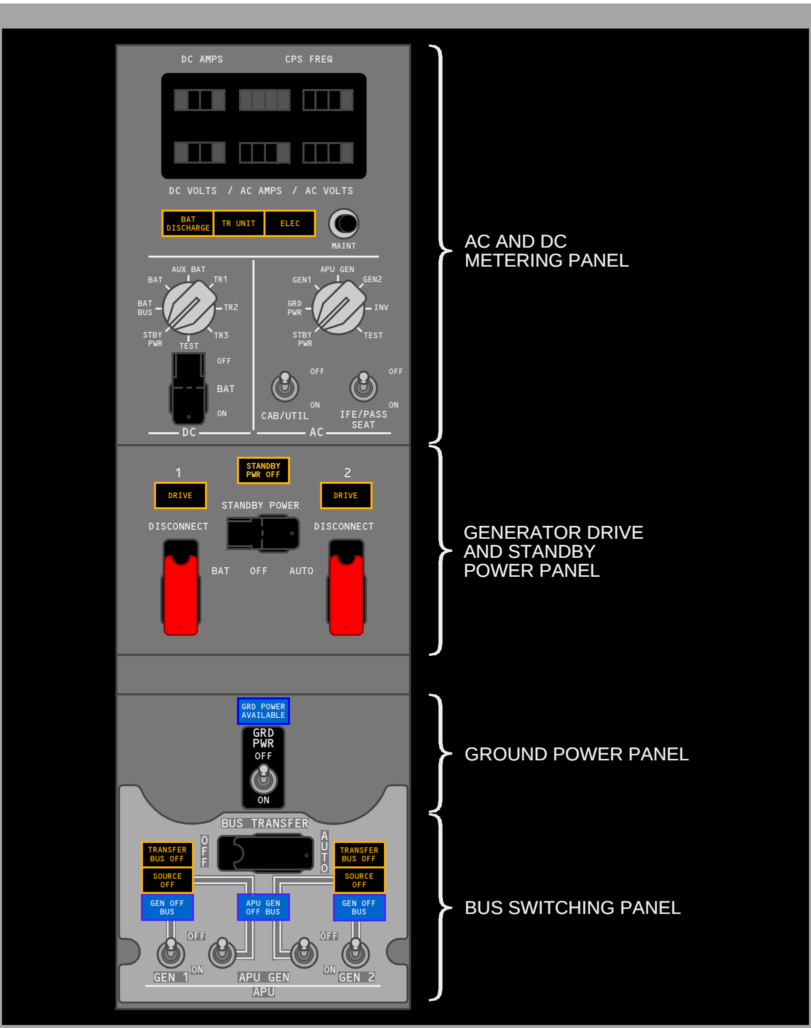
Electrical Panel

YA701 - YF049, YM482 - YM484



FORWARD OVERHEAD PANEL

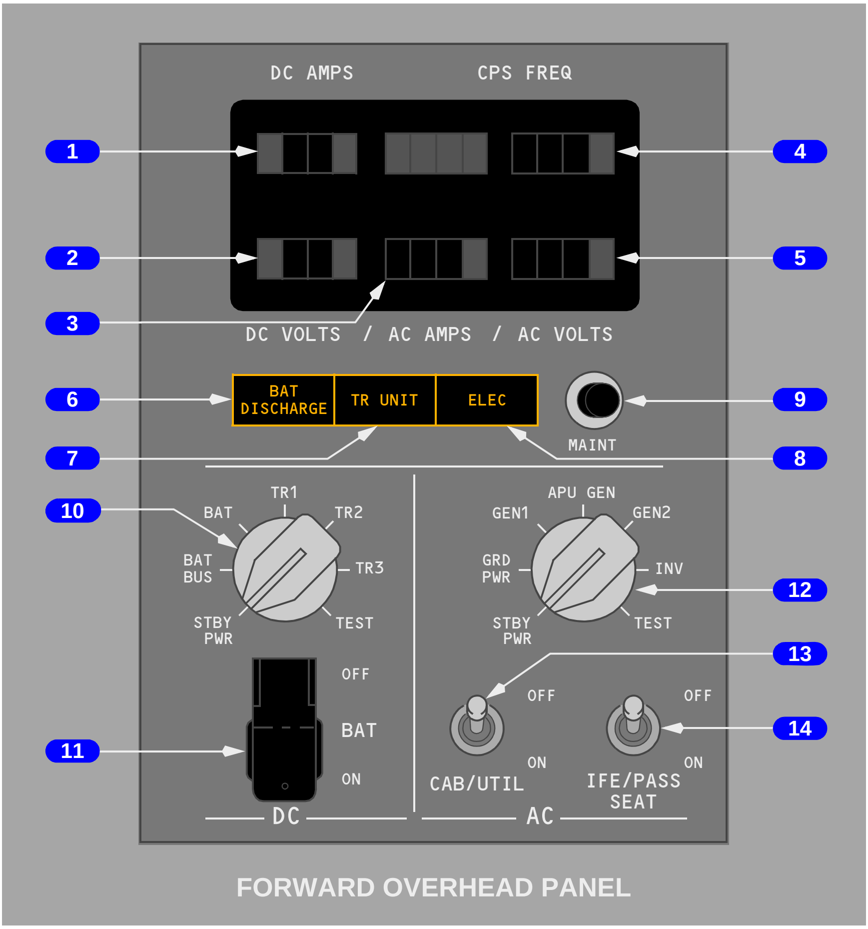
YF921 - YL551, YN531 - YV754



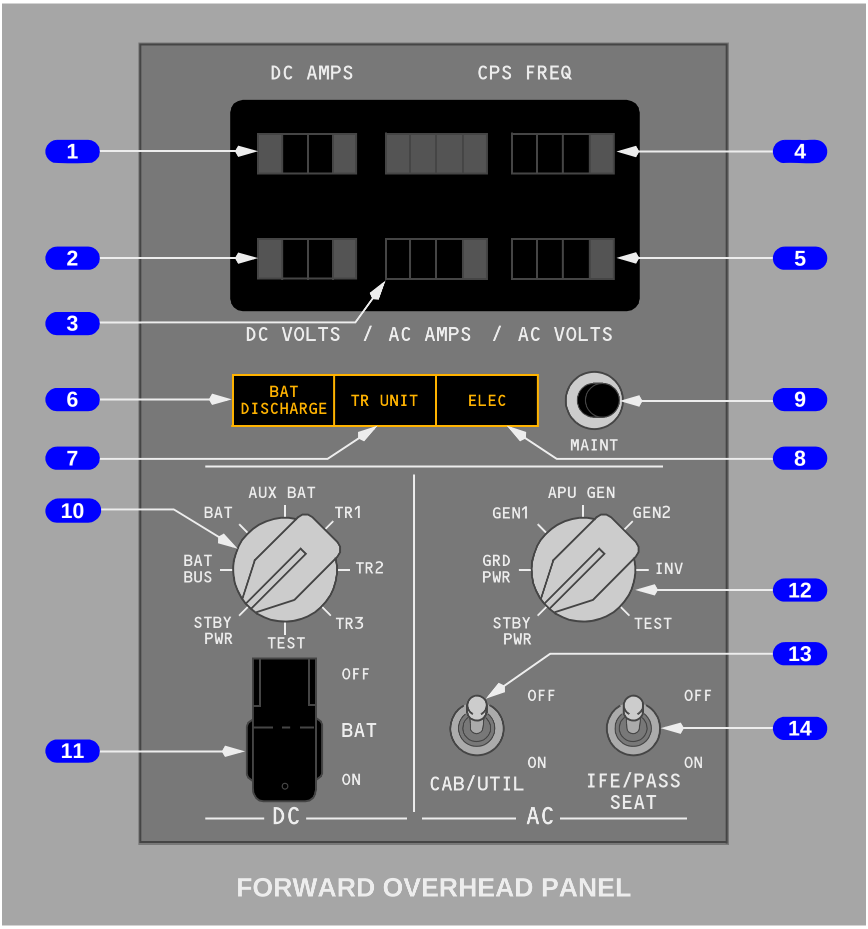
FORWARD OVERHEAD PANEL

AC and DC Metering Panel

YA701 - YF049, YM482 - YM484



YF921 - YL551, YN531 - YV754



1 **DC Ammeter**

Indicates amperage of source selected by DC meters selector.

2 **DC Voltmeter**

Indicates voltage of source selected by DC meters selector.

3 **AC Ammeter**

Indicates amperage of source selected by AC meters selector.

4 **Frequency Meter**

Indicates frequency of source selected by AC meters selector.

5 AC Voltmeter

Indicates voltage of source selected by AC meters selector.

6 Battery Discharge (BAT DISCHARGE) Light

Illuminated (amber) – with BAT switch ON, excessive battery discharge detected.

7 TR UNIT Light

Illuminated (amber) –

- on the ground – any TR has failed.
- in flight –
  - TR1 failed; or
  - TR2 and TR3 failed.

8 Electrical (ELEC) Light

Illuminated (amber) – a fault exists in DC power system or standby power system.

Note: Operates only with airplane on ground.

9 Maintenance Test (MAINT) Switch

Used by maintenance.

10 DC Meters Selector

Selects DC source for DC voltmeter and DC ammeter indications.

TEST – used by maintenance.

11 Battery (BAT) Switch

OFF –

- removes power from battery bus and switched hot battery bus when operating with normal power sources available
- removes power from battery bus, switched hot battery bus, DC standby bus, static inverter, and AC standby bus when battery is only power source.

ON (guarded position) –

- provides power to switched hot battery bus
- energizes relays to provide automatic switching of standby electrical system to battery power with loss of normal power.

12 AC Meters Selector

Selects AC source for AC voltmeter, AC ammeter and frequency meter indications

TEST – used by maintenance.

13 CAB/UTIL Switch

OFF – removes electrical power from galley and cabin equipment systems including:

- all 115V AC galley busses

YA701 - YA710, YM482 - YN534

- cabin recirculation fan

YF048 - YL551, YS151 - YV754

- left & right recirculation fans
- fwd and aft door area heaters
- drain mast heaters
- lavatory water heaters
- logo lights
- potable water compressor
- 115V AC shaver outlets when installed

YN531 - YV754

- LED cabin lighting

ON – supplies electrical power to galley and cabin equipment systems.

14 IFE/PASS SEAT Switch

OFF – removes electrical power from installed components of the passenger seats, in-flight entertainment systems, and other power systems including:

- 115V AC audio entertainment equipment
- 115V AC video entertainment equipment
- cabin telephone equipment
- FAX machine
- 28V DC video equipment and passenger seat electronic outlets

YA701 - YA710

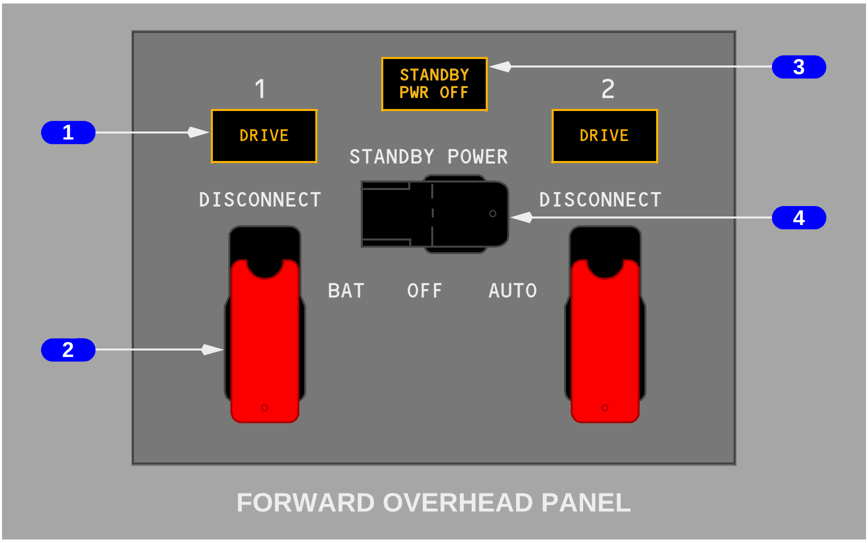
- ACARS printer

YF048 - YF928, YK626 - YK630, YK973 - YK980, YL541 - YL551, YN531 - YV754

- flight deck door surveillance system

ON – supplies electrical power to installed components of the passenger seats, in-flight entertainment systems, and other power systems.

Generator Drive and Standby Power Panel



1 Generator Drive (DRIVE) Lights

Illuminated (amber) – Integrated drive generator (IDG) low oil pressure caused by one of the following:

- IDG failure
- engine shutdown
- IDG automatic disconnect due to high oil temperature
- IDG disconnected through generator drive DISCONNECT switch.

2 Generator Drive Disconnect (DISCONNECT) Switches (guarded)

Disconnects IDG if electrical power is available and engine start lever is in IDLE. IDG cannot be reconnected in the air.

3 STANDBY Power Off (PWR OFF) Light

Illuminated (amber) – one or more of the following busses are unpowered:

- AC standby bus
- DC standby bus
- battery bus.

4 STANDBY POWER Switch

AUTO (guarded position) –

- In flight, or on the ground, and AC transfer busses powered:
  - AC standby bus is powered by AC transfer bus 1
  - DC standby bus is powered by TR1, TR2 and TR3
- In flight, or on the ground, loss of all AC power
  - AC standby bus is powered by battery through static inverter
  - DC standby bus is powered by battery
  - Battery bus is powered by battery.

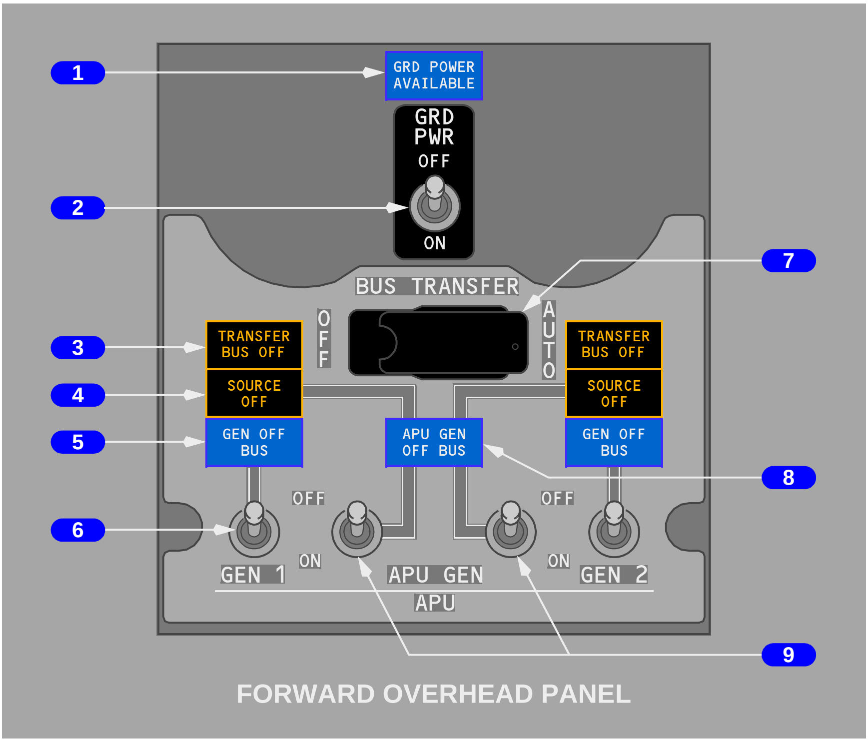
OFF (center position) –

- STANDBY PWR OFF light illuminates
- AC standby bus, static inverter, and DC standby bus are not powered.

BAT (unguarded position) –

- AC standby bus is powered by battery through static inverter
- DC standby bus and battery bus are powered directly by battery.

Ground Power Panel and Bus Switching Panel



1 Ground Power Available (GRD POWER AVAILABLE) Light

Illuminated (blue) – ground power is connected and meets airplane power quality standards.

2 Ground Power (GRD PWR) Switch

Three position switch, spring–loaded to neutral

OFF – disconnects ground power from AC transfer busses.

ON – if momentarily moved to ON position and ground power is available:

- removes previously connected power from AC transfer busses
- connects ground power to AC transfer busses if power quality is correct.

3 TRANSFER BUS OFF Lights

Illuminated (amber) – related transfer bus is not powered.

4 SOURCE OFF Lights

Illuminated (amber) – no source has been manually selected to power the related transfer bus, or the manually selected source has been disconnected

- if a source has been selected to power the opposite transfer bus, both transfer busses are powered.

5 Generator Off Bus (GEN OFF BUS) Lights

Illuminated (blue) – IDG is not supplying power to the related transfer bus.

6 Generator (GEN) Switches

Three position switch, spring–loaded to neutral.

OFF – disconnects IDG from related AC transfer bus by opening generator circuit breaker.

ON – connects IDG to related AC transfer bus by disconnecting previous power source and closing generator circuit breaker.

7 BUS TRANSFER Switch

AUTO (guarded position) – BTBs operate automatically to maintain power to AC transfer busses from any operating generator or external power

- DC cross tie relay automatically provides normal or isolated operation as required.

OFF – isolates AC transfer bus 1 from AC transfer bus 2 if one IDG is supplying power to both AC transfer busses

- DC cross tie relay opens to isolate DC bus 1 from DC bus 2.

8 APU Generator Off Bus (GEN OFF BUS) Light

Illuminated (blue) – APU is running and not powering a bus.

9 APU Generator (GEN) Switches

Three position switch, spring–loaded to neutral.

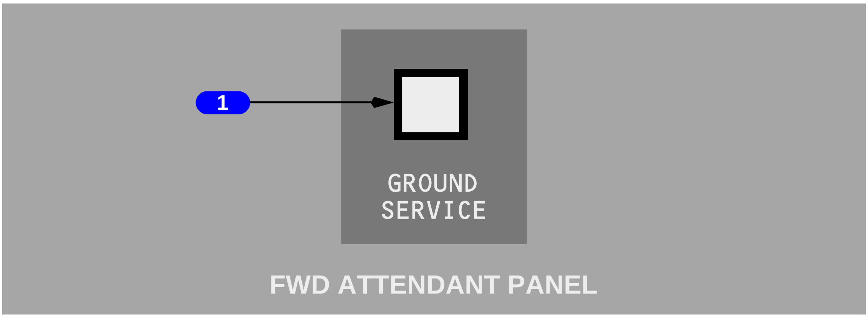
OFF –

- APU generator powering both AC transfer busses
  - moving a single APU GEN switch to OFF illuminates related SOURCE OFF light. APU continues to power AC transfer busses
  - subsequently moving other APU GEN switch to OFF disconnects APU generator from tie bus and removes APU power from AC transfer busses
- APU generator powering one AC transfer bus; IDG powering one AC transfer bus
  - moving related APU GEN switch to OFF disconnects APU generator from tie bus and AC transfer bus. IDG powers AC transfer busses.

ON –

- Neither AC transfer bus powered by IDG – moving a single APU GEN switch to ON:
  - connects both AC transfer busses to the APU generator
  - disconnects external power, if connected
  - opposite SOURCE OFF light illuminates until the other APU GEN switch is moved to ON.
- Both AC transfer busses powered by IDGs – moving an APU GEN switch ON:
  - powers the related AC transfer bus from the APU generator
  - other AC transfer bus continues to receive power from the IDG.

Ground Service Switch



1 GROUND SERVICE Switch

Momentary push–button switch.

Provides manual control of ground service busses. Enables servicing airplane using external power without activating AC transfer busses.

Illuminated (white) –

- ON – connects external power to ground service busses
- OFF – disconnects external power from ground service busses.

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Electrical Chapter 6

System Description Section 20

Introduction

Single Battery

YA701 - YF049, YM482 - YM484

Primary electrical power is provided by two engine integrated drive generators (IDGs) which supply three-phase, 115 volt, 400 cycle alternating current. Each IDG supplies its own bus system in normal operation and can also supply essential and non-essential loads of the opposite side bus system when one IDG is inoperative. Transformer rectifier (TR) units and a battery/battery charger supply DC power. The battery also provides backup power for the AC and DC standby system. The APU operates a generator and can supply power to both AC transfer busses on the ground or in flight.

There are two basic principles of operation for the 737 electrical system:

- There is no paralleling of the AC sources of power.
- The source of power being connected to a transfer bus automatically disconnects an existing source.

The electrical power system may be categorized into three main divisions: the AC power system, the DC power system, and the standby power system.

Dual Battery

YF921 - YL551, YN531 - YV754

Primary electrical power is provided by two engine integrated drive generators (IDGs) which supply three-phase, 115 volt, 400 cycle alternating current. Each IDG supplies its own bus system in normal operation and can also supply essential and non-essential loads of the opposite side bus system when one IDG is inoperative. Transformer rectifier (TR) units and the main battery/battery charger supply DC power. The main and auxiliary batteries also provide backup power for the AC and DC standby system. The APU operates a generator and can supply power to both AC transfer busses on the ground or in flight.

There are two basic principles of operation for the 737 electrical system:

- There is no paralleling of the AC sources of power.
- The source of power being connected to a transfer bus automatically disconnects an existing source.

The electrical power system may be categorized into three main divisions: the AC power system, the DC power system, and the standby power system.

Electrical Power Generation

Engine Generators

Primary power is obtained from two engine IDGs. The IDG maintains a constant generator speed throughout the normal operating range of the engine. An integral electro–mechanical disconnect device provides for complete mechanical isolation of the IDG.

APU Generator

The APU generator can supply power to both AC transfer busses on the ground or in flight. As the only power source, the APU generator can meet electrical power requirements for all ground conditions and most flight conditions.

External Ground Power

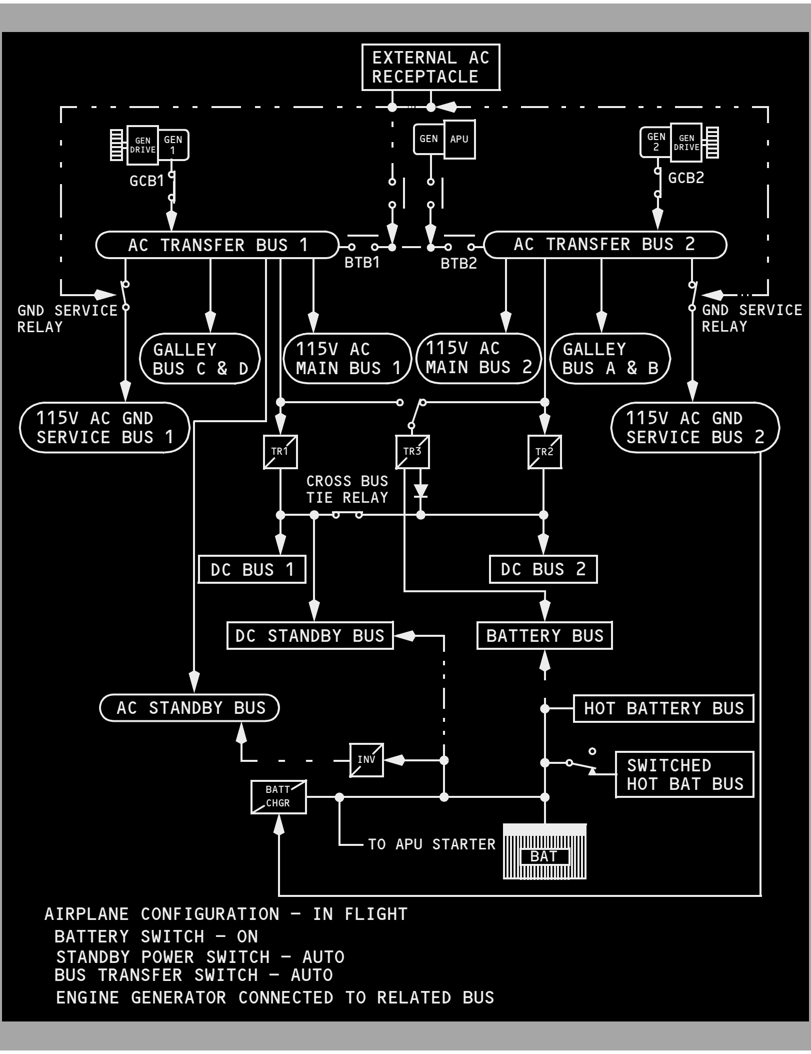
An external AC power receptacle located near the nose gear wheel well, on the lower right side of the fuselage, allows the use of an external power source. Status lights on a panel adjacent to the receptacle permit the ground crew to determine if external power is being used. When connected, external power can supply power to both transfer busses.

Ground Service

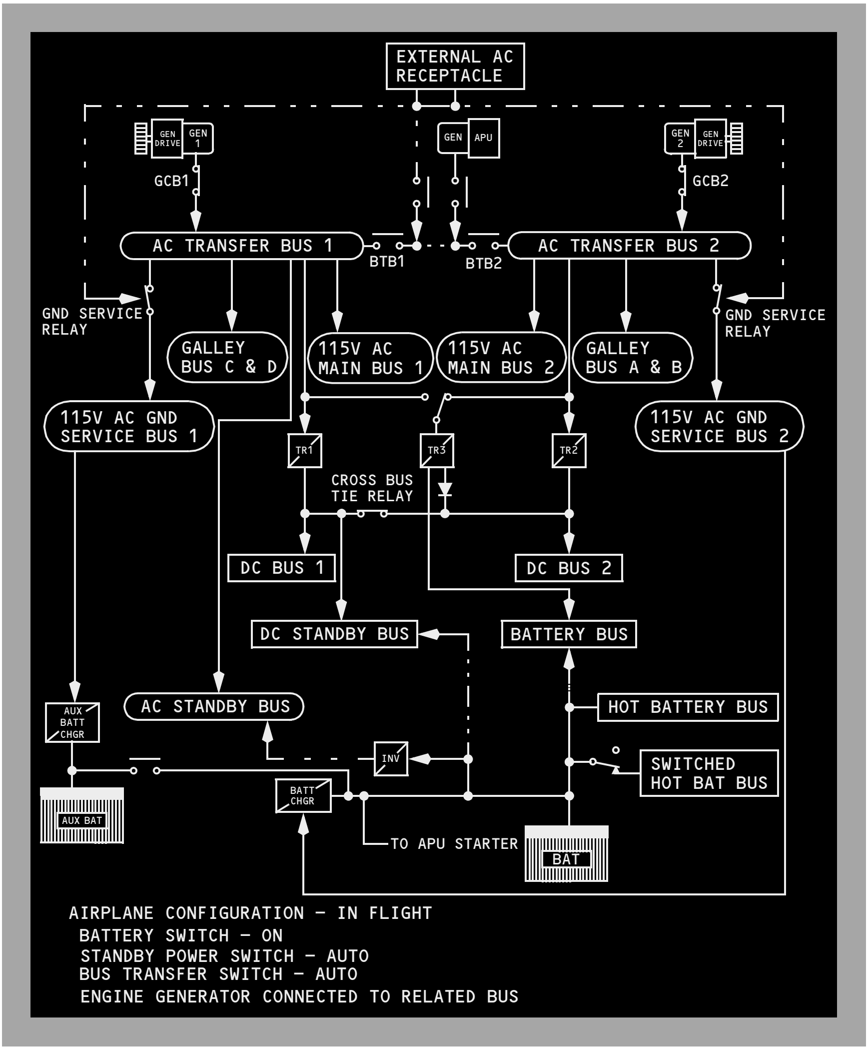
For ground servicing, a ground service switch is on the forward attendant’s panel. The switch provides ground power directly to the AC ground service busses for utility outlets, cabin lighting and the battery charger without powering all airplane electrical busses. The ground service switch is a momentary push button and is overridden when both AC transfer busses are powered.

Electrical Power Schematic

YA701 - YF049, YM482 - YM484



YF921 - YL551, YN531 - YV754



AC Power System

Each AC power system consists of a transfer bus, a main bus, two galley busses, and a ground service bus. Transfer bus 1 also supplies power to the AC standby bus. If the AC source powering either transfer bus fails or is disconnected, the transfer bus can be powered by any available source through the tie bus with the bus tie breakers (BTBs).

With the airplane on the ground and both generator control switches OFF, or with both engines shut down, selecting the GRD PWR switch ON connects external power to both transfer busses. Likewise, selecting either APU GEN switch ON connects APU power to both transfer busses. Whichever source is selected last powers both busses. It is not possible to power one transfer bus with external power and one transfer bus with APU power.

The transfer busses can be powered from the engine generators by momentarily positioning the related generator switch to ON. This closes the related generator circuit breaker (GCB) and connects the generator to the transfer bus. Whenever external power or APU is powering both transfer busses, and engine generator power is applied to its onside transfer bus, external power or APU continues to supply power to the remaining transfer bus.

In flight, each engine generator normally powers its own transfer bus. If an engine generator is no longer supplying power, the BTBs automatically close to allow the other engine generator to supply both transfer busses through the tie bus and BTBs. The APU can power either or both busses through the BTBs.

The system also incorporates an automatic generator on–line feature in case the airplane takes off with the APU powering both transfer busses. If the APU is either shut down or fails, the engine generators are automatically connected to their related transfer busses. This action occurs only once in flight and only under the circumstances described above.

Bus Tie System

Either generator or the APU can supply power to both transfer busses. If the BUS TRANS switch is in the AUTO position and the source powering the transfer bus is disconnected or fails, the source powering the opposite transfer bus automatically picks up the unpowered transfer bus through the BTBs.

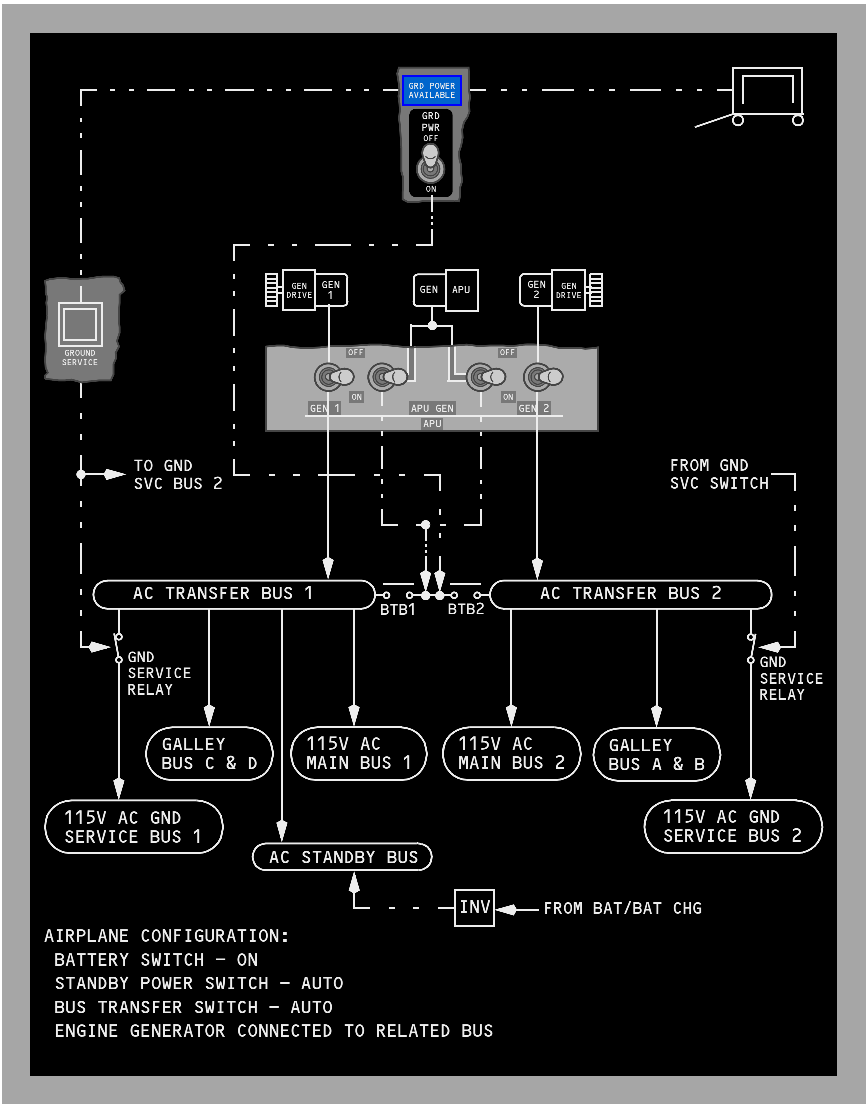
Automatic Load Shedding (Engine Generators)

For single generator operation, the system is designed to shed electrical load incrementally based on actual load sensing. The galleys and main bus on transfer bus 2 are shed first; if an overload is still sensed, the galleys and main bus on transfer bus 1 are shed; if overload still exists, the IFE buses are shed. When configuration changes to more source capacity (two generator operation), automatic load restoration of the main busses, galley busses and IFE buses occurs; manual restoration of galley and main bus power can be attempted by moving the CAB/UTIL Power Switch to OFF, then back ON.

APU Automatic Load Shedding

In flight, if the APU is the only source of electrical power, all galley busses and main buses are automatically shed. If electrical load still exceeds design limits, both IFE busses are also automatically shed. On the ground, the APU attempts to carry a full electrical load. If an overload condition is sensed, the APU sheds galley busses and main busses until the load is within limits. Manual restoration of galley and main bus power can be attempted by moving the CAB/UTIL Power Switch to OFF, then back ON.

AC Power Schematic



AIRPLANE CONFIGURATION:
BATTERY SWITCH – ON
STANDBY POWER SWITCH – AUTO
BUS TRANSFER SWITCH – AUTO
ENGINE GENERATOR CONNECTED TO RELATED BUS

Electrical Power Controls and Monitoring

Generator Drive

The IDGs contain the generator and drive in a common housing, and are lubricated and cooled by a self–contained oil system. An integral electro–mechanical disconnect device provides for complete mechanical isolation of the IDG.

The generator drive (DRIVE) amber caution light is illuminated when low oil is sensed in the IDG. IDG low oil pressure is caused by one of the following:

- IDG failure
- engine shutdown
- IDG automatic disconnect due to high oil temperature
- IDG disconnected through generator drive DISCONNECT switch.

A generator drive disconnect switch is installed. This switch disconnects the generator from the engine in the event of a generator drive malfunction. Reactivation of the generator may be accomplished only on the ground by maintenance personnel.

AC Voltmeter, Ammeter and Frequency Meter

AC voltage and frequency may be read on the AC voltmeter and frequency meter for standby power, ground power, generator No. 1, APU generator, generator No. 2 and the static inverter. Frequency is indicated only when the generator is electrically excited. The voltage regulator automatically controls the generator output voltage.

Current readings for the two engine IDGs and the APU generator may be read on the AC ammeter.

The TEST position is used by maintenance and connects the voltage and frequency meter to the power systems test module for selection of additional reading points.

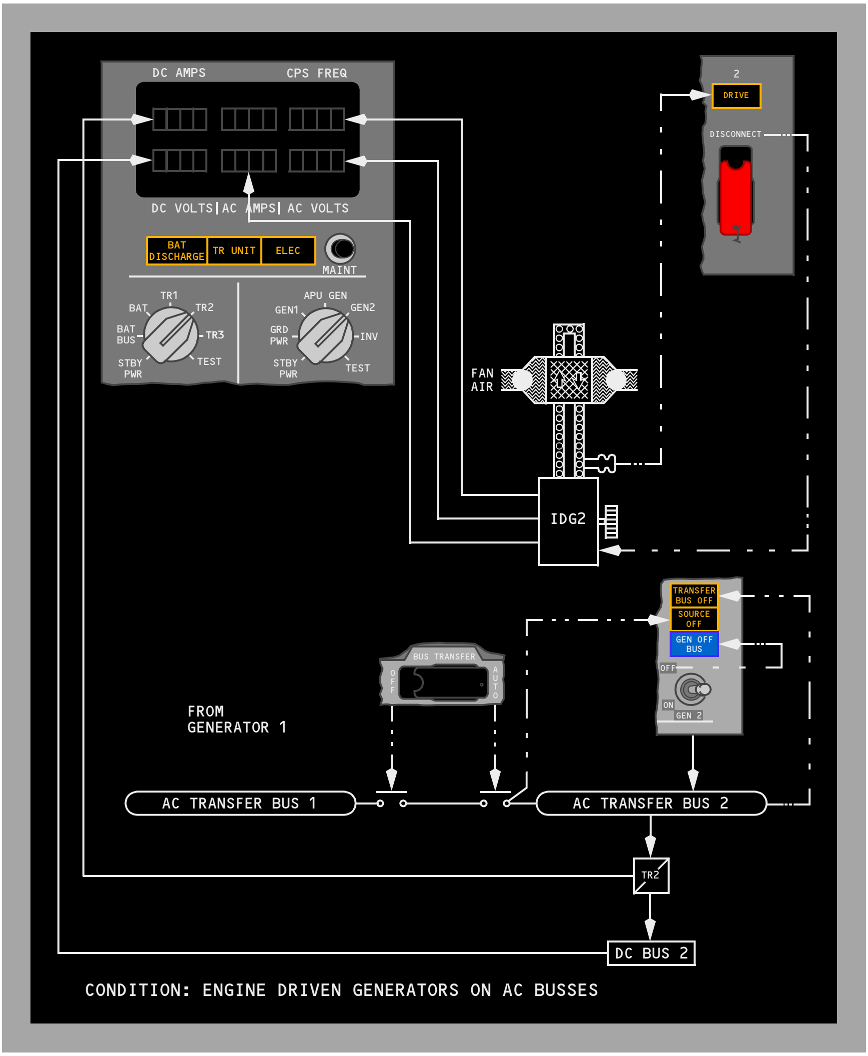
DC Voltmeter and Ammeter

DC voltage and amperage may be read on the DC voltmeter and ammeter for the battery and each of the three TRs. The standby power and battery bus displays only DC voltage.

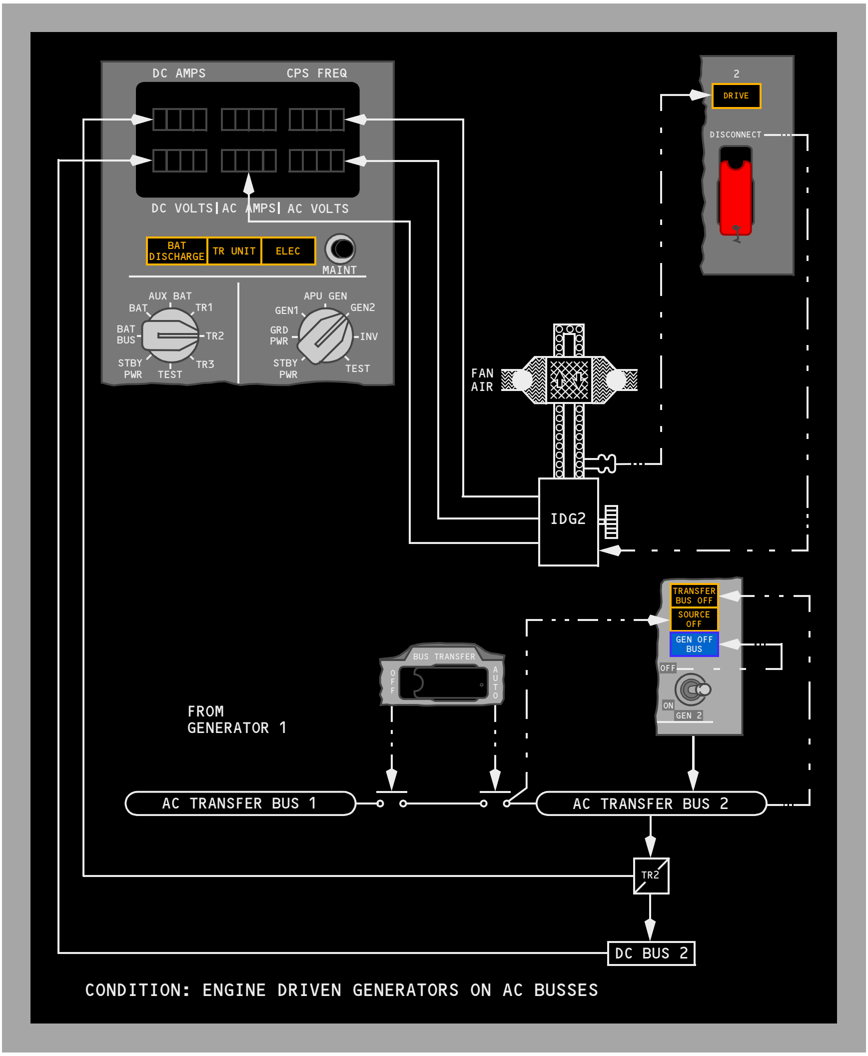
The TEST position is used by maintenance.

Electrical Power Controls and Monitoring Schematic

YA701 - YF049, YM482 - YM484



YF921 - YL551, YN531 - YV754



DC Power System

28 volt DC power is supplied by three TR units, which are energized from the AC transfer busses. The battery provides DC power to loads required to be operative when no other source is available.

On the ground, an amber ELEC light comes on to indicate that a fault exists in DC power system or standby power system. The ELEC light is inhibited in flight.

Transformer Rectifier Units

The TRs convert 115 volt AC to 28 volt DC, and are identified as TR1, TR2, and TR3.

TR1 receives AC power from transfer bus 1. TR2 receives AC power from transfer bus 2. TR3 normally receives AC power from transfer bus 2 and has a backup source of AC power from transfer bus 1. Any two TRs are capable of supplying the total connected load.

Under normal conditions, DC bus 1, DC bus 2, and the DC standby bus are connected via the cross bus tie relay. In this condition, TR1 and TR2 are each powering DC bus 1, DC bus 2, and the DC standby bus. TR3 powers the battery bus and serves as a backup power source for TR1 and TR2.

The cross bus tie relay automatically opens, isolating DC bus 1 from DC bus 2, under the following conditions:

- At glide slope capture during a flight director or autopilot ILS approach. This isolates the DC busses during approach to prevent a single failure from affecting both navigation receivers and flight control computers
- Bus transfer switch positioned to OFF.

In–flight, an amber TR UNIT light illuminates if TR1, or TR2 and TR3 has failed. On the ground, any TR fault causes the light to illuminate.

Battery Power

Single Battery

YA701 - YF049, YM482 - YM484

A 24 volt nickel–cadmium battery is located in the electronics compartment. The battery can supply part of the DC system. Battery charging is automatically controlled. A fully charged battery has sufficient capacity to provide standby power for a minimum of 30 minutes. Battery voltage range is 22–30 volts.

DC busses powered from the battery following a loss of both generators are:

- battery bus
- DC standby bus
- hot battery bus
- switched hot battery bus.

The switched hot battery bus is powered whenever the battery switch is ON.

The hot battery bus is always connected to the battery. There is no switch in this circuit. The battery must be above minimum voltage to operate units supplied by this bus. An amber BAT DISCHARGE light comes on when excessive battery discharge is detected.

Dual Battery
YF921 - YL551, YN531 - YV754

Two 24 volt nickel–cadmium batteries, main and auxiliary, are located in the electronics compartment. The batteries can supply part of the DC system. The auxiliary battery operates in parallel with the main battery when the battery is powering the standby system. At all other times, the auxiliary battery is isolated from the power distribution system. Battery charging is automatically controlled. Two fully charged batteries have sufficient capacity to provide standby power for a minimum of 60 minutes. Battery voltage range is 22–30 volts.

DC busses powered from the battery following a loss of both generators are:

- battery bus
- DC standby bus
- hot battery bus
- switched hot battery bus.

The switched hot battery bus is powered whenever the battery switch is ON.

The hot battery bus is always connected to the battery. There is no switch in this circuit. The battery must be above minimum voltage to operate units supplied by this bus. An amber BAT DISCHARGE light comes on when excessive battery discharge is detected.

Battery Charger Transformer/Rectifier

Single Battery
YA701 - YF049, YM482 - YM484

The purpose of the battery charger is to restore and maintain the battery at full electrical power. The battery charger is powered through AC ground service bus 2.

The battery charger provides a voltage output tailored to maximize the battery charge. Following completion of the primary charge cycle, the battery charger reverts to a constant voltage TR mode. In the TR mode, it powers loads connected to the hot battery bus and the switched hot battery bus. The battery charger TR also powers the battery bus if TR3 fails. With loss of AC transfer bus 1 or the source of power to DC bus 1, the AC and DC standby busses are powered by the battery/battery charger.

Dual Battery
YF921 - YL551, YN531 - YV754

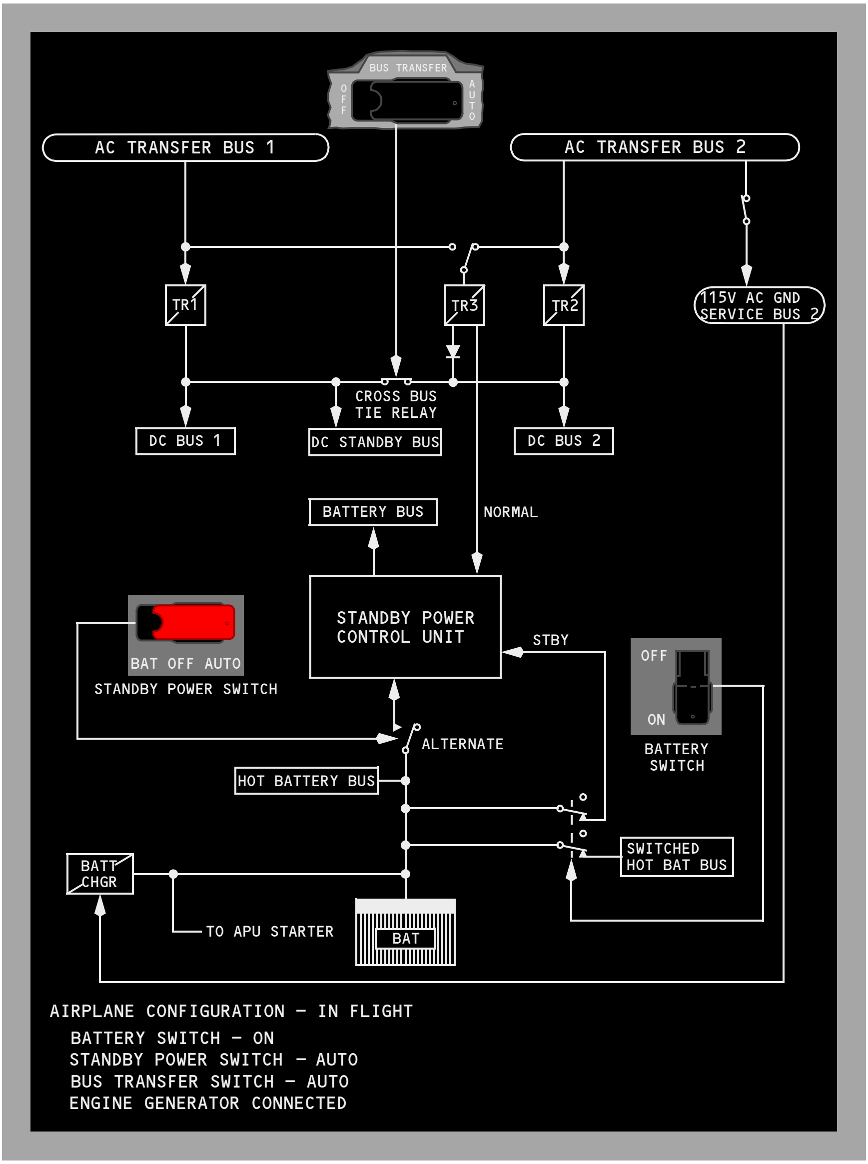
The purpose of the battery chargers is to restore and maintain the batteries at full electrical power. The main battery charger is powered through AC ground service bus 2. The auxiliary battery charger is powered through AC ground service bus 1.

The battery chargers provide a voltage output tailored to maximize the battery charge. Following completion of the primary charge cycle, the main battery charger reverts to a constant voltage TR mode. In the TR mode, it powers loads connected to the hot battery bus and the switched hot battery bus. The main battery charger TR also powers the battery bus if TR3 fails. With loss of AC transfer bus 1 or the source of power to DC bus 1, the AC and DC standby busses are powered by the main and auxiliary battery/battery chargers.

The auxiliary battery charger and battery are isolated from the power distribution system under normal operation. When the main battery is powering the standby system, the auxiliary battery is connected to operate in parallel with the main battery.

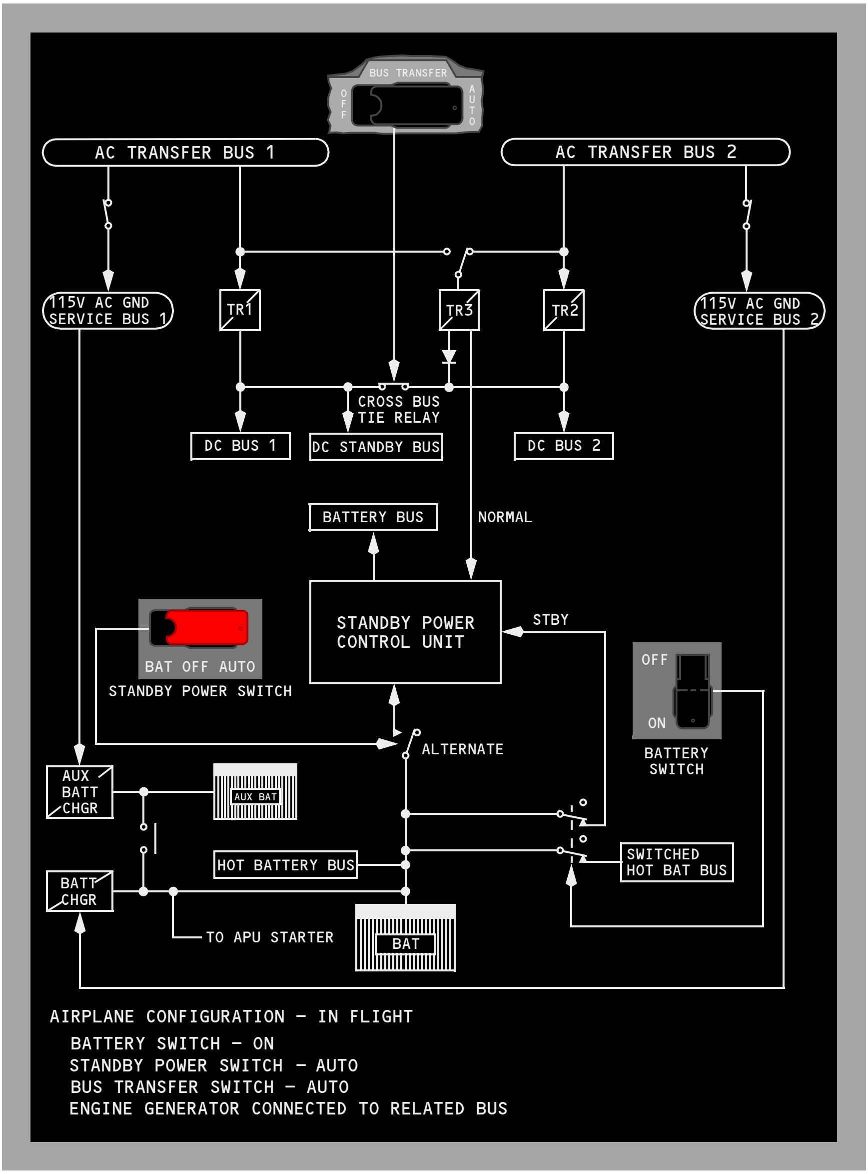
DC Power System Schematic

YA701 - YF049, YM482 - YM484



AIRPLANE CONFIGURATION - IN FLIGHT
BATTERY SWITCH - ON
STANDBY POWER SWITCH - AUTO
BUS TRANSFER SWITCH - AUTO
ENGINE GENERATOR CONNECTED

YF921 - YL551, YN531 - YV754



AIRPLANE CONFIGURATION – IN FLIGHT

BATTERY SWITCH – ON
STANDBY POWER SWITCH – AUTO
BUS TRANSFER SWITCH – AUTO
ENGINE GENERATOR CONNECTED TO RELATED BUS

Standby Power System
Normal Operation

The standby system provides 115V AC and 24V DC power to essential systems in the event of loss of all engine or APU–driven AC power. The standby power system consists of:

- static inverter
- AC standby bus
- DC standby bus
- battery bus
- hot battery bus
- switched hot battery bus
- main battery

YF921 - YL551, YN531 - YV754
- auxiliary battery.

During normal operation the guarded standby power switch is in AUTO and the battery switch is ON. This configuration provides alternate power sources in case of partial power loss as well as complete transfer to battery power if all normal power is lost. Under normal conditions the AC standby bus is powered from AC transfer bus 1. The DC standby bus is powered by TR1, TR2, and TR3; the battery bus is powered by TR3; the hot battery bus and switched hot battery bus are powered by the battery/battery charger.

Alternate Operation
Single Battery
YA701 - YF049, YM482 - YM484

The alternate power source for standby power is the battery. With the standby power switch in the AUTO position, the loss of all engine or APU electrical power causes the battery to power the standby loads, both in the air and on the ground. The AC standby bus is powered from the battery via the static inverter. The DC standby bus, battery bus, hot battery bus, and switched hot battery bus are powered directly from the battery.

The standby power switch provides for automatic or manual control of power to the standby buses.

In the AUTO position, automatic switching from normal to alternate power occurs if power from either AC transfer bus 1 or DC bus 1 is lost.

Positioning the switch to BAT overrides automatic switching and places the AC standby bus, DC standby bus, and battery bus on battery power. The battery switch may be ON or OFF. If the battery switch is OFF, the switched hot battery bus is not powered.

Positioning the standby power switch to OFF de–energizes both the AC standby bus and the DC standby bus and illuminates the STANDBY PWR OFF light.

Dual Battery
YF921 - YL551, YN531 - YV754

The alternate power sources for standby power are the main battery and auxiliary battery. With the standby power switch in the AUTO position, the loss of all engine or APU electrical power causes the batteries to power the standby loads, both in the air and on the ground. The AC standby bus is powered from the batteries via the static inverter. The DC standby bus, battery bus, hot battery bus, and switched hot battery bus are powered directly from the batteries.

The standby power switch provides for automatic or manual control of power to the standby buses.

In the AUTO position, automatic switching from normal to alternate power occurs if power from either AC transfer bus 1 or DC bus 1 is lost.

Positioning the switch to BAT overrides automatic switching and places the AC standby bus, DC standby bus, and battery bus on battery power. The battery switch may be ON or OFF. If the battery switch is OFF, the switched hot battery bus is not powered.

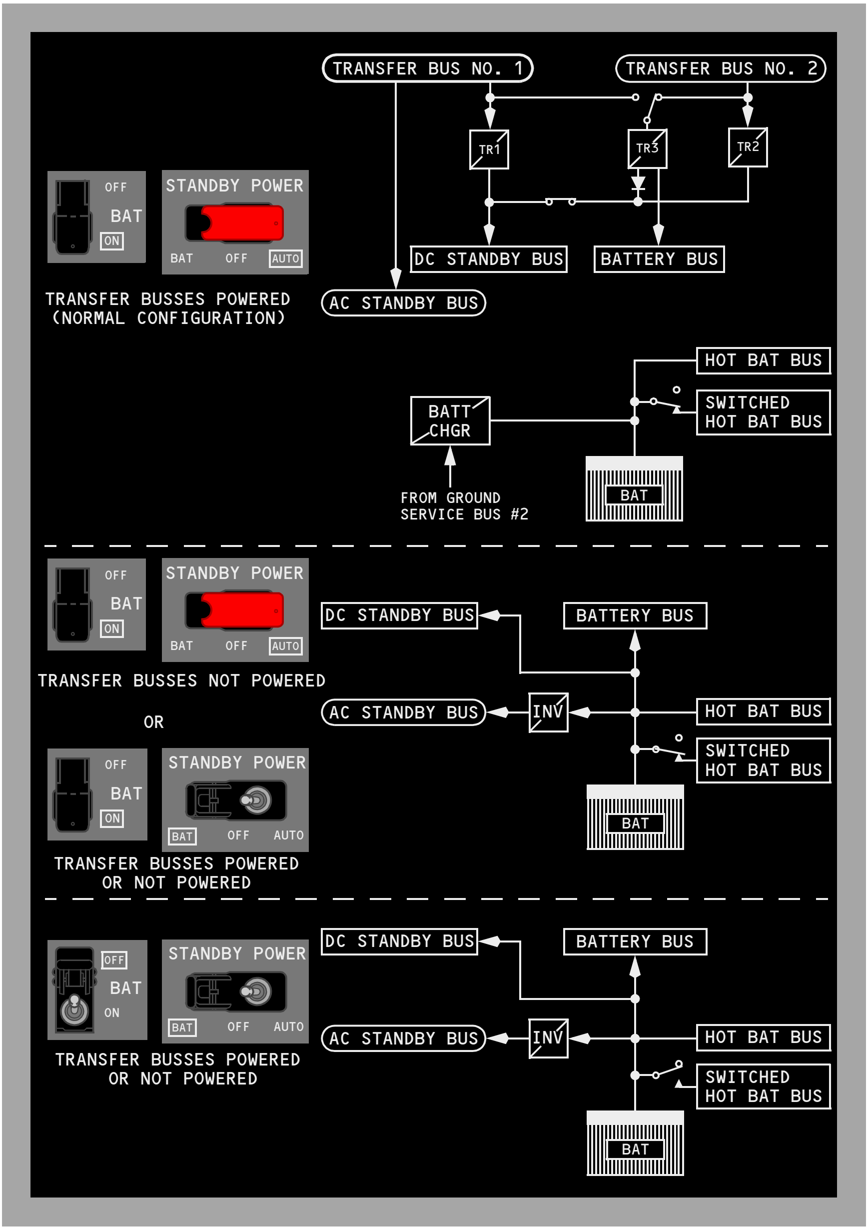
Positioning the standby power switch to OFF de–energizes both the AC standby bus and the DC standby bus and illuminates the STANDBY PWR OFF light.

Static Inverter

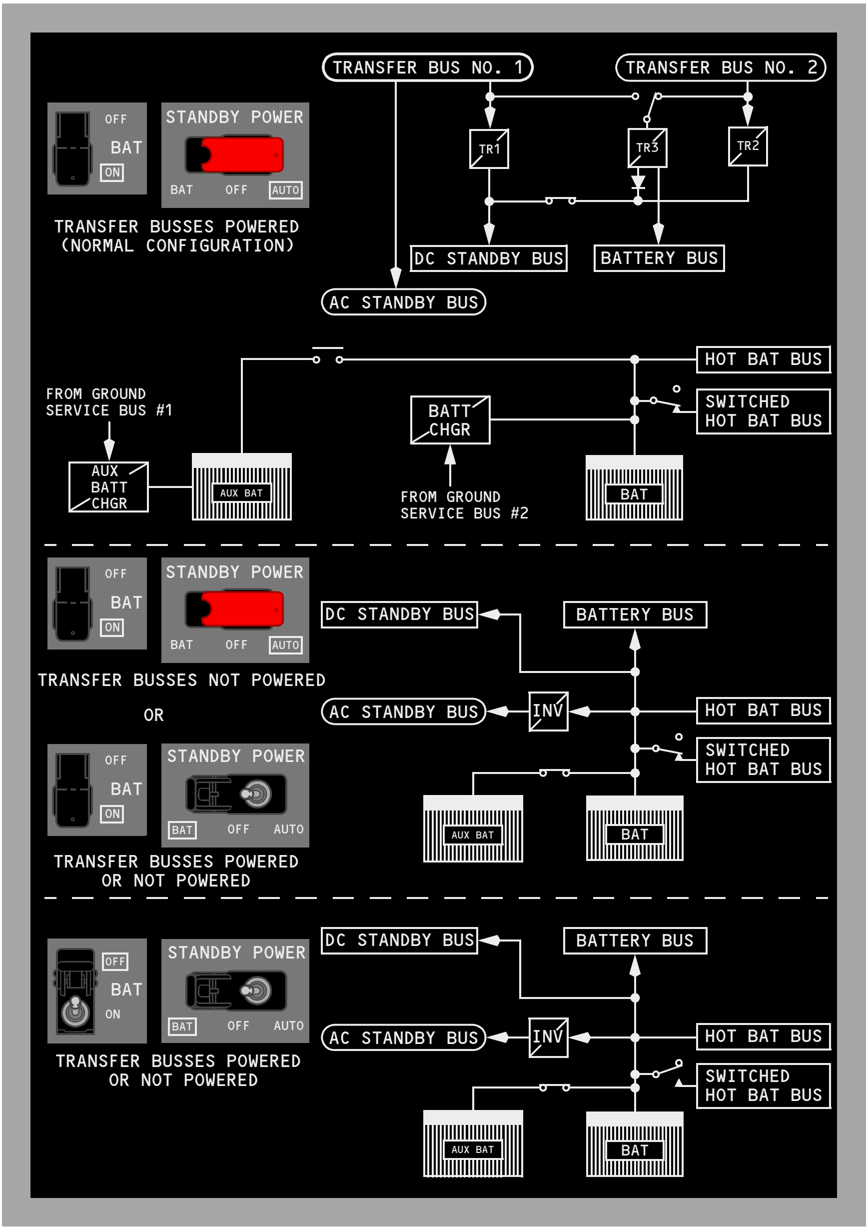
The static inverter converts 24 volt DC power from the battery to 115V AC power to supply the AC standby bus during the loss of normal electrical power. The power supply to the inverter is controlled by the standby power switch and the battery switch on the overhead panel.

Standby Power System Schematic

YA701 - YF049, YM482 - YM484



YF921 - YL551, YN531 - YV754



All Generators Inoperative

YA701 - YF049, YM482 - YM484
The following list identifies the significant equipment that operates when the battery is the only source of electrical power.

YF921 - YL551, YN531 - YV754
The following list identifies the significant equipment that operates when the main battery and the auxiliary battery are the only source of electrical power.

Airplane General

- standby compass light
- white dome lights
- emergency instrument flood lights
- flight crew oxygen
- passenger oxygen

Air Systems

- A/C pack valves
- BLEED TRIP OFF lights
- manual pressurization control
- altitude warning horn

YA701 - YA710, YM482 - YN534
- PACK TRIP OFF lights

YF048 - YL551, YS151 - YV754
- PACK lights

Anti-Ice

YF921 - YL551, YN531 - YV754

- Captain’s pitot probe heat

Communications

- flight interphone system
- service interphone system
- passenger address system
- VHF No. 1

Electrical

- STANDBY POWER OFF light

Engines, APU

- upper display unit

N1, N2, fuel flow, EGT, fuel quantity, oil pressure, oil temperature, oil quantity

- thrust reversers
- starter valves
- right igniters
- APU operation (start attempts not recommended above 25,000 feet)

Fire Protection

- APU and engine fire extinguisher bottles
- APU and engine fire detection system
- Cargo fire extinguisher bottles

Flight Instruments

- Captain’s outboard display unit with primary flight display.

YF048 - YV754

- Captain’s inboard display unit with navigation display
- clocks
- left EFIS control panel

YA701 - YA706

- Standby instruments

radio magnetic indicator (RMI), standby airspeed/altimeter, standby attitude indicator, standby magnetic compass

YA707 - YV754

- Standby instruments

integrated standby flight instrument display (ISFD), radio magnetic indicator (RMI), standby magnetic compass

Flight Management, Navigation

YF048 - YV754

- left FMC

YF048 - YV754

- left CDU
- heading/track indications
- VHF NAV No. 1
- ILS No. 1
- left IRS
- left GPS
- marker beacon
- ADF No. 1

YF048 - YL551, YN531 - YV754

- transponder No. 1

YF048 - YV754

- DME No. 1

Fuel

- crossfeed valve
- engine fuel shutoff valves
- spar fuel shutoff valve
- FUEL VALVE CLOSED lights
- fuel quantity indicators

Hydraulic Power

- engine hydraulic shutoff valves
- standby rudder shutoff valves

Landing Gear

- inboard antiskid system
- ANTISKID INOP light
- parking brake
- air/ground system
- landing gear indicator lights

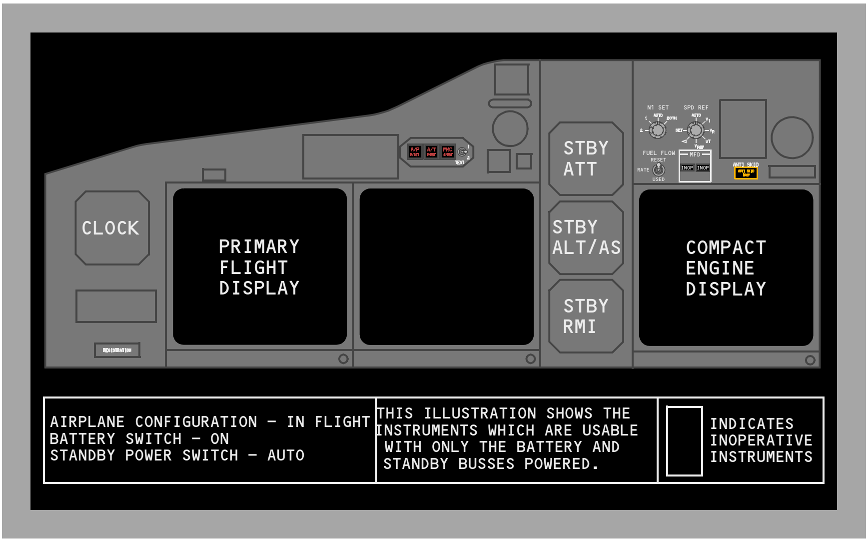
Warnings

- stall warning system
- aural warnings
- master caution light recall

Basic Equipment Operating – Captain Instrument Panel

The standby power system utilizes the battery as a source of power to supply the below depicted flight instruments. All of the Captain's instruments that are powered by standby power are integrally lighted on standby power

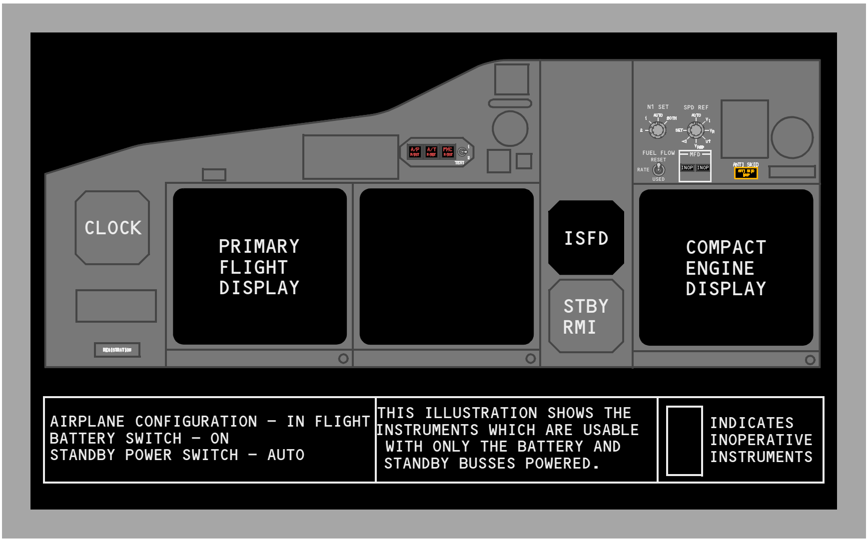
YA701 - YA706



AIRPLANE CONFIGURATION – IN FLIGHT
BATTERY SWITCH – ON
STANDBY POWER SWITCH – AUTO

THIS ILLUSTRATION SHOWS THE INSTRUMENTS WHICH ARE USABLE WITH ONLY THE BATTERY AND STANDBY BUSSES POWERED.

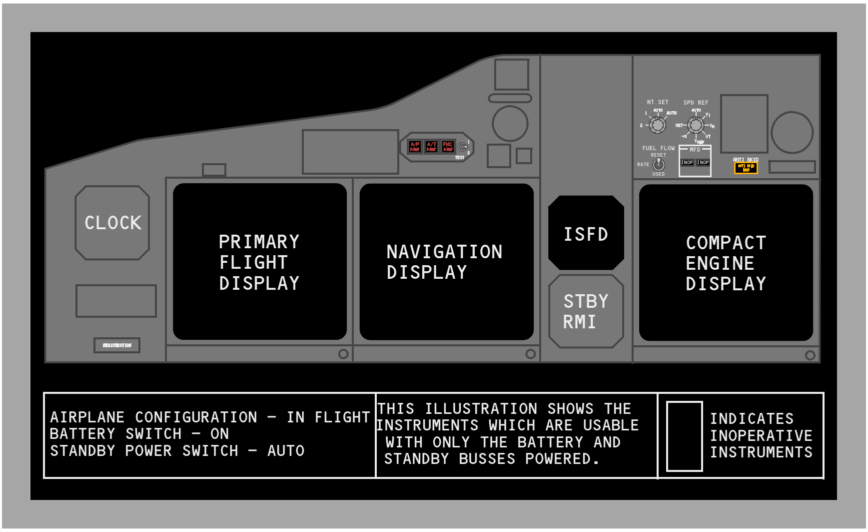
YA707 - YA710



AIRPLANE CONFIGURATION – IN FLIGHT
BATTERY SWITCH – ON
STANDBY POWER SWITCH – AUTO

THIS ILLUSTRATION SHOWS THE INSTRUMENTS WHICH ARE USABLE WITH ONLY THE BATTERY AND STANDBY BUSSES POWERED.

YF048 - YV754

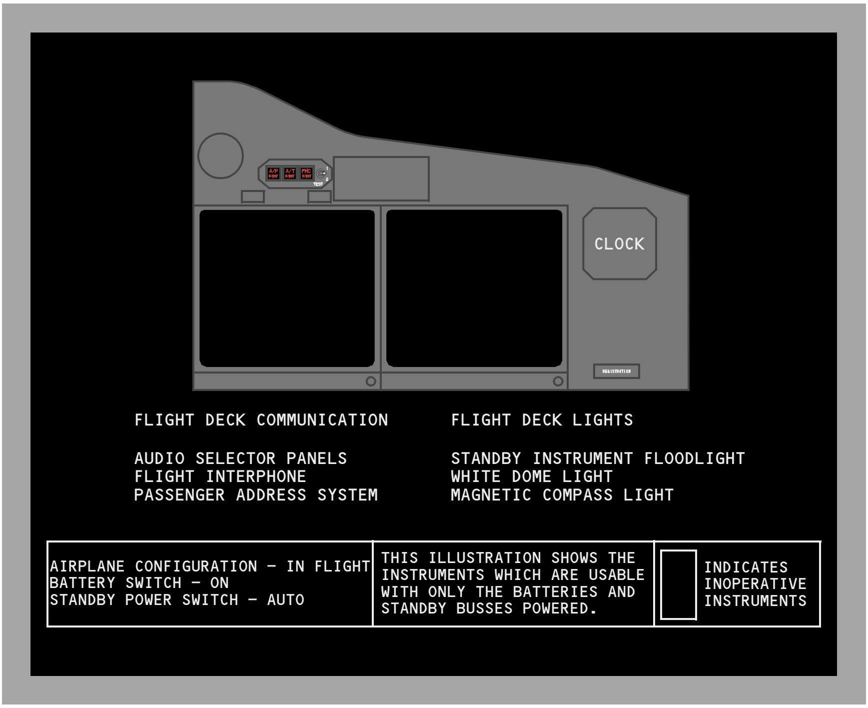


AIRPLANE CONFIGURATION – IN FLIGHT
BATTERY SWITCH – ON
STANDBY POWER SWITCH – AUTO

THIS ILLUSTRATION SHOWS THE INSTRUMENTS WHICH ARE USABLE WITH ONLY THE BATTERY AND STANDBY BUSSES POWERED.

▯ INDICATES INOPERATIVE INSTRUMENTS

Basic Equipment Operating – First Officer Instrument Panel



FLIGHT DECK COMMUNICATION

AUDIO SELECTOR PANELS
FLIGHT INTERPHONE
PASSENGER ADDRESS SYSTEM

FLIGHT DECK LIGHTS

STANDBY INSTRUMENT FLOODLIGHT
WHITE DOME LIGHT
MAGNETIC COMPASS LIGHT

AIRPLANE CONFIGURATION – IN FLIGHT
BATTERY SWITCH – ON
STANDBY POWER SWITCH – AUTO

THIS ILLUSTRATION SHOWS THE INSTRUMENTS WHICH ARE USABLE WITH ONLY THE BATTERIES AND STANDBY BUSSES POWERED.

▯ INDICATES INOPERATIVE INSTRUMENTS

Engines, APU Chapter 7

Table of Contents Section TOC

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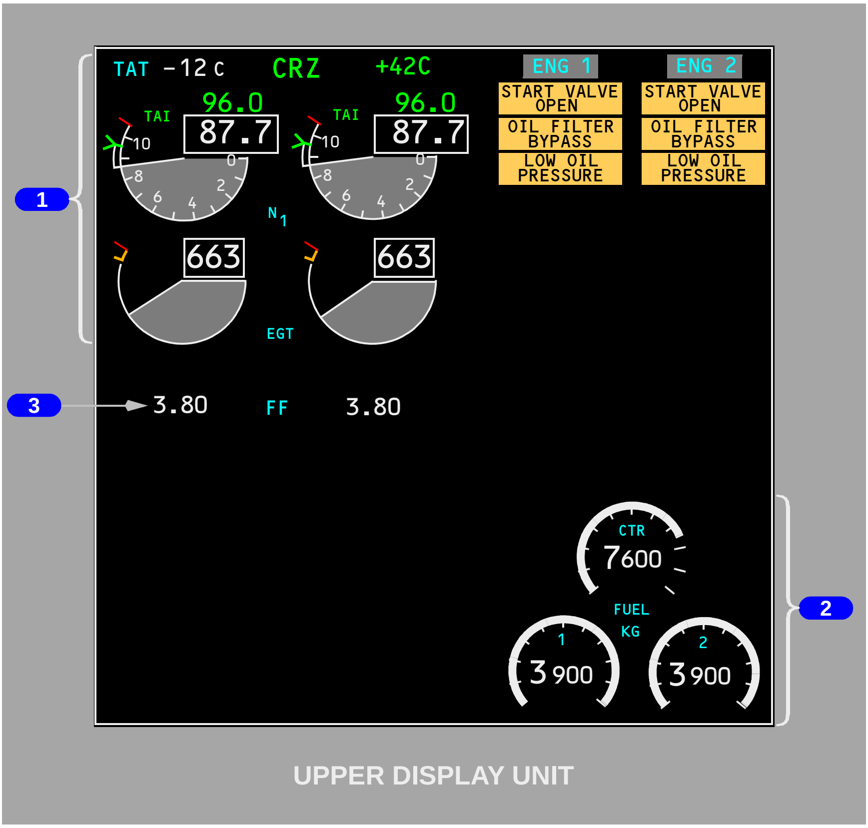
Primary Engine Indications



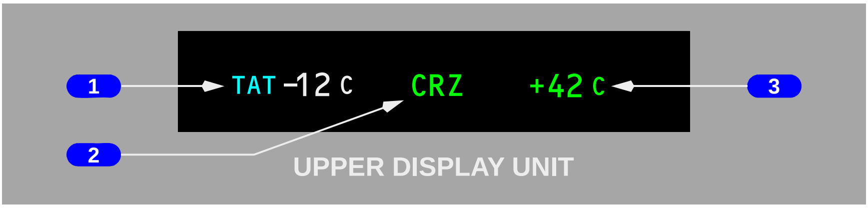
1 **Primary Engine Indications**

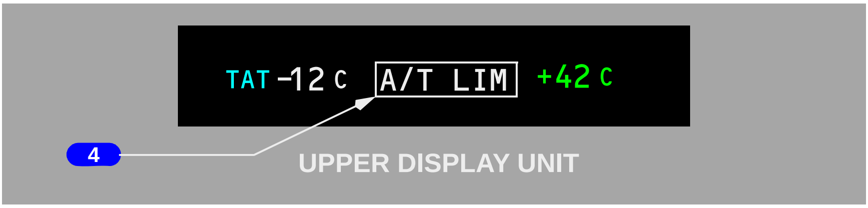
2 **Fuel Quantity Indications**

Refer to Chapter 12, Fuel

3 **Fuel Flow Indications**

Total Air Temperature, Thrust Mode Display, Selected Temperature and Autothrottle Limit





1 Total Air Temperature (TAT) Indication

Displayed (label – cyan, temp – white) – total air temperature (degrees C).

2 Thrust Mode Display

Displayed (green) – the active N1 limit reference mode.

With N1 Set Outer Knob (on engine display control panel) in AUTO, active N1 limit is displayed by reference N1 bugs.

With N1 Set Outer Knob (on engine display control panel) in either 1, 2 or BOTH (other than AUTO), the thrust mode display annunciation is MAN.

Active N1 limit is normally calculated by FMC.

Thrust mode display annunciations are:

- R-TO – reduced takeoff
- R-CLB – reduced climb
- TO – takeoff
- CLB – climb
- CRZ – cruise
- G/A – go–around
- CON – continuous
- – – – – FMC not computing thrust limit.

Note: R-TO does not indicate the type of reduced takeoff. The N1 limit may be reduced due to the entry of an assumed temperature, a takeoff thrust derate or a combination of both assumed temperature and takeoff thrust derate.

3 Selected Temperature

Displayed (green) – selected assumed temperature (degrees C) for reduced thrust takeoff N1.

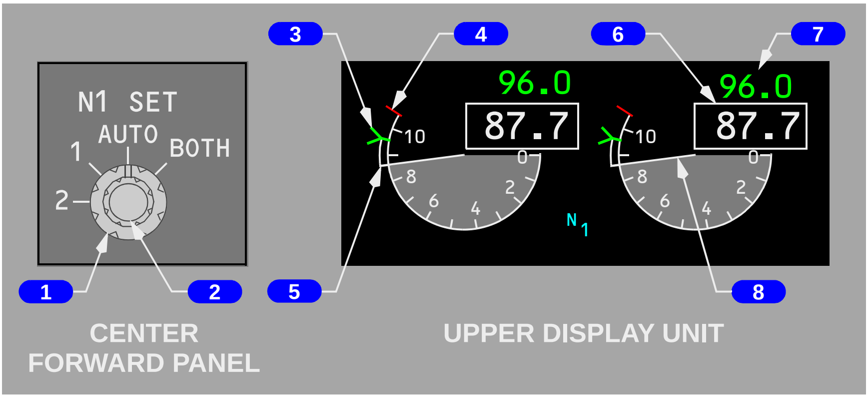
Repeats data selected on TAKEOFF REF page.

4 Autothrottle Limit (A/T LIM) Indication

Illuminated (white) – The FMC is not providing the A/T system with N1 limit values. The A/T is using a degraded N1 thrust limit from the related EEC.

Replaces thrust mode display annunciation when illuminated.

N1 Indications



1 N1 SET Outer Knob

AUTO –

- both reference N1 bugs set by FMC based on N1 limit page and takeoff reference page
- displays reference N1 bugs at active N1 limit for A/T.

BOTH –

- both reference N1 bugs and readouts manually set by turning N1 SET inner knob
- has no effect on A/T operation.

1 or 2 –

- respective N1 reference bug and readout manually set by turning N1 SET inner knob
- has no effect on A/T operation.

2 N1 SET Inner Knob (spring-loaded to center)

Rotate – positions reference N1 bug(s) and readouts when N1 SET outer knob is set to BOTH, 1, or 2.

3 Reference N1 Bugs

Displayed (green) – with N1 SET outer knob in AUTO, 1, 2 or BOTH position.

Position corresponds to digital value on the Reference N1 Readout.

4 N1 Redlines

Displayed (red) – N1% RPM operating limit

5 N1 Command Sectors

Displayed (white) – momentary difference between actual N1 and value commanded by thrust lever position.

6 N1 RPM Readouts (digital)

Displayed (white) – normal operating range.

Displayed (red) –

- operating limit exceeded
- on ground after engine shutdown, red box indicates an inflight exceedance has occurred.

7 Reference N1 Readouts

Displayed (green) –

- manually set N1% RPM when N1 SET outer knob is in BOTH, 1, or 2 position
- – – – – when N1 SET outer knob is in AUTO position and FMC source invalid.
- blank when N1 SET outer knob is in AUTO position

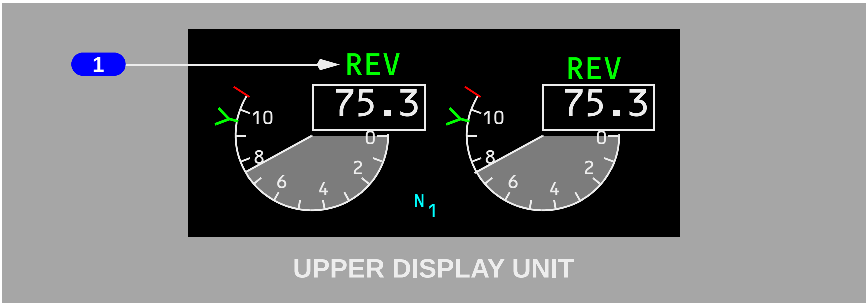
Not Displayed when Reverse Thrust is selected.

8 N1 RPM Indications

Displays N1% RPM:

- displayed (white) – normal operating range
- displayed (red) – operating limit exceeded.

Thrust Reverser Indications

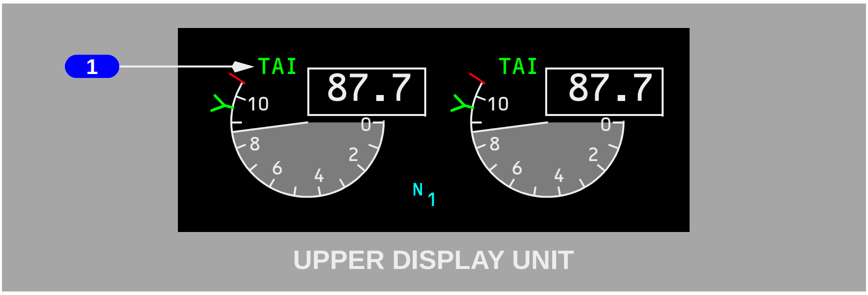


1 Thrust Reverser (REV) Indications

Displayed (amber) – thrust reverser is moved from stowed position.

Displayed (green) – thrust reverser is deployed.

Thermal Anti–Ice Indication

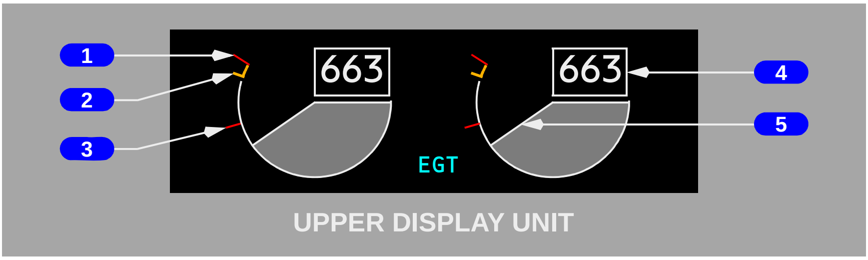


1 Thermal Anti–Ice (TAI) Indications

Displayed (green) – cowl anti–ice valve(s) open.

Displayed (amber) – cowl anti–ice valve is not in position indicated by related engine anti–ice switch.

EGT Indications



1 Exhaust Gas Temperature (EGT) Redlines

Displayed (red) – maximum takeoff EGT limit.

2 Exhaust Gas Temperature (EGT) Amber Bands

Displayed (amber) – lower end of band displays maximum continuous EGT limit.

3 Exhaust Gas Temperature (EGT) Start Limit Lines

Displayed (red) – until the engine achieves stabilized idle (approximately 59% N2).

4 Exhaust Gas Temperature (EGT) Readouts (digital)

Displayed (white) – normal operating range (degrees C)

YA701 - YM484, YS151 - YV754
Displayed (amber) – maximum continuous limit exceeded; color change inhibited for up to 5 minutes during takeoff or go-around

YN531 - YN534
Displayed (amber) – maximum continuous limit exceeded

- Color change inhibited for up to 5 minutes during takeoff or go-around (normal operation)
- color change inhibited for up to 10 minutes during takeoff or go-around (when an engine out condition occurs within the first 5 minutes of the inhibit)

Displayed (red) – maximum takeoff limit or start limit exceeded

On ground, after both engines are shut down, red box indicates an exceedance has occurred

Displayed (white-blinking) EEC senses conditions that may lead to hot start or stall during ground starting. Current versions of EEC software will automatically cut fuel for an impending hot start or stall during ground starting.

5 Exhaust Gas Temperature (EGT) Indications

Displayed (white) – normal operating range.

YA701 - YM484, YS151 - YV754
Displayed (amber) – maximum continuous limit exceeded; color change inhibited for up to 5 minutes during takeoff or go–around

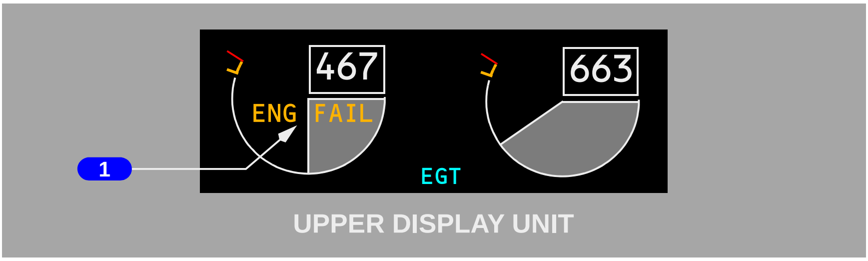
YN531 - YN534

Displayed (amber) – maximum continuous limit exceeded

- color change inhibited for up to 5 minutes during takeoff or go–around (normal operation)
- color change inhibited for up to 10 minutes during takeoff or go–around (when an engine out condition occurs within the first 5 minutes of the inhibit)

Displayed (red) – maximum takeoff limit or start limit exceeded.

Engine Fail Alert



1 Engine Fail (ENG FAIL) Alert

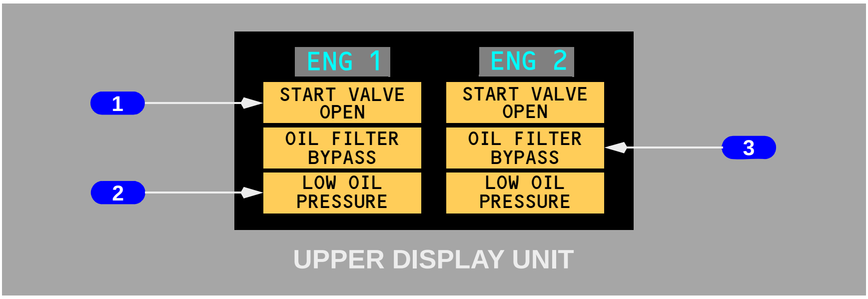
Displayed (amber) –

- engine operating below sustainable idle (less than 50% N2); and
- engine start lever in IDLE position.

Alert remains until –

- engine recovers; or
- start lever moved to CUTOFF; or
- engine fire switch pulled.

Crew Alerts



1 START VALVE OPEN Alert

Illuminated (amber) –

- steady – respective engine start valve open and air is supplied to starter
- blinking – uncommanded opening of start valve. Alert is displayed and solid amber boxes are displayed in unannunciated positions for that engine. All three boxes blink for ten seconds, then alert remains on steady and solid amber boxes are removed (see Note).

2 LOW OIL PRESSURE Alert

Illuminated (amber) –

- steady – oil pressure at or below red line
- blinking – with a condition of low oil pressure. Alert is displayed and solid amber boxes are displayed in unannunciated positions for that engine. All three boxes blink for ten seconds, then alert remains on steady and solid amber boxes are removed (see Note).

3 OIL FILTER BYPASS Alert

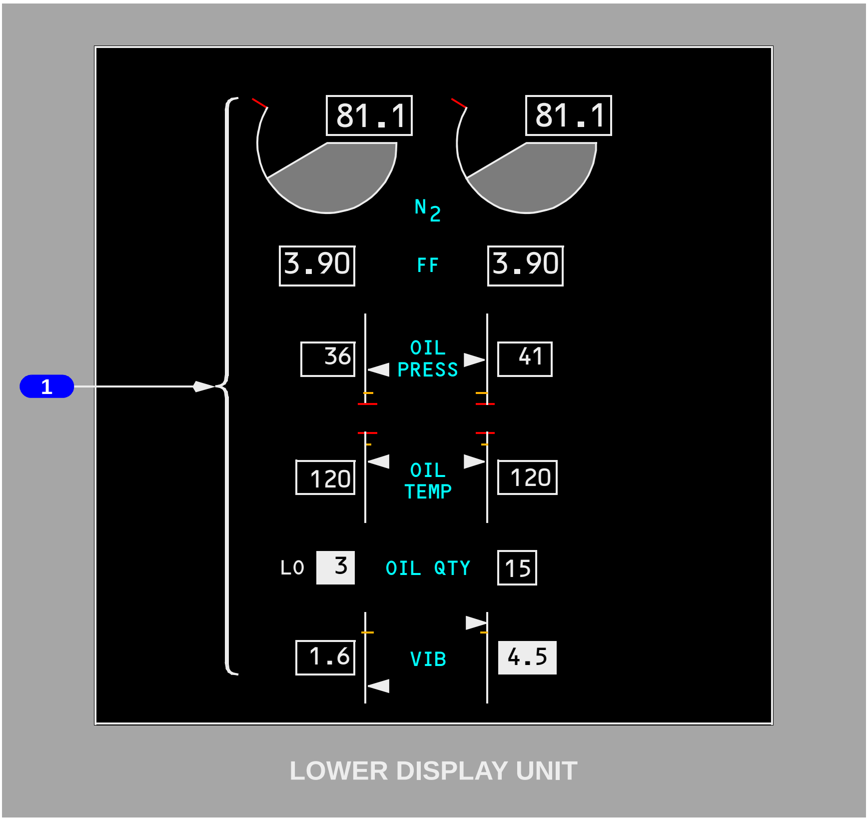
Illuminated (amber) –

- steady – indicates an impending bypass of scavenge oil filter
- blinking – with an impending bypass. Alert is displayed and solid amber boxes are displayed in unannunciated positions for that engine. All three boxes blink for ten seconds, then alert remains on steady and solid amber boxes are removed (see Note).

Note: Blinking is inhibited:

- during takeoff from 80 knots to 400 feet RA, or 30 seconds after reaching 80 knots, whichever occurs first
- during landing below 200 feet RA until 30 seconds after touchdown
- during periods when blinking is inhibited, alerts illuminate steady.

Secondary Engine Indications

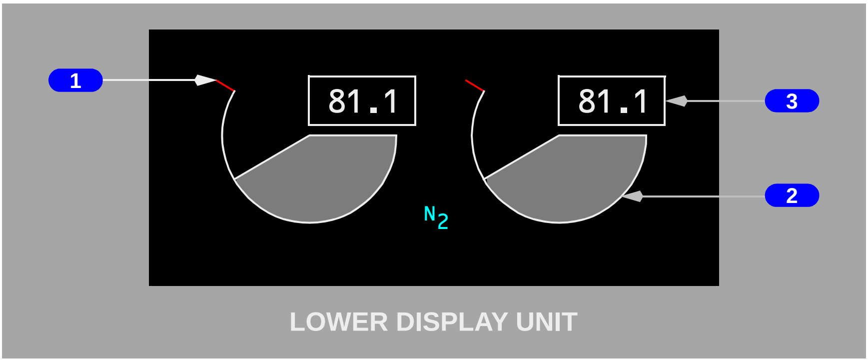


1 Secondary Engine Indications

Secondary engine indications are displayed:

- when CDS initially receives power
- when selected by the Multi-Function Display (MFD)
- in flight when an engine start lever moved to CUTOFF
- in flight when an engine fails
- when a secondary engine parameter exceeds normal operating range.

N2 Indications



1 N2 Redlines

Displayed (red) – N2% RPM operating limit.

2 N2 RPM Indications

Displays N2% RPM

- displayed (white) – normal operating range
- displayed (red) – operating limit exceeded.

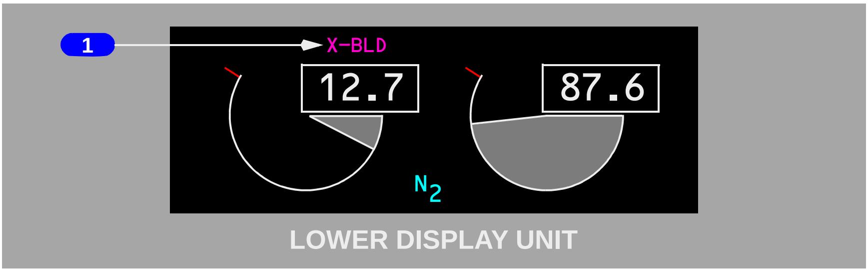
3 N2 Readouts (digital)

Displayed (white) – normal operating range.

Displayed (red) –

- operating limit exceeded
- on ground, after engine shutdown, red box indicates an inflight exceedance has occurred.

Crossbleed Start Indication

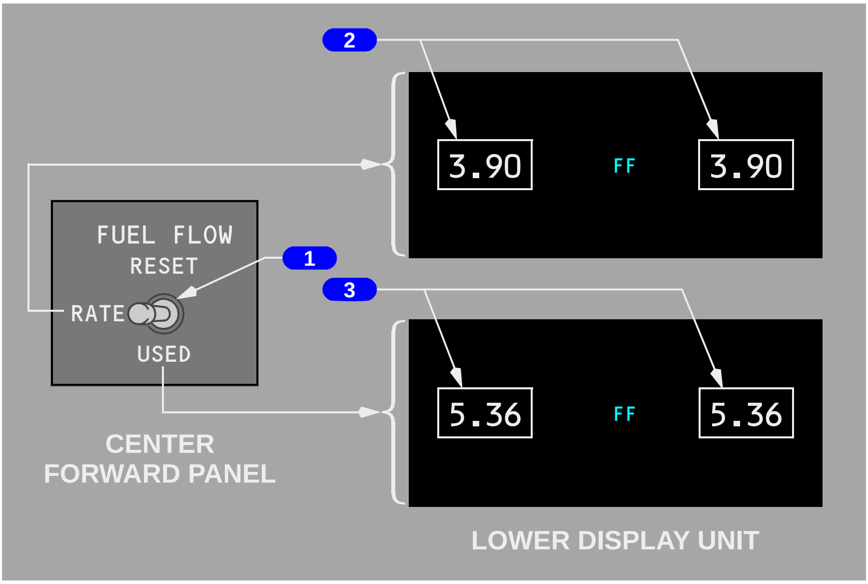


1 Crossbleed Start (X–BLD) Indication

Displayed (magenta) – crossbleed air recommended for inflight start.

Displayed when airspeed is less than required for a windmilling start.

Fuel Flow/Fuel Used Indications



1 FUEL FLOW Switch (spring-loaded to RATE)

RATE – displays fuel flow to engine.

USED –

- displays fuel used since last reset
- after 10 seconds, display automatically reverts to fuel flow.

RESET –

- resets fuel used to zero
- displays fuel used for 1 second, decreases to zero, then displays fuel flow.

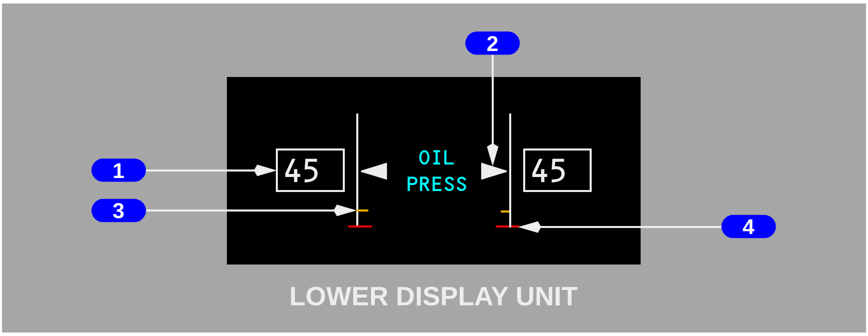
2 Fuel Flow (FF) Readout (digital)

Displayed (white) – fuel flow to engine with FUEL FLOW switch in RATE position (kilograms per hour x 1000).

3 Fuel Used Readout (digital)

Displayed (white) – when FUEL FLOW switch moved to USED or RESET.

Oil Pressure Indications



1 Oil Pressure (OIL PRESS) Readout

Displays engine oil pressure (psi)

- displayed (white) – normal operating range
- displayed (amber) – caution range
- displayed (red) – operating limit reached.

2 Oil Pressure (OIL PRESS) Pointer

Displays engine oil pressure:

- displayed (white) – normal operating range
- displayed (amber) – caution range reached
- displayed (red) – operating limit reached.

3 Low Oil Pressure (OIL PRESS) Amber Band

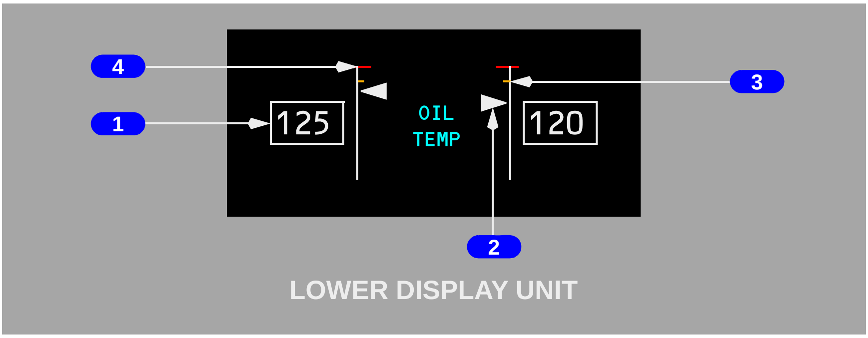
Displayed (amber) – low oil pressure caution range beginning at red line.:

- variable depending on N2% RPM above 65% N2
- amber band not displayed below 65% N2.

4 Low Oil Pressure (OIL PRESS) Redline

Displayed (red) – oil pressure operating limit.

Oil Temperature Indications



1 Oil Temperature (OIL TEMP) Readout

Displays oil temperature (degrees C):

- displayed (white) – normal operating range
- displayed (amber) – caution range reached
- displayed (red) – operating limit reached.

2 Oil Temperature (OIL TEMP) Pointer

Displays oil temperature (degrees C):

- displayed (white) – normal operating range
- displayed (amber) – caution range reached
- displayed (red) – operating limit reached.

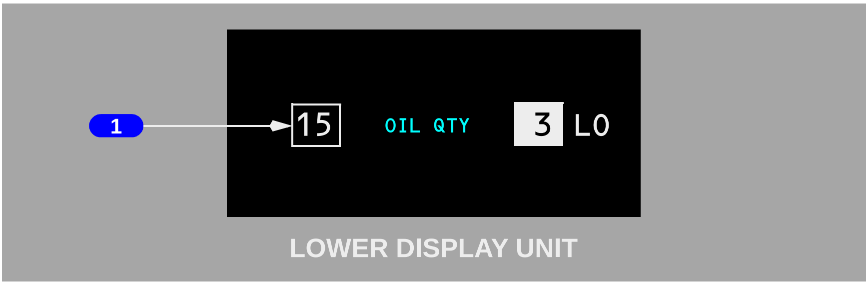
3 High Oil Temperature (OIL TEMP) Amber Band

Displayed (amber) – oil temperature caution range.

4 High Oil Temperature (OIL TEMP) Redline

Displayed (red) – oil temperature operating limit.

Oil Quantity Indications



1 Oil Quantity (OIL QTY) Readout

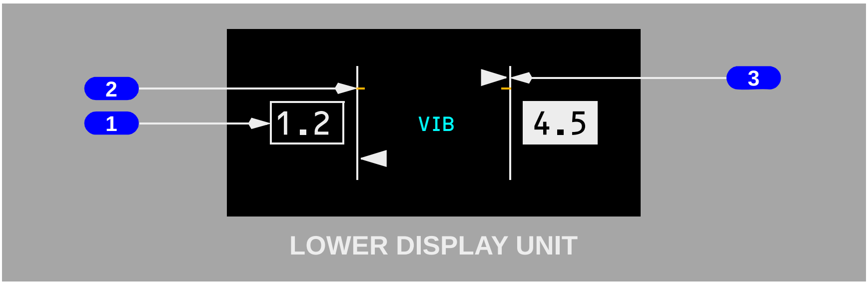
Displays usable oil quantity in quarts.

Video is reversed and LO (white) displayed for low oil quantity.

Note: Indicated oil quantity may decrease significantly during engine start, takeoff and climb out. If this occurs, engine operation is not impacted and the correct oil quantity should be indicated during level flight.

Note: An oil quantity indication as low as zero is normal if windmilling N2 RPM is below approximately 8%.

Engine Vibration Indications



1 Vibration (VIB) Readout

Displayed (white) – engine vibration level.

Video is reversed for high vibration.

2 High Limit

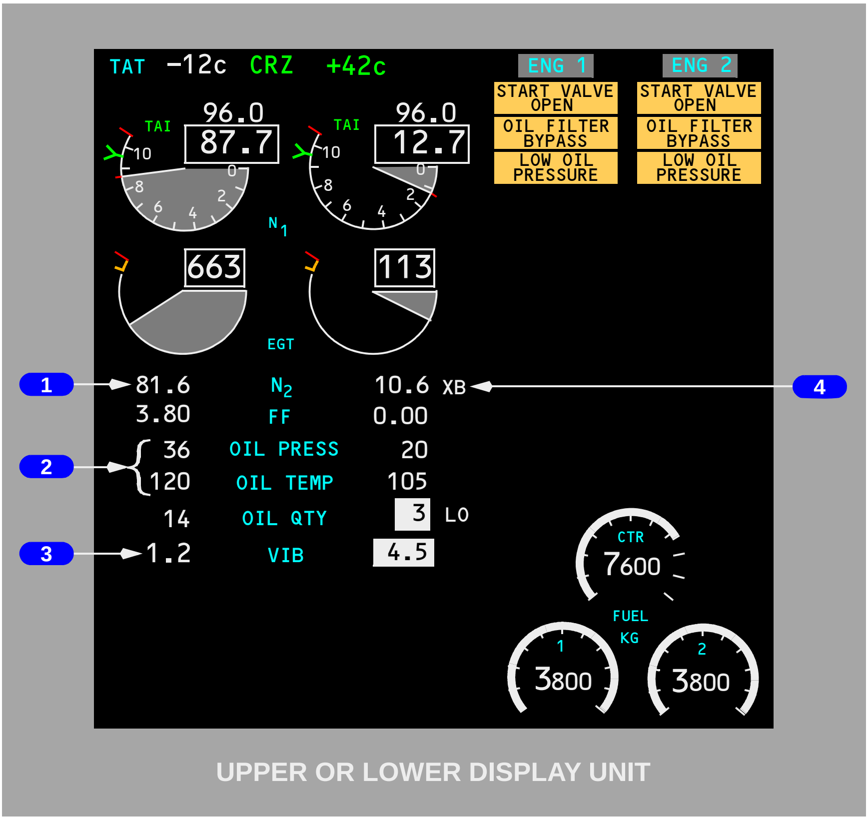
Displays tick mark and thick line.

3 Vibration (VIB) Pointer

Displayed (white) – engine vibration level.

Compact Engine Displays

The following changes occur to the secondary engine display in the compact engine displays.



1 N2 RPM Indications

N2 changes from round dial display to a digital display.

The digital display is framed by a red box after engine shutdown on the ground if an inflight exceedance occurred.

2 OIL PRESS, OIL TEMP Indications

Displayed as digital readouts only

The digital readouts display amber or red if limits are exceeded.

3 Vibration (VIB) Indications

Displayed as digital readout only.

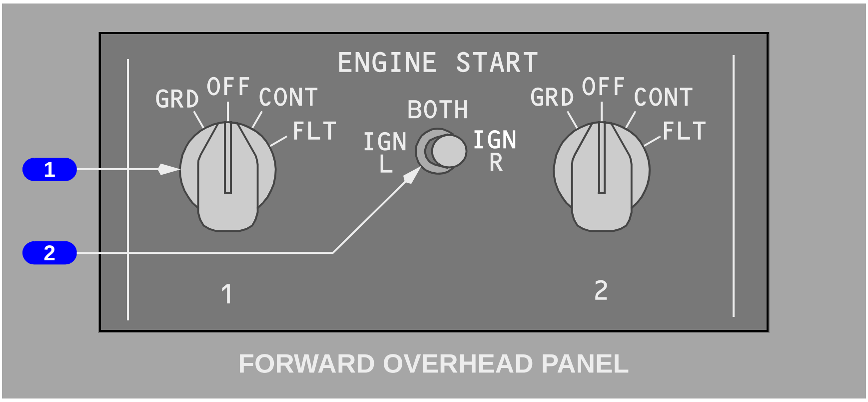
4 Crossbleed Start (XB) Indications

Displayed on the side of N2

Engines, APU — Chapter 7

General Controls and Indicators — Section 15

Engine Start Switches



1 ENGINE START Switches

GRD –

- opens start valve
- closes engine bleed valve
- for ground starts, arms selected igniter(s) to provide ignition when engine start lever is moved to IDLE
- for inflight starts, arms both igniters to provide ignition when engine start lever is moved to IDLE
- releases to OFF at start valve cutout.

OFF –

- ignition normally off
- both igniters are activated when engine start lever is in IDLE and:
  - an uncommanded rapid decrease in N2 occurs or,
  - N2 is between 57% and 50% or,
  - in flight - N2 is between idle and 5%.

CONT –

- provides ignition to selected igniters when engine is operating and engine start lever is in IDLE
- in flight - provides ignition to both igniters when N2 is below idle and engine start lever is in IDLE.

FLT – provides ignition to both igniters when engine start lever is in IDLE.

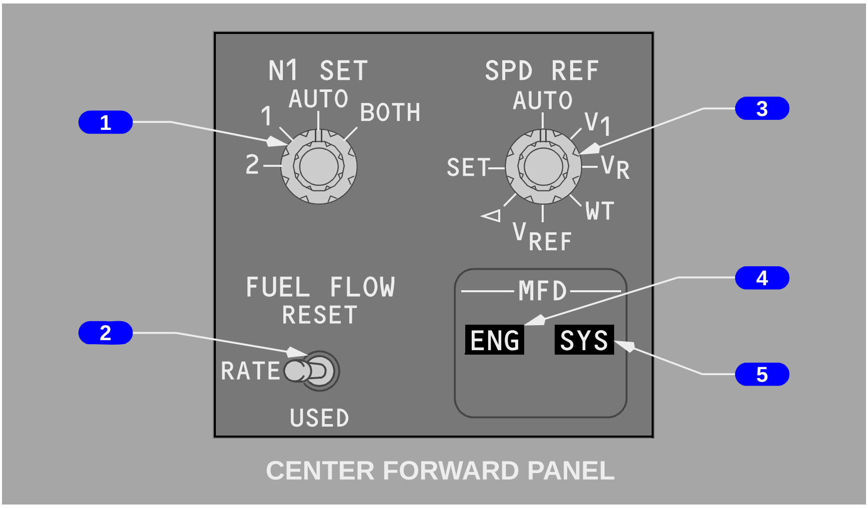
2 Ignition Select Switch

IGN L – selects the left igniter for use on both engines.

BOTH – selects both igniters for use on both engines.

IGN R – selects the right igniter for use on both engines.

Engine Display Control Panel



1 N1 SET Knob

Refer to section 11, Over/Under - Displays

2 FUEL FLOW Switch

Refer to section 11, Over/Under - Displays

3 Speed Reference Selector

Refer to Chapter 10, Flight Instruments, Displays.

4 MFD Engine (ENG) Switch

Push – ENG

- displays secondary engine indications on lower DU; or if the lower DU is unavailable, on upper or inboard DU based on the position of the display select panel selector
- second push blanks lower DU.

5 MFD System (SYS) Switch

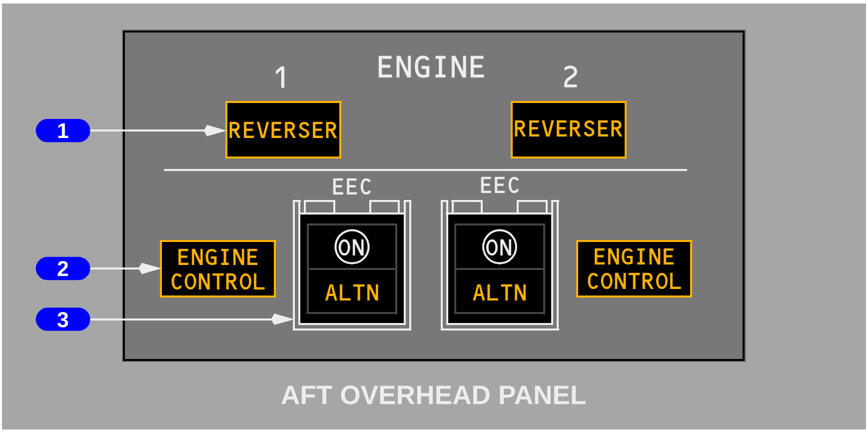
Refer to:

- Chapter 13, Hydraulics

YN531 - YN534

- Chapter 14, Landing Gear

Engine Panel



1 REVERSER Lights

Illuminated (amber) – one or more of following has occurred:

- isolation valve or thrust reverser control valve is not in commanded position
- one or more thrust reverser sleeves are not in commanded state
- auto–restow circuit has been activated
- a failure has been detected in synchronization shaft lock circuitry.

2 ENGINE CONTROL Lights

Illuminated (amber) – engine control system is not dispatchable due to faults in system.

Light operates when:

- engine is operating and,
- airplane on ground and:
  - below 80 kt prior to takeoff or,
  - approximately 30 seconds after touchdown.

3 Electronic Engine Control (EEC) Switches

ON – in view (white)

- indicates normal control mode is selected
- engine ratings calculated by EEC from sensed atmospheric conditions and bleed air demand
- when ON is not in view, the EEC has been manually selected to the alternate mode.

ALTN – in view (amber)

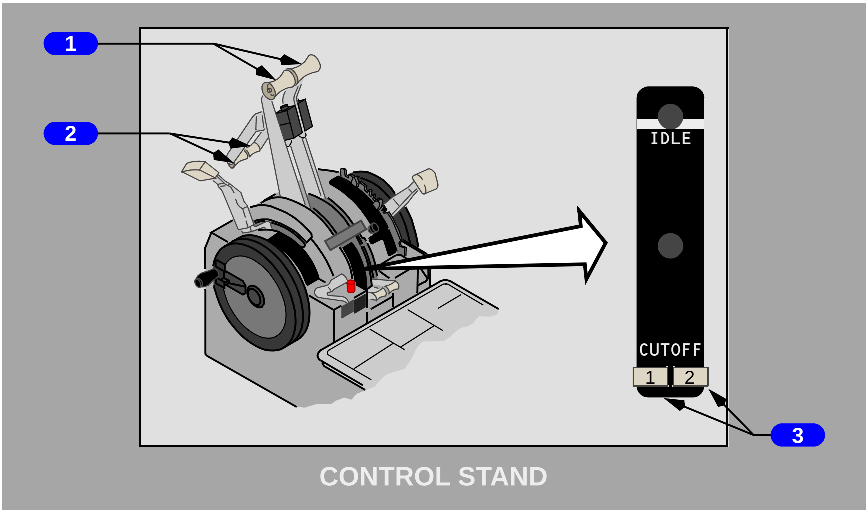
- indicated EEC has automatically switched to alternate control mode or it has been selected manually
- EEC provides rated thrust or higher.

Note: Both ON and ALTN may be in view if EEC has automatically switched to soft alternate mode.

Note: EGT limits must be observed in both normal and alternate control modes.

Engine Controls

YA701 - YT511



1 Forward Thrust Levers

- controls engine thrust
- cannot be advanced if the reverse thrust lever is in the deployed position.

2 Reverse Thrust Levers

- controls engine reverse thrust
- cannot select reverse thrust unless related forward thrust lever is at IDLE.

Note: Reverse thrust lever is blocked at reverse idle position until related thrust reverser is more than 60% deployed.

Note: Movement of reverse thrust lever into reverse thrust engages locking pawl preventing forward thrust lever from moving. Terminating reverse thrust removes locking pawl and restores forward thrust lever movement ability.

3 Engine Start Levers

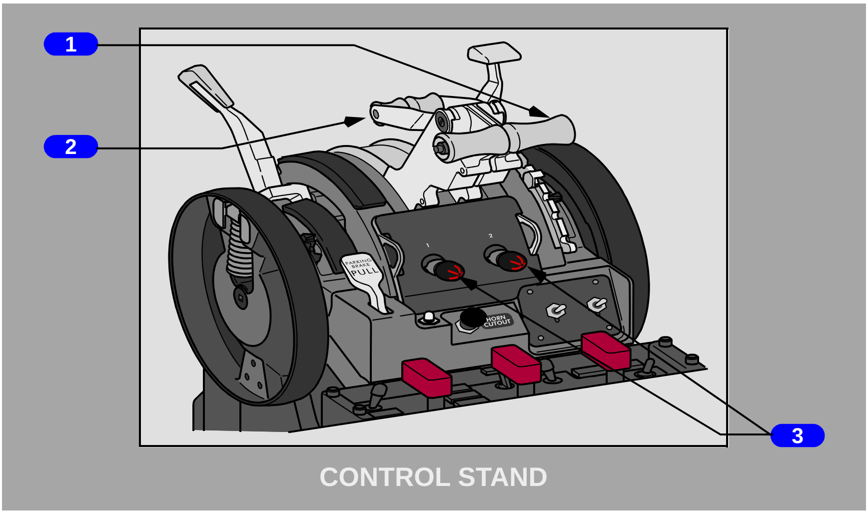
IDLE –

- energizes ignition system through EEC
- electrically opens spar fuel shutoff valve in the wing leading edge outboard of the pylon
- electrically opens engine–mounted fuel shutoff valve via the EEC.

CUTOFF –

- closes both spar and engine fuel shutoff valves
- de–energizes ignition system.

YT512 - YV754



CONTROL STAND

1 Forward Thrust Levers

- controls engine thrust
- cannot be advanced if the reverse thrust lever is in the deployed position.

2 Reverse Thrust Levers

- controls engine reverse thrust
- cannot select reverse thrust unless related forward thrust lever is at IDLE.

Note: Reverse thrust lever is blocked at reverse idle position until related thrust reverser is more than 60% deployed.

Note: Movement of reverse thrust lever into reverse thrust engages locking pawl preventing forward thrust lever from moving. Terminating reverse thrust removes locking pawl and restores forward thrust lever movement ability.

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CUTOFF –

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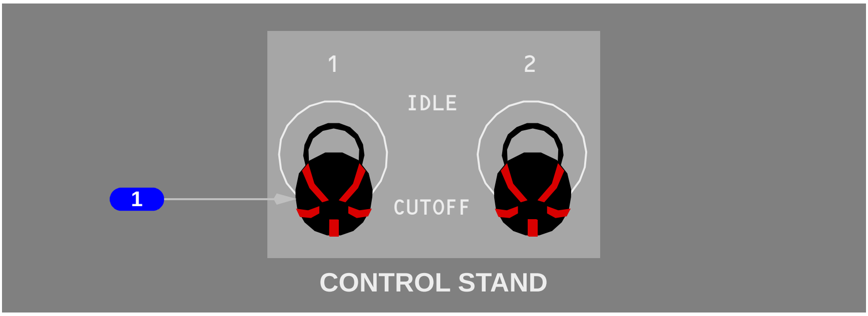
- de–energizes ignition system.

Engine Start Levers

YT512 - YV754



1 Engine Start Levers

IDLE –

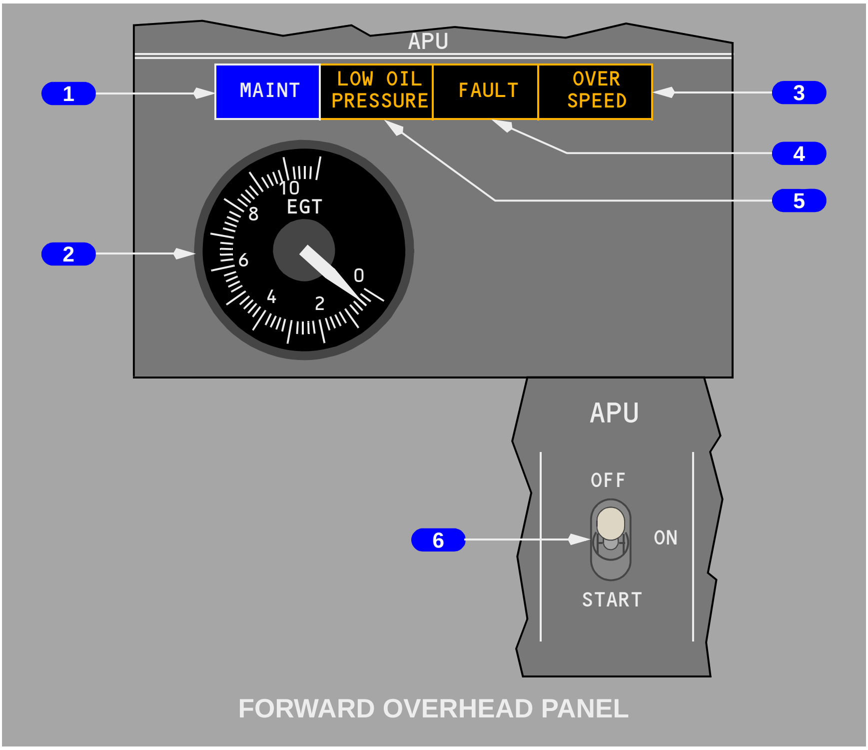
- energizes ignition system through EEC
- electrically opens spar fuel shutoff valve in the wing leading edge outboard of the pylon
- electrically opens engine–mounted fuel shutoff valve via the EEC.

CUTOFF –

- closes both spar and engine fuel shutoff valves
- de–energizes ignition system.

Note: Illuminate (red) in the event of engine fire or during an engine fire test.

APU



1 APU Maintenance (MAINT) Light

Illuminated (blue) – APU maintenance problem exists:

- APU may be operated
- light is disarmed when APU switch is in OFF.

2 APU Exhaust Gas Temperature (EGT) Indicator

Displays APU EGT

EGT indicator remains powered for 5 minutes after shutdown.

3 APU OVERSPEED Light

Illuminated (amber) –

- APU RPM limit has been exceeded resulting in an automatic shutdown
- overspeed shutdown protection feature has failed a self–test during a normal APU shutdown
- if light is illuminated when APU switch is placed to OFF, light extinguishes after 5 minutes
- light is disarmed when the APU switch is in OFF position.

4 APU FAULT Light

Illuminated (amber) –

- a malfunction exists causing APU to initiate an automatic shutdown
- if light is illuminated when APU switch is placed to OFF, light extinguishes after 5 minutes
- light is disarmed when APU switch is in OFF position.

5 APU LOW OIL PRESSURE Light

Illuminated (amber) –

- during start until the APU oil pressure is normal
- oil pressure is low causing an automatic shutdown (after start cycle is complete)
- if light is illuminated when APU switch is placed to OFF, light extinguishes after 5 minutes
- light is disarmed when APU switch is in OFF position.

6 APU Switch

OFF – normal position when APU is not running

- positioning switch to OFF with APU running trips APU generator off the bus(es), if connected, and closes APU bleed air valve. APU continues to run for a 60 second cooling period
- APU air inlet door automatically closes after shutdown.

ON – normal position when APU is running.

START (momentary) – positioning APU switch from OFF to START and releasing it to ON, initiates an automatic start sequence.

Engines, APU Chapter 7

Engine System Description Section 20

Introduction

The airplane is powered by two CFM56–7 engines. The engine is a dual–rotor, axial–flow turbofan. The N1 rotor consists of a fan, a low–pressure compressor and a low–pressure turbine. The N2 rotor consists of a high–pressure compressor and a high–pressure turbine. The N1 and N2 rotors are mechanically independent. The N2 rotor drives the engine gearboxes. A bleed–air–powered starter motor is connected to the N2 rotor.

A dual–channel electronic engine control (EEC) regulates each engine. The EEC monitors autothrottle and flight crew inputs to automatically set engine thrust.

Each engine has individual flight deck controls. Thrust is set by positioning the thrust levers. The thrust levers are positioned automatically by the autothrottle system or manually by the flight crew. The forward thrust levers control forward thrust from idle to maximum. If the EECs are in the alternate mode, advancing the thrust levers full forward provides some overboost and should be considered only during emergency situations when all other available actions have been taken and terrain contact is imminent. The reverse thrust levers control thrust from reverse idle to maximum reverse

Engine Indications

Primary and secondary engine indications are provided. Engine indications are displayed on the center forward panel upper display unit (DU), lower DU or the Captain’s or First Officer’s inboard DU.

Primary Engine Indications

N1 and EGT are the primary engine indications. The primary engine indications are normally displayed on the center forward panel upper DU. If that unit fails, the display automatically moves to the lower DU. The primary engine indications can also be manually selected to either the Captain’s or First Officer’s inboard DU, or the lower DU, using the respective display select panel.

Secondary Engine Indications

N2, fuel flow, oil pressure, oil temperature, oil quantity, and engine vibration are the secondary engine indications. The secondary engine indications, except for fuel flow, are manually selected to either the Captain’s or First Officer’s inboard DU, or the lower DU, using the respective display select panel and the ENG switch on the engine display control panel. Fuel flow is displayed full time on the upper display unit below the primary engine indications.

The secondary engine indications are automatically displayed when:

- the displays initially receive electrical power
- in flight when an engine start lever is moved to CUTOFF
- in flight when an engine N2 RPM is below idle
- a secondary engine parameter is exceeded.

When the secondary engine indications are automatically displayed, they cannot be cleared until the condition is no longer present.

Normal Display Format

N1, EGT, and N2 are displayed as both digital readouts and round dial/moving pointer indications. The digital readouts display numerical values while the moving pointers indicate relative value.

Oil pressure, oil temperature, and engine vibration indications are both digital readouts and vertical indication/moving pointers. Fuel flow and oil quantity are digital readouts only. All digital readouts are enclosed by boxes.

The dials and vertical indications display the normal operating range, caution range, and operating limits.

Normal operating range is displayed on a dial or vertical indication in white.

N1, EGT, and N2 have operating limits indicated by redlines. EGT also displays an amber caution limit. If one of these indications exceeds the red or amber line, the digital readout, box, pointer, and indicator change color to red or amber.

The oil temperature and oil pressure vertical indications have a caution range and an operating limit redline. If the oil temperature or pressure reaches the caution range, the digital readout, digital readout box, and pointer all change color to amber. If one of these indications reach the operating limit, the digital readout, digital readout box, and pointer all change color to red.

The EEC must receive electrical power to supply engine operating data to the flight deck engine indications. When the EEC is not powered, N1, N2, oil quantity and engine vibration are displayed directly from the engine sensors. Positioning the engine start switch to GRD supplies electrical power to the EEC and displays pointers/digits for all engine parameters.

During battery start with no power on the airplane, only N1, N2, and oil quantity are available. The EEC is not powered until the engine accelerates to a speed greater than 15% N2. At 15% N2, the EEC becomes energized and pointers/digits for all engine parameters are displayed.

An engine failure alert indication (ENG FAIL) is displayed in amber on the EGT indicator when the respective engine is operating at a condition below sustainable idle (50% N2) and the engine start lever is in the IDLE position. The alert remains until the engine recovers, the engine start lever is moved to CUTOFF, or the engine fire switch is pulled.

Compact Display

In compact format, the primary and secondary engine indications are combined on the same display. The N1 and EGT indications are displayed as they are normally. All other indications change to digital readouts only. N2, oil temperature, and oil pressure digital readouts turn red or amber if an exceedance occurs. The N2 digital display is framed with a red box after engine shutdown on the ground if an inflight exceedance occurred.

Primary and secondary engine indications are displayed in compact format on the upper DU when the secondary engine indications are selected for display (manually or automatically) and the lower DU is unavailable. Alternatively, the compacted indications are displayed on the lower DU if the upper DU is unavailable.

Electronic Engine Control (EEC)

Each engine has a full authority digital EEC. Each EEC has two independent control channels, with automatic channel transfer if the operating channel fails. With each engine start or start attempt, the EEC alternates between control channels. The EEC uses thrust lever inputs to automatically control forward and reverse thrust. N1 is used by the EEC to set thrust in two control modes: normal and alternate. Manual selection of the control mode can be made with the EEC switches on engine panel.

EEC Normal Mode

In the normal mode, the EEC uses sensed flight conditions and bleed air demand to calculate N1 thrust ratings. The EEC compares commanded N1 to actual N1 and adjusts fuel flow to achieve the commanded N1.

The full rated takeoff thrust for the installed engine is available at a thrust lever position less than the forward stop. Fixed or assumed temperature derated takeoff thrust ratings are set at thrust lever positions less than full rated takeoff. The maximum rated thrust is available at the forward stop. The EEC limits the maximum thrust according to the airplane model as follows:

Note: Typical engine ratings based on model/series airplane. For actual engine ratings refer to Performance Dispatch chapter.

- 737-700 – CFM56-7B24 rating
- 737-800 – CFM56-7B27 rating

Takeoff Bump Thrust

YN531 - YN534

Takeoff bump thrust is available when increased thrust is needed for takeoff, above the normal maximum takeoff thrust setting. When selected using the FMC N1 LIMIT page, takeoff thrust is increased by either the flight crew or the autothrottle positioning the thrust levers to set N1 to the reference N1 bug. Bump thrust applies only to the takeoff rating; maximum climb, maximum continuous and go-around thrust ratings are not affected.

Airplanes equipped with a takeoff thrust bump have a reserve thrust capability which is greater than the standard values listed under the EEC Normal Mode listed above. Use of this reserve thrust capability is intended for emergency use only in the event of wind shear or impending ground contact.

FMC selection of takeoff bump thrust can be configured as either “Bump Option” or a “Full-Rate Option.” When configured as a FMC “Bump Option”, the default takeoff rating is lower than takeoff bump, and the takeoff bump must be activated via the FMC-CDU. With this “Bump Option” configuration, assumed temperature engine derates are not available from the bump. When configured as a FMC “Full-Rate Option”, the default takeoff rating is the takeoff bump. With this full-rate option, the assumed temperature engine derate method may always be used. With this “Full-Rate Option” configuration, the ability to select the lowest normally offered takeoff fixed derate is lost.

EEC Alternate Mode

The EEC can operate in either of two alternate modes, soft or hard. If required signals are not available to operate in the normal mode, the EEC automatically changes to the soft alternate mode. When this occurs, the ALTN switch illuminates and the ON indication remains visible. In the soft alternate mode, the EEC uses the last valid flight conditions to define engine parameters which allows the mode change to occur with no immediate change in engine thrust. Thrust rating shortfalls or exceedances may occur as flight conditions change. The soft alternate mode remains until the hard alternate mode is entered by either retarding the thrust lever to idle or manually selecting ALTN with the EEC switch on the aft overhead panel.

Note: Loss of either DEU results in a loss of signal to both EECs. The EEC ALTN lights illuminate and each EEC reverts to the alternate mode to prevent the engines from operating on a single source of data.

When the hard alternate mode is entered, the EEC reverts to the alternate mode thrust schedule. Hard alternate mode thrust is always equal to or greater than normal mode thrust for the same lever position. If the hard alternate mode is entered by reducing the thrust lever to idle while in the soft alternate mode, the ALTN switch remains illuminated and the ON indication remains visible. When ALTN is selected manually, the ON indication is blanked.

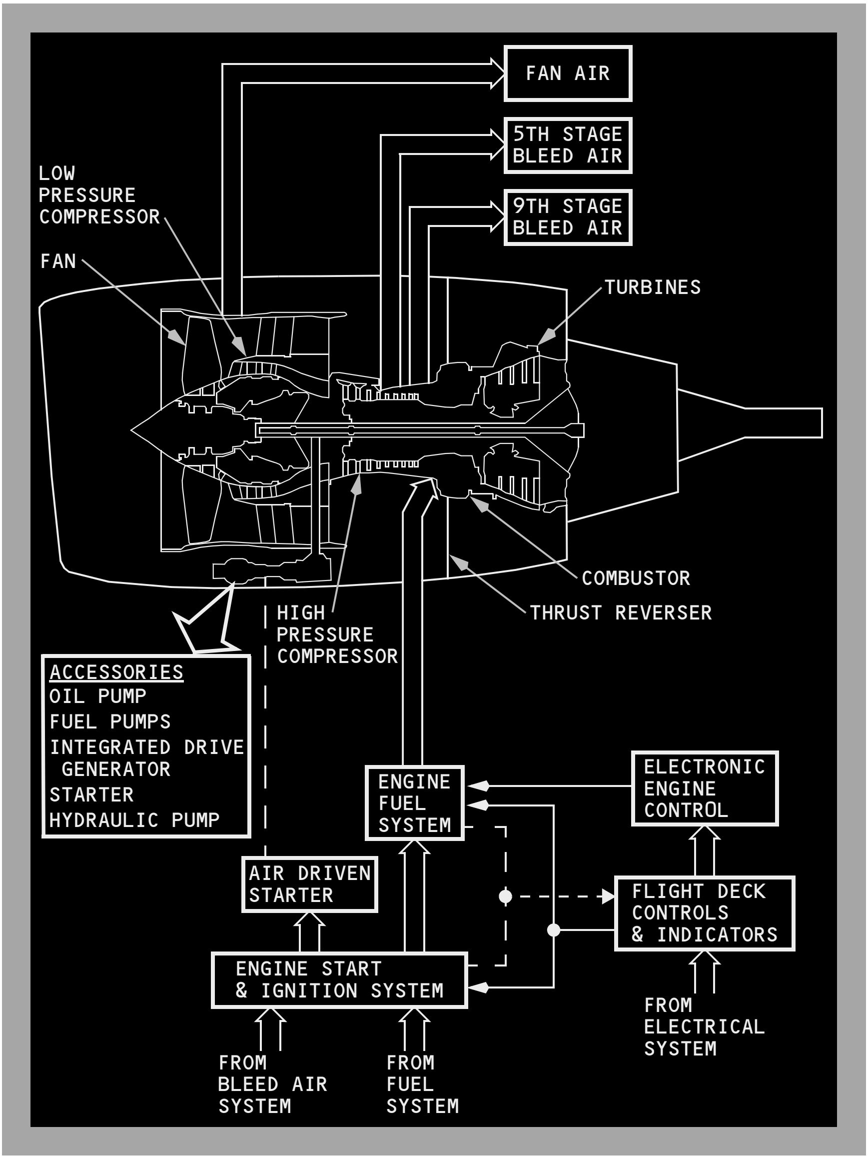
Structural Limit Protection

The EEC provides N1 and N2 redline overspeed protection in both normal and alternate modes. The EGT limit must be observed by the crew because the EEC does not provide EGT redline exceedance protection.

Idle Operation

The EEC automatically selects ground minimum idle, flight minimum idle, and approach idle. Ground minimum idle is selected for ground operations and flight minimum idle is selected for most phases of flight. Approach idle is selected in flight if flaps are in landing configuration or engine anti–ice is ON for either engine. At the same airspeed and altitude, N1 and N2% RPM will be higher for approach idle than for flight minimum idle. This higher% RPM improves engine acceleration time in the event of a go–around. Approach idle is maintained until after touchdown, when ground minimum idle is selected. In flight, if a fault prevents the EEC from receiving flap or anti–ice signals, approach idle schedule begins below 15,000 feet MSL.

Power Plant Schematic



Engine Fuel System

Fuel is delivered under pressure from fuel pumps located in the fuel tanks. The fuel flows through a fuel spar shutoff valve located at the engine mounting wing stations. The fuel passes through the first stage engine fuel pump where pressure is increased. It then passes through two fuel/oil heat exchangers where IDG oil and main engine oil heat the fuel. A fuel filter then removes contaminants. Fuel automatically bypasses the filter if the filter becomes saturated. Before the fuel bypass occurs, the fuel FILTER BYPASS alert illuminates on the fuel control panel. The second stage engine fuel pump adds more pressure before the fuel reaches the hydro mechanical unit (HMU). To meet thrust requirements, the EEC meters fuel through the HMU.

The spar fuel shutoff valve and engine fuel shutoff valve allow fuel flow to the engine when both valves are open. The valves are open when the engine fire switch is in and the start lever is in IDLE. Both valves close when either the start lever is in CUTOFF or the engine fire switch is out. SPAR VALVE CLOSED and ENG VALVE CLOSED lights located on the overhead panel indicate valve position.

Fuel flow is measured after passing through the engine fuel shutoff valve and is displayed on the display unit. Fuel flow information is also provided to the FMS.

Engine Oil System

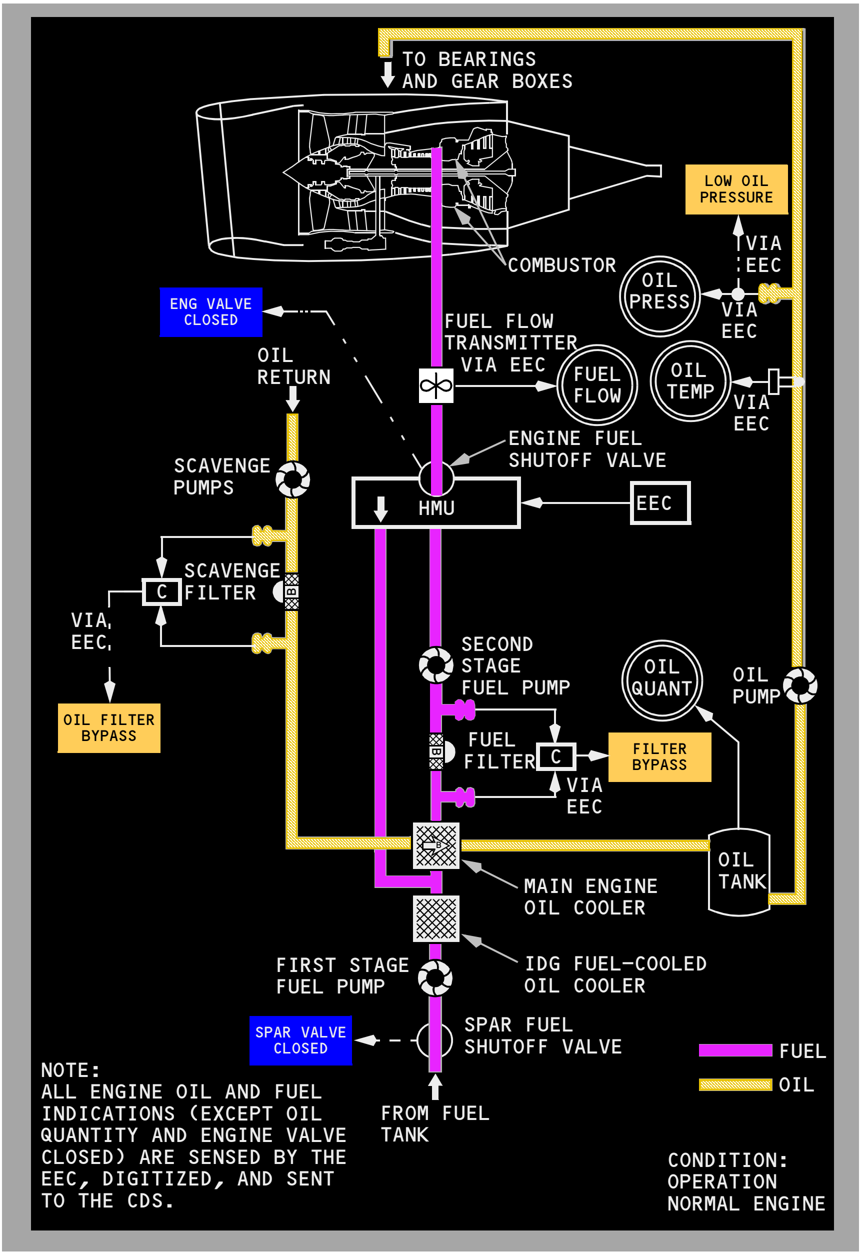
Oil from the individual engine tank is circulated under pressure, through the engine to lubricate the engine bearings and accessory gearbox. The oil quantity indicator, oil temperature indicator, oil pressure indicator and LOW OIL PRESSURE alert are all located on the display unit.

The oil system is pressurized by the engine driven oil pump. Oil from the pump, goes to the engine bearings and gearbox. Sensors for the oil temperature indicator, oil pressure indicator and LOW OIL PRESSURE alert are located downstream of the oil pump prior to engine lubrication.

Oil is returned to the oil tank by engine driven scavenge pumps. From the scavenge pumps oil passes through a scavenge filter. If the filter becomes saturated with contaminants, oil automatically bypasses the filter. Prior to the oil bypassing the scavenge filter, the OIL FILTER BYPASS alert illuminates on the upper display unit.

Prior to returning to the oil tank, the oil passes through the main engine oil cooler where it is cooled by engine fuel to maintain proper oil temperature.

Engine Fuel and Oil System Schematic



NOTE:
ALL ENGINE OIL AND FUEL INDICATIONS (EXCEPT OIL QUANTITY AND ENGINE VALVE CLOSED) ARE SENSED BY THE EEC, DIGITIZED, AND SENT TO THE CDS.

CONDITION:
OPERATION
NORMAL ENGINE

Engine Start System

Starter operation requires pressurized air and electrical power. Air from the bleed air system powers the starter motor. The APU, an external ground cart, or the other operating engine provides the bleed air source.

In the GRD position, the engine start switch uses battery power to close the engine bleed air valve and open the start valve to allow pressure to rotate the starter. When the start valve opens, an amber START VALVE OPEN alert is provided on the upper display unit. The starter rotates the N2 compressor through the accessory drive gear system. When the engine accelerates to the recommended value (25% N2 or max motoring), moving the engine start lever to the IDLE position opens the fuel valves on the wing spar and engine, and causes the EEC to supply fuel and ignition to the combustor where the fuel ignites. Initial fuel flow indications lag actual fuel flow by approximately two seconds, therefore, during engine start, an EGT rise may occur before fuel flow indication.

At starter cutout speed (approximately 56% N2), power is removed from the start switch holding solenoid. The engine start switch returns to OFF, the engine bleed air valve returns to the selected position, and the start valve closes.

Abnormal Start Protection (Ground Starts Only)

During ground starts, the EEC monitors engine parameters to detect impending hot starts, engine stalls, EGT start limit exceedances, and wet starts. These protection features do not function during inflight starts.

If an impending hot start is detected by a rapid rise in EGT or EGT approaching the start limit, or a compressor stall occurs, the white box surrounding the EGT digital readout flashes white. The flashing white box resets when the start lever is moved to CUTOFF or the engine reaches idle N2. Current versions of EEC software (7.B.Q and later) automatically turn off the ignition and shuts off fuel to the engine for an impending hot start or stall.

If the EGT exceeds the starting limit, the EGT display, both box and dial, turn red. The EEC automatically turns off the ignition and shuts off fuel to the engine. The alert terminates and the display returns to white when EGT drops below the start limit. Following shutdown of both engines, the EGT box turns red to remind the crew of the exceedance.

A wet start occurs if the EGT does not rise after the start lever is moved to IDLE. If a wet start is detected, the EEC turns off the ignition and shuts off fuel to the engine 15 seconds after the start lever is moved to IDLE.

Engine Ignition System

Each engine has two igniter plugs. The EEC arms the igniter plug(s) selected by the ignition select switch. The left igniter plug receives power from the associated AC transfer bus. The right igniter plug receives power from the AC standby bus.

Auto-Relight

An auto-relight capability is provided for flameout protection. Whenever the EEC detects an engine flameout, both igniters are activated. A flameout is detected when an uncommanded rapid decrease in N2 occurs, or N2 is below idle RPM.

Inflight Starting

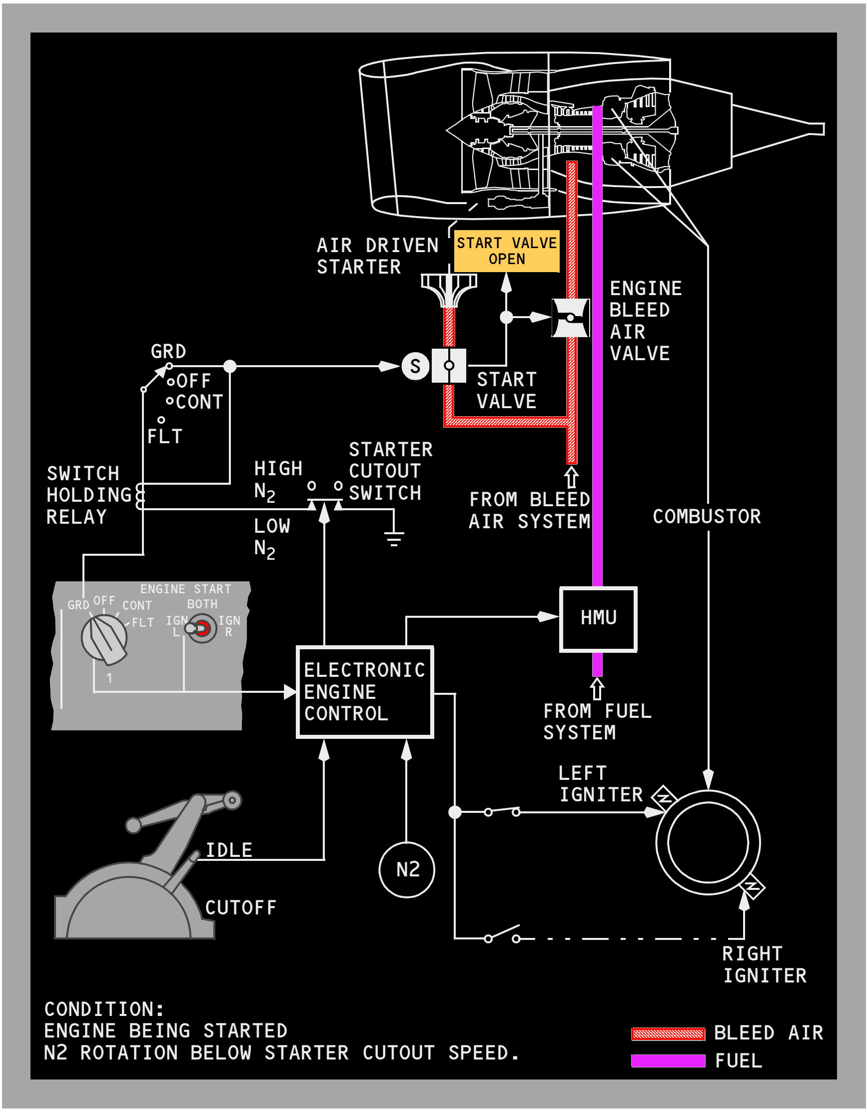
Two methods of starting an engine inflight are available, windmill and crossbleed. None of the ground start protection features are functional during inflight start.

Note: At low N2 values, the oil scavenge pump may not provide enough pressure to return oil to the tank, causing a low oil quantity indication. Normal oil quantity should be indicated after start.

If crossbleed starting is required, the X–BLD indication (XB for the compact engine display) is displayed above the N2 dial. This indication is based on airplane altitude, airspeed and N2.

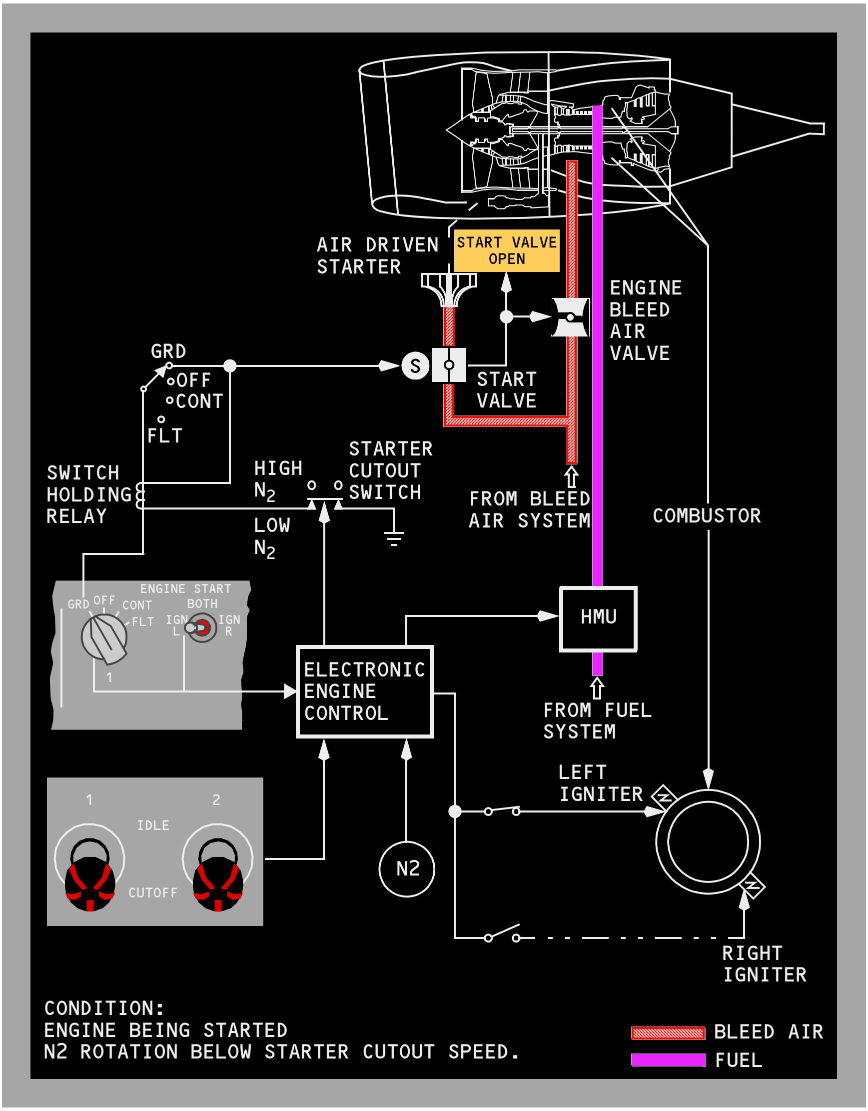
Engine Start and Ignition System Schematic

YA701 - YT511



CONDITION:
ENGINE BEING STARTED
N2 ROTATION BELOW STARTER CUTOUT SPEED.

YT512 - YV754



CONDITION:
ENGINE BEING STARTED
N2 ROTATION BELOW STARTER CUTOUT SPEED.

Thrust Reverser

Each engine is equipped with a hydraulically operated thrust reverser, consisting of left and right translating sleeves. Aft movement of the reverser sleeves causes blocker doors to deflect fan discharge air forward, through fixed cascade vanes, producing reverse thrust. The thrust reverser is for ground operations only and is used after touchdown to slow the airplane, reducing stopping distance and brake wear.

Hydraulic pressure for the operation of engine No. 1 and engine No. 2 thrust reversers comes from hydraulic systems A and B, respectively. If hydraulic system A and/or B fails, alternate operation for the affected thrust reverser is available through the standby hydraulic system. When the standby system is used, the affected thrust reverser deploys and retracts at a slower rate and some thrust asymmetry can be anticipated.

The thrust reverser can be deployed when either radio altimeter senses less than 10 feet altitude, or when the air/ground safety sensor is in the ground mode. Movement of the reverse thrust levers is mechanically restricted until the forward thrust levers are in the idle position.

When reverse thrust is selected, an electro–mechanical lock releases, the isolation valve opens and the thrust reverser control valve moves to the deploy position, allowing hydraulic pressure to unlock and deploy the reverser system. An interlock mechanism restricts movement of the reverse thrust lever until the reverser sleeves have approached the deployed position. When either reverser sleeve moves from the stowed position, the amber REV indication, located on the upper display unit, illuminates. As the thrust reverser reaches the deployed position, the REV indication illuminates green and the reverse thrust lever can be raised to detent No. 2. This position provides adequate reverse thrust for normal operations. When necessary, the reverse thrust lever can be pulled beyond detent No. 2, providing maximum reverse thrust.

Downward motion of the reverse thrust lever past detent No. 1 (reverse idle thrust) initiates the command to stow the reverser. When the lever reaches the full down position, the control valve moves to the stow position allowing hydraulic pressure to stow and lock the reverser sleeves. After the thrust reverser is stowed, the isolation valve closes and the electro–mechanical lock engages.

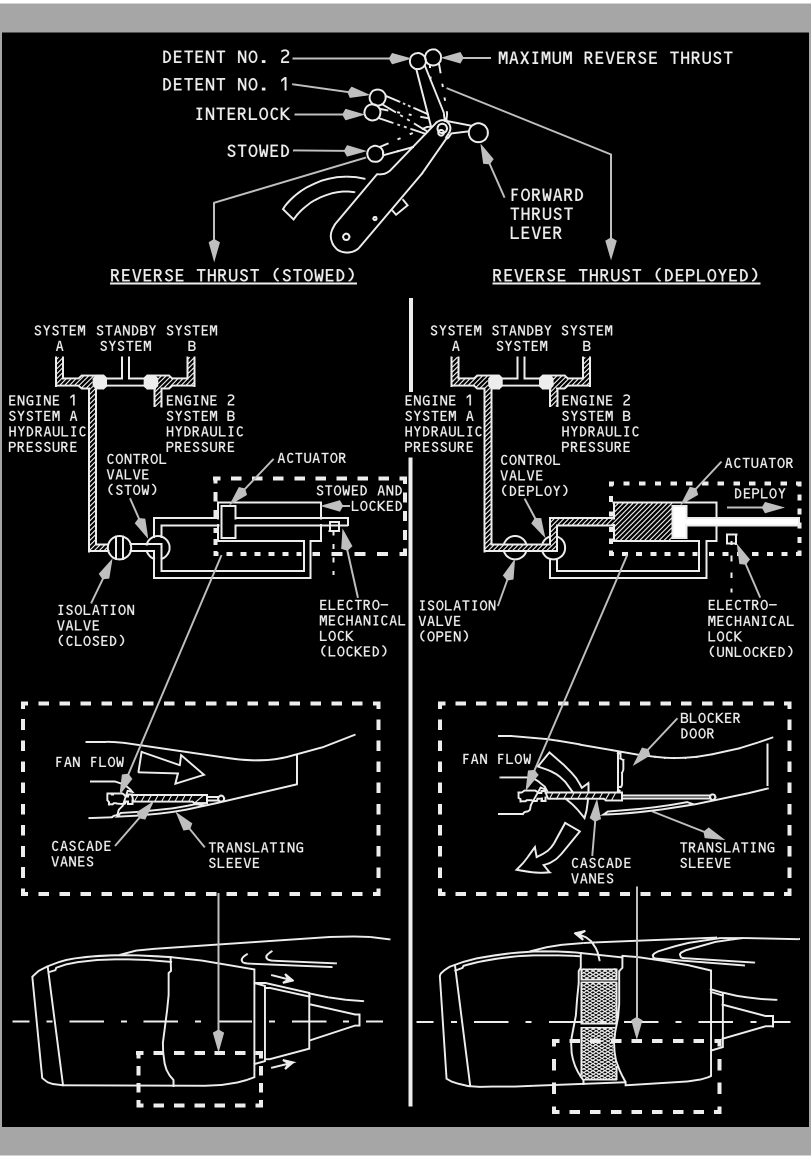
The REVERSER light, located on the aft overhead panel, illuminates when the thrust reverser is commanded to stow and extinguishes 10 seconds later when the isolation valve closes. Any time the REVERSER light illuminates for more than approximately 12 seconds, a malfunction has occurred and the MASTER CAUTION and ENG system annunciator lights illuminate.

Note: A pause in movement of the reverse thrust levers past detent No. 1 toward the stow position may cause MASTER CAUTION and ENG system annunciator lights to illuminate. A pause of approximately 18 seconds engages the electro-mechanical lock and prevents the thrust reverser sleeves from further movement. Cycling the thrust reversers may clear the fault and restore normal operation.

When the reverser sleeves are in the stow position, an electro–mechanical lock and a hydraulically operated locking actuator inhibit motion to each reverser sleeve until reverser extension is selected. Additionally, an auto–restow circuit compares the actual reverser sleeve position and the commanded reverser position. In the event of incomplete stowage or uncommanded movement of the reverser sleeves toward the deployed position, the auto–restow circuit opens the isolation valve and commands the control valve to the stow position directing hydraulic pressure to stow the reverser sleeves. Once the auto–restow circuit is activated, the isolation valve remains open and the control valve is held in the stowed position until the thrust reverser is commanded to deploy or until corrective maintenance action is taken.

WARNING: Actuation of the thrust reversers on the ground without suitable precautions is dangerous to ground personnel.

Thrust Reverser Schematic



Airborne Vibration Monitoring System

The airborne vibration monitoring (AVM) system monitors engine vibration levels. Its primary function is the display of low and high pressure rotor synchronous vibration on the secondary engine display. The AVM is also used to balance the low pressure rotor. Balancing reduces high vibration indication or audible noise and tactile vibration.

Engines, APU — Chapter 7

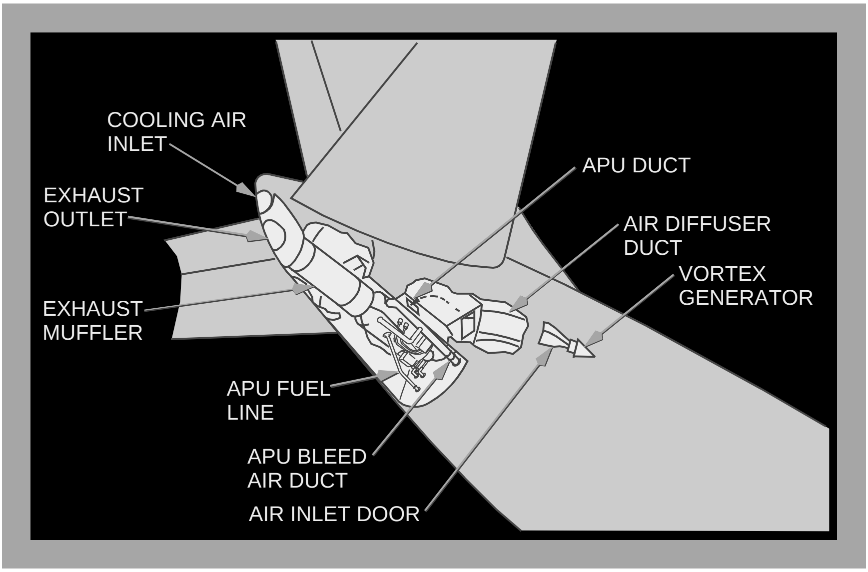
APU System Description — Section 30

Introduction

The auxiliary power unit (APU) is a self–contained gas turbine engine installed within a fireproof compartment located in the tail of the airplane.

The APU supplies bleed air for engine starting or air conditioning. An AC electrical generator on the APU provides an auxiliary AC power source.

APU Location



APU Operation

The APU starts and operates up to the airplane maximum certified altitude.

The APU supplies bleed air for both air conditioning packs on the ground or one pack in flight. Both transfer busses can be powered on the ground or in flight.

APU Fuel Supply

Fuel to start and operate the APU comes from the left side of the fuel manifold when the AC fuel pumps are operating. If the AC fuel pumps are not operating, fuel is suction fed from the No. 1 tank. During APU operation, fuel is automatically heated to prevent icing.

APU Engine and Cooling Air

APU engine air routes to the APU through an automatically operated air inlet door located on the right side of the fuselage. APU exhaust gases discharge overboard through an exhaust muffler.

Air for APU cooling enters through a cooling air inlet above the APU exhaust outlet. This air circulates through the APU compartment, passes through the oil cooler and vents through the exhaust outlet.

Electrical Requirements for APU Operation

APU operation requires the following:

- APU fire switch on the overheat/fire panel must be IN
- APU fire control handle on the APU ground control panel must be IN
- battery switch must be ON.

YA701 - YF049, YM482 - YM484
Electrical power to start the APU comes from No. 1 transfer bus or the airplane battery. With AC power available, the starter generator uses AC power to start the APU. With no AC power, the starter generator uses battery power to start the APU.

YF921 - YL551, YN531 - YV754
Electrical power to start the APU comes from No. 1 transfer bus or the airplane main battery. With AC power available, the starter generator uses AC power to start the APU. With no AC power, the starter generator uses battery power to start the APU.

Moving the battery switch to OFF on the ground or in the air automatically shuts down the APU because of power loss to the electronic control unit.

APU Start

The automatic start sequence begins by moving the APU switch momentarily to START. This initiates opening of the air inlet door. When the APU inlet door reaches the full open position the start sequence begins. After the APU reaches the proper speed, ignition and fuel are provided. When the APU is ready to accept a bleed air or electrical load the APU GEN OFF BUS light illuminates.

Note: When the APU is started using battery power only, there is no indication on the electrical metering panel that the APU generator has come on line and is ready to be selected. Both the frequency and voltage readings are zero until the APU generator is placed on line.

Note: During the APU start cycle, the APU EGT indication may fluctuate from 0º to 1100º C prior to normal EGT rise and the LOW OIL PRESSURE light may cycle on and off several times. These indications have no adverse effect on starting the APU. It is not necessary to monitor EGT during start.

If the APU does not reach the proper speed with the proper acceleration rate within the time limit of the starter, the start cycle automatically terminates. The start cycle may take as long as 120 seconds. Automatic shutdown occurs in the event of EGT exceedance.

If the start fails or the APU GEN OFF BUS light fails to illuminate by the end of the start cycle, a system failure has occurred and the FAULT light illuminates.

Operate the APU for one full minute before using it as a bleed air source. This one minute stabilization is recommended to extend the service life of the APU.

APU Shutdown

Operate the APU for one full minute with no bleed air load prior to shutdown. This cooling period is recommended to extend the service life of the APU. When the APU switch is moved to OFF, this time delay is met automatically.

Moving the APU switch to OFF trips the APU generator, closes the APU bleed air valve and extinguishes the APU GEN OFF BUS light. Shutdown occurs automatically after 60 seconds. When the APU speed decreases sufficiently during shutdown, the fuel valve and inlet door close. If the fuel valve does not close, the FAULT light will illuminate after approximately 30 seconds. An immediate shutdown can be accomplished by pulling the APU fire switch.

Electronic Control Unit (ECU)

An electronic control unit (ECU) monitors and controls the APU. Automatic shutdown protection is provided for overspeed conditions, low oil pressure, high oil temperature, APU fire, fuel control unit failure, EGT exceedance, and other system faults monitored by the ECU.

The ECU automatically controls APU speed through the electronic fuel control. If speed or EGT exceed acceptable levels with the APU providing electrical load only, some electrical load is shed. When electrical load and air extraction raise the EGT above acceptable levels during engine starting, electrical load shedding occurs prior to reducing bleed air. When electrical load and air extraction raise the EGT above acceptable levels other than during engine starting, the inlet guide vanes move toward a closed position, reducing bleed air extraction while maintaining electrical load.

APU Automatic Load Shedding

In flight, if the APU is the only source of electrical power, all galley busses and main buses are automatically shed. If electrical load still exceeds design limits, both IFE busses are also automatically shed. On the ground, the APU attempts to carry a full electrical load. If an overload condition is sensed, the APU sheds galley busses and main busses until the load is within limits. Manual restoration of galley and main bus power can be attempted by moving the CAB/UTIL Power Switch to OFF, then back ON.

Fire Protection Chapter 8

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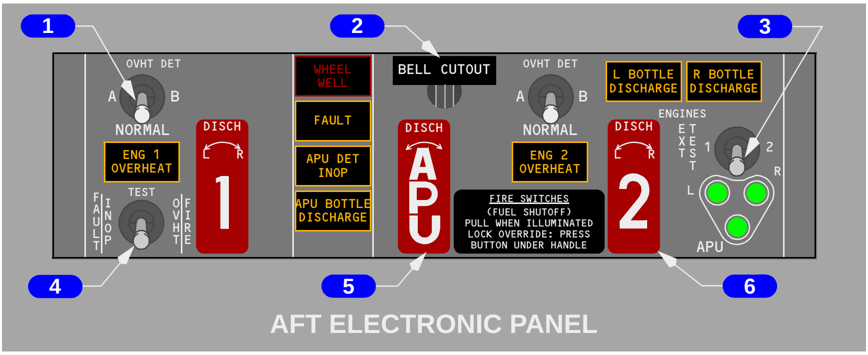
Overheat/Fire Protection Panel Switches



1 Overheat Detector (OVHT DET) Switch

NORMAL – detection loop A and loop B are active.

A – detection loop A is active.

B – detection loop B is active.

2 Fire Warning BELL CUTOUT Switch

Push –

- extinguishes both master FIRE WARN lights
- silences the fire warning bell
- silences the remote APU fire warning horn (on the ground only)
- resets the system for additional warnings.

3 Extinguisher (EXT) TEST Switch

(spring–loaded to center)

1 or 2 – tests bottle discharge circuit continuity for all three extinguisher bottles.

4 Fault/Inoperative (FAULT/INOP) and Overheat/Fire (OVHT/FIRE) TEST Switch

(spring–loaded to center)

FAULT/INOP – tests fault detection circuits for both engines and the APU.

OVHT/FIRE – tests overheat and fire detection loops on both engines and APU, and wheel well fire detector

Note: See Fire and Overheat Detection System Fault Test in Section 20.

5 APU Fire Switch

Illuminated (red) –

- indicates fire in APU
- unlocks APU fire switch.

Note: Master FIRE WARN lights illuminate, fire warning bell sounds, and in the main wheel well the APU fire warning horn sounds (on ground only), and APU fire warning light flashes.

In – normal position, mechanically locked if no fire signal.

Up –

- arms APU extinguisher circuit
- closes fuel shutoff valve, APU bleed air valve, and APU inlet door
- trips generator control relay and breaker
- allows APU fire switch to rotate.

Rotate (left or right) –

- discharges APU fire bottle.

6 Engine Fire Switch

Illuminated (red) –

- indicates fire in related engine
- unlocks related engine fire switch.

Note: Master FIRE WARN lights illuminate and fire warning bell sounds.

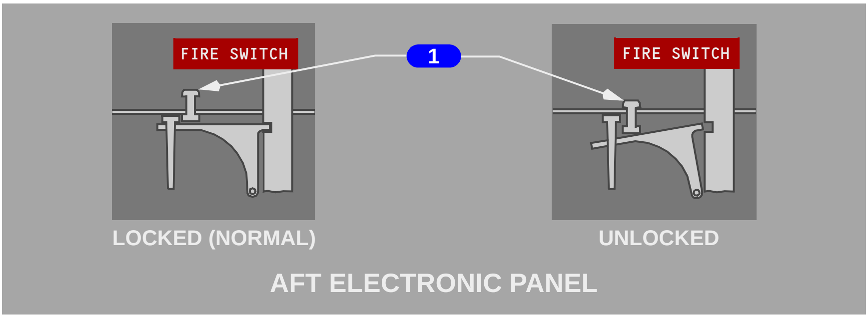
In – normal position, mechanically locked if no fire signal.

Up –

- arms one discharge squib on each engine fire extinguisher
- closes fuel, hydraulic shutoff and engine bleed air valves
- disables thrust reverser
- trips generator control relay and breaker
- deactivates engine driven hydraulic pump LOW PRESSURE light
- allows engine fire switch to rotate.

Rotate (left or right) – discharges related fire bottle.

Fire Switch Override

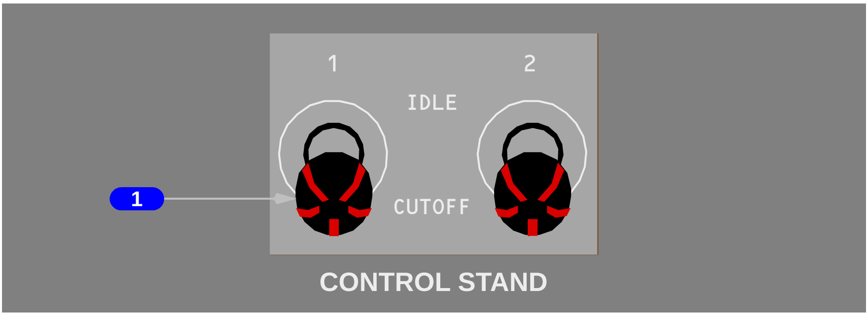


1 Fire Switch Override

Push – unlocks fire switch.

Engine Start Levers

YT512 - YV754

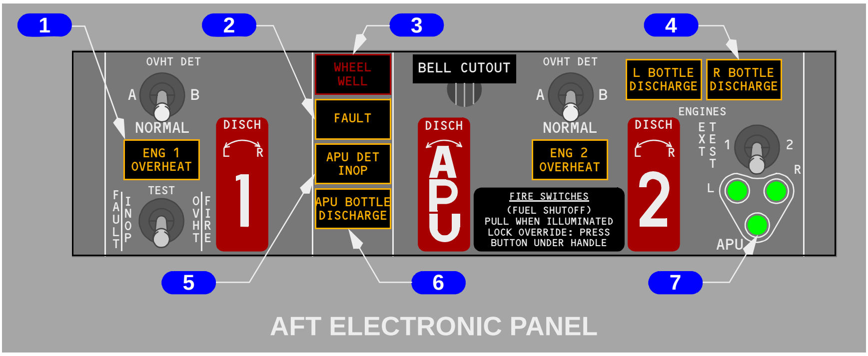


1 Engine Start Levers

Illuminated (red) –

- an associated engine fire is detected, or
- the fire TEST switch is held to the OVHT/FIRE position.

Overheat/Fire Protection Panel Lights



1 Engine (ENG) OVERHEAT Light

Illuminated (amber) – indicates overheat in related engine.

Note: MASTER CAUTION and OVHT/DET system annunciator lights illuminate.

2 FAULT Light

Illuminated (amber) – with the overheat detector switch in NORMAL - indicates both detector loops for an engine have failed.

Illuminated (amber) – with the overheat detector switch in A or B – indicates the selected loop for an engine has failed.

Note: MASTER CAUTION and OVHT/DET system annunciator lights do not illuminate.

3 WHEEL WELL Fire Warning Light

Illuminated (red) – indicates fire in main gear wheel well

Note: Master FIRE WARN lights illuminate and fire warning bell sounds.

4 Engine BOTTLE DISCHARGE Light

Illuminated (amber) – indicates related fire extinguisher bottle has discharged.

5 APU Detector Inoperative (DET INOP) Light

Illuminated (amber) – indicates APU detector loop has failed.

Note: MASTER CAUTION and OVHT/DET system annunciator lights illuminate.

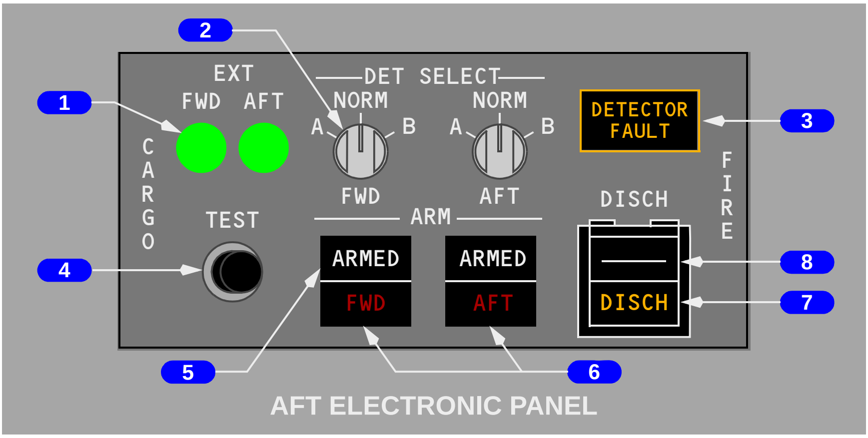
6 APU BOTTLE DISCHARGE Light

Illuminated (amber) – indicates APU extinguisher bottle has discharged.

7 Extinguisher Test (EXT TEST) Lights

Illuminated (green) – EXT TEST switch is positioned to 1 or 2 and circuit continuity is normal.

Cargo Fire Panel



1 Extinguisher (EXT) Test Lights

Illuminated (green) - Cargo Fire TEST switch is pushed and fire bottle discharge squib circuit continuity is normal.

2 Detector Select (DET SELECT) Switches

NORM - detection loop A and B are active.

A - detection loop A is active.

B - detection loop B is active.

3 DETECTOR FAULT Light

Illuminated (amber) -

- One or more of the selected detector loop(s) in either cargo compartment has failed.

4 Cargo Fire TEST Switch

PUSH - tests circuits for both forward and aft cargo fire detector loops and suppression system.

Note: See Cargo Fire System Tests in Section 20.

5 Cargo Fire ARM Switches

PUSH -

- FWD ARMED - extinguisher armed for the forward cargo compartment
- AFT ARMED - extinguisher armed for the aft cargo compartment.

Note: If the first bottle has discharged and the system remains armed, the second bottle discharge is inhibited upon landing. The second bottle discharge timer is disabled when the system is disarmed.

6 Cargo Fire (FWD/AFT) Warning Lights

Illuminated (red) -

- at least one detector in each loop detects smoke
- with power failed in one loop, at least one detector on the remaining loop detects smoke.

Note: Master FIRE WARN lights illuminate and fire warning bell sounds.

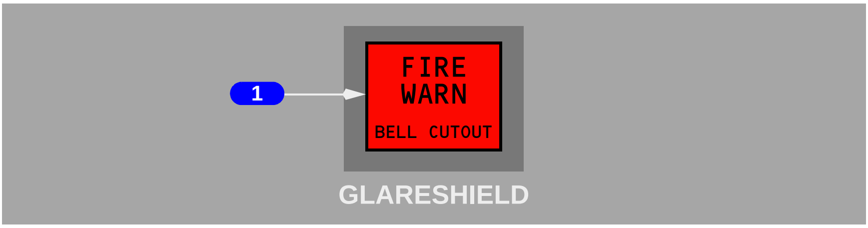
7 Cargo Fire Bottle Discharge (DISCH) Light

Illuminated (amber) - indicates that either extinguisher bottle has discharged

8 Cargo Fire Discharge (DISCH) Switch

PUSH - if system is armed, discharges the first extinguisher bottle. The timer is set for 60 minutes to discharge the second extinguisher bottle.

Master Fire Warning Light



1 Master Fire Warning (FIRE WARN) Lights

Illuminated (red) – indicates a fire warning (or system test) in engine, APU, main gear wheel well or cargo compartment

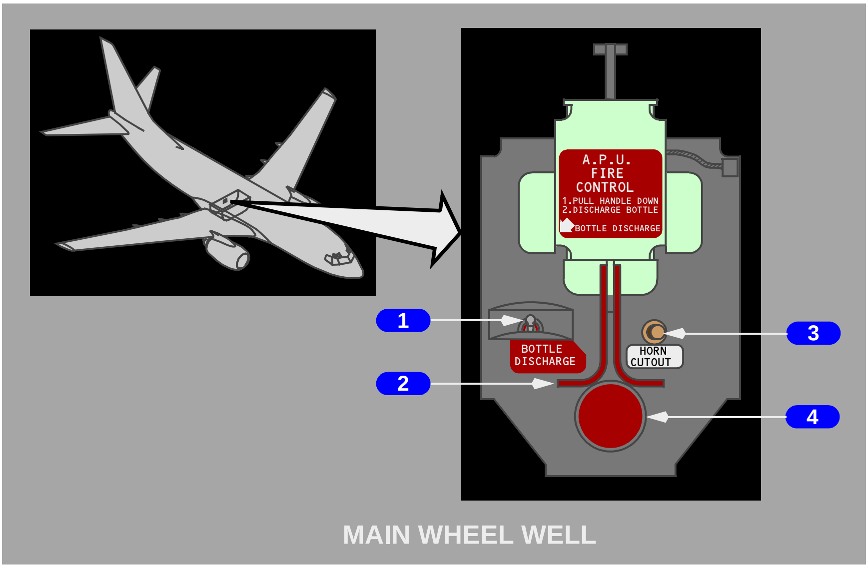
- fire warning bell sounds
- if on ground, remote APU fire warning horn sounds.

Push –

- extinguishes both master FIRE WARN lights
- silences fire warning bell
- silences remote APU fire warning horn
- resets system for additional warnings.

Note: Pushing fire warning bell cutout switch on overheat/fire protection panel results in same actions.

APU Ground Control Panel



1 APU BOTTLE DISCHARGE Switch

(spring–loaded to the right and safety wired.)

Left – discharges APU extinguisher.

Note: Armed only if APU fire control handle is pulled at this panel.

2 APU Fire Control Handle

Up – normal position.

Down –

- arms APU BOTTLE DISCHARGE switch (on this panel only)
- closes APU fuel shutoff, bleed air valve and APU inlet door
- trips generator control relay and breaker.

3 APU Fire Warning HORN CUTOUT Switch

Push –

- silences fire alarm bell
- silences APU fire warning horn
- causes APU fire warning light to stop flashing but remain illuminated.

4 APU Fire Warning Light

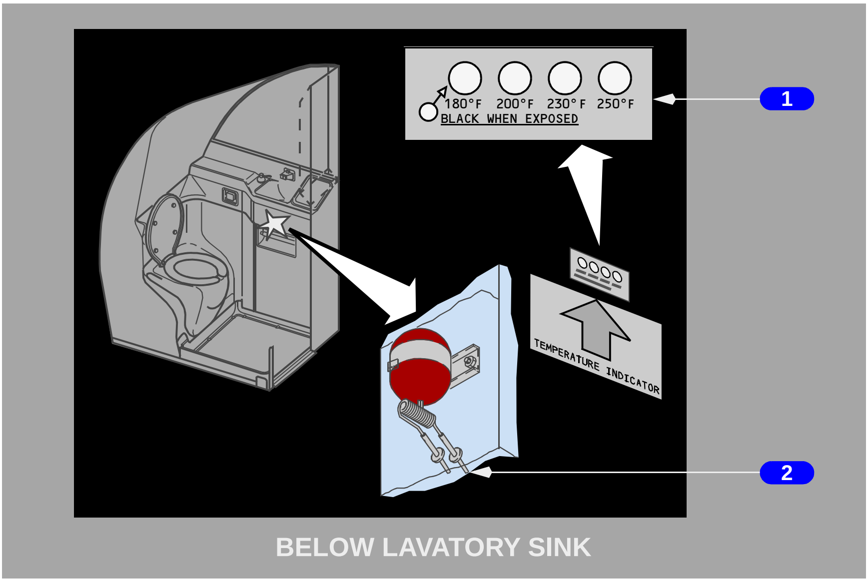
Illuminated (red flashing) – indicates fire in APU.

Note: Also, flight deck fire warning bell sounds and APU fire warning horn in main wheel well sounds.

Illuminated (red steady) – indicates APU fire warning HORN CUTOUT switch has been pushed following an APU fire indication.

Lavatory Fire

Lavatory Fire Extinguisher



1 TEMPERATURE INDICATOR Placard

White – normal condition.

Black – exposed to high temperatures.

2 Heat Activated Nozzles

Flat black – normal condition.

Aluminum – indicates extinguisher has discharged.

Both nozzles discharge toward the towel disposal container.

Intentionally
Blank

Introduction

There are fire detection and extinguishing systems for:

- engines
- APU
- lavatories
- cargo compartments.

The engines also have overheat detection systems.

The main gear wheel well has a fire detection system, but no fire extinguishing system.

Engine Fire Protection

Engine fire protection consists of these systems:

- engine overheat and fire detection powered by the battery bus
- engine fire extinguishing powered by the hot battery bus.

Engine Overheat and Fire Detection

Each engine contains two overheat/fire detector loops. Each loop provides both fire and overheat detection. As the temperature of a detector increases to a predetermined limit, the detector senses an overheat condition. At higher temperatures, the detector senses a fire condition. Normally, both detector loops must sense a fire or overheat condition to cause an engine overheat or fire alert. The ENG OVERHEAT light or engine fire switch remains illuminated until the temperature drops below the onset temperature.

An OVHT DET switch for each engine, labeled A, B, and NORMAL, permits selection of either loop A or B, or both A and B, as the active detecting loops.

The system contains a fault monitoring circuit. If one loop fails with the OVHT DET switch in NORMAL, that loop is automatically deselected and the remaining loop functions as a single loop detector. There is no flight deck indication of single loop failure. If both loops fail on an engine, the FAULT light illuminates and the system is inoperative.

If the OVHT DET switch is positioned to A or B, the system operates as a single loop system. The non–selected loop is not monitored. If the selected loop fails, the FAULT light illuminates and the system is inoperative.

The indications of an engine overheat are:

- both MASTER CAUTION lights illuminate
- the OVHT/DET system annunciator light illuminates
- the related ENG OVERHEAT light illuminates.

The indications of an engine fire are:

- the fire warning bell sounds
- both master FIRE WARN lights illuminate
- the related engine fire switch illuminates

YT512 - YV754

- the related engine start lever illuminates
- all related engine overheat alert indications illuminate.

Engine Fire Extinguishing

The engine fire extinguisher system consists of two engine fire extinguisher bottles, two engine fire switches, two BOTTLE DISCHARGE lights, and an EXT TEST switch. Either or both bottles can be discharged into either engine.

The engine fire switches are normally locked down to prevent inadvertent shutdown of an engine. Illumination of an engine fire switch or ENG OVERHEAT light unlocks the engine fire switch. The switches may also be unlocked manually.

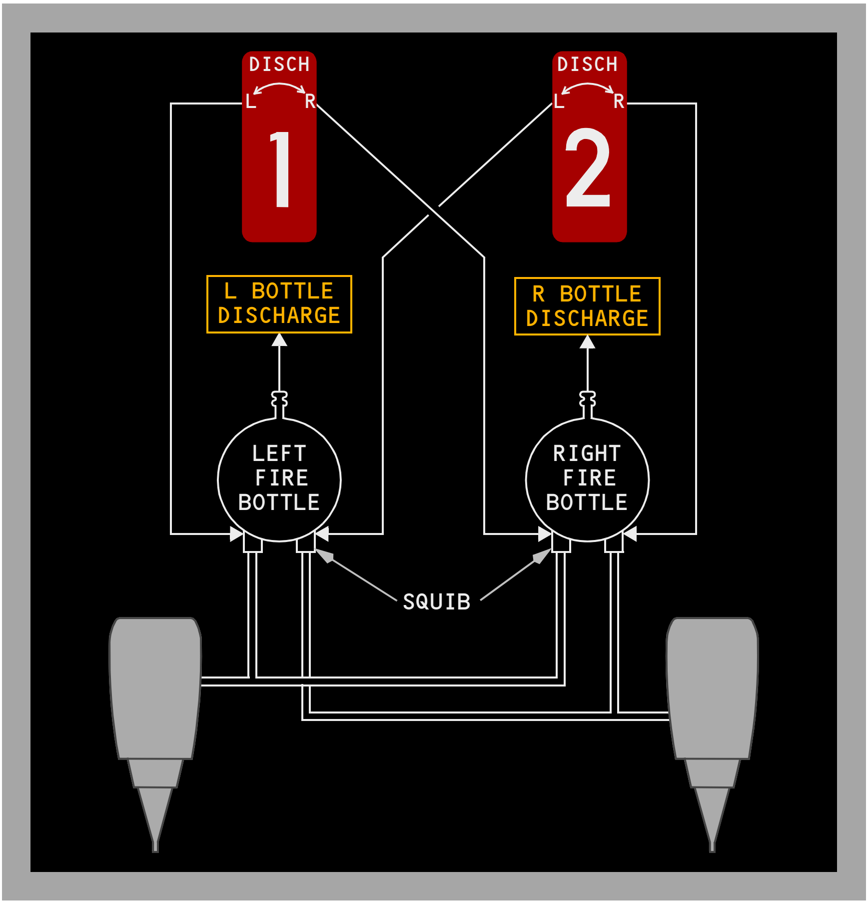
Pulling the engine fire switch up:

- closes both the engine fuel shutoff valve and the spar fuel shutoff valve
- closes the engine bleed air valve resulting in loss of wing anti–ice to the affected wing and closure of bleed air operated pack valve
- trips the generator control relay and breaker
- closes the hydraulic fluid shutoff valve. The engine driven hydraulic pump LOW PRESSURE light is deactivated
- disables thrust reverser for the related engine.
- allows the engine fire switch to be rotated for discharge
- arms one discharge squib on each engine fire extinguisher bottle.

Rotating the engine fire switch electrically “fires” a squib, discharging the extinguishing agent into the related engine. Rotating the switch the other way discharges the remaining bottle.

The L or R BOTTLE DISCHARGE light illuminates a few seconds after the engine fire switch is rotated, indicating the bottle has discharged.

Engine Fire Extinguisher Schematic



APU Fire Protection

APU fire protection consists of these systems:

- APU fire detection powered by the battery bus.
- APU fire extinguishing powered by the hot battery bus.

APU Fire Detection

A single fire detection loop is installed on the APU. As the temperature of the detector increases to a predetermined limit, the detector senses a fire condition. The APU fire switch remains illuminated until the temperature of the detector has decreased below the onset temperature.

The system contains a fault monitoring circuit. If the loop fails, the APU DET INOP light illuminates indicating the APU fire detection system is inoperative.

The indications of an APU fire are:

- the fire warning bell sounds
- both master FIRE WARN lights illuminate
- the APU fire switch illuminates
- the APU automatically shuts down
- the wheel well APU fire warning horn sounds, (on the ground only), and the wheel well APU fire warning light flashes.

APU Fire Extinguishing

The APU fire extinguisher system consists of one APU fire extinguisher bottle, an APU fire switch, an APU BOTTLE DISCHARGE light, and an EXT TEST switch. The APU ground control panel located in the right main wheel well also contains an APU fire warning light, an APU BOTTLE DISCHARGE switch, an APU fire control handle and APU HORN CUTOUT switch.

The APU fire switch is normally locked down to prevent inadvertent shutdown of the APU. Illumination of the APU fire switch unlocks the switch. The switch may also be unlocked manually.

Pulling the APU Fire switch up:

- provides backup for the automatic shutdown feature
- deactivates the fuel solenoid and closes the APU fuel shutoff valve
- closes the APU bleed air valve
- closes the APU air inlet door
- trips the APU generator control relay and breaker
- allows the APU fire switch to be rotated for discharge
- arms the APU fire extinguisher bottle squib.

Rotating the APU fire switch in either direction electrically “fires” the squib discharging the extinguishing agent into the APU. The APU BOTTLE DISCHARGE light illuminates after a few seconds, indicating the bottle has discharged.

Main Wheel Well Fire Protection

Main wheel well fire protection consists of fire detection powered by the No. 2 AC transfer bus.

Note: The main wheel well has no fire extinguishing system. The nose wheel well does not have a fire detection system.

Main Wheel Well Fire Detection

A single fire detector loop is installed in the main wheel well. As the temperature of the detector increases to a predetermined limit, the detector senses a fire condition. The WHEEL WELL fire warning light remains illuminated until the temperature of the detector has decreased below the onset temperature.

The indications for a main wheel well fire are:

- the fire warning bell sounds
- both master FIRE WARN lights illuminate
- the WHEEL WELL fire warning light illuminates.

Cargo Compartment Fire Protection

Cargo fire protection consists of these systems:

- cargo compartment smoke detection powered by DC bus 1 and DC bus 2
- cargo compartment fire extinguishing powered by the hot battery bus.

Cargo Compartment Smoke Detection

The forward and aft cargo compartments each have smoke detectors in a dual loop configuration. Normally, both detection loops must sense smoke to cause an alert. In the event of a detector failure, the system can be manually converted to single-loop detection through the DETECT SELECT switch on the cargo fire control panel. In the event of a power failure in one loop the system automatically converts to single-loop detection.

Cargo Compartment Fire Warning

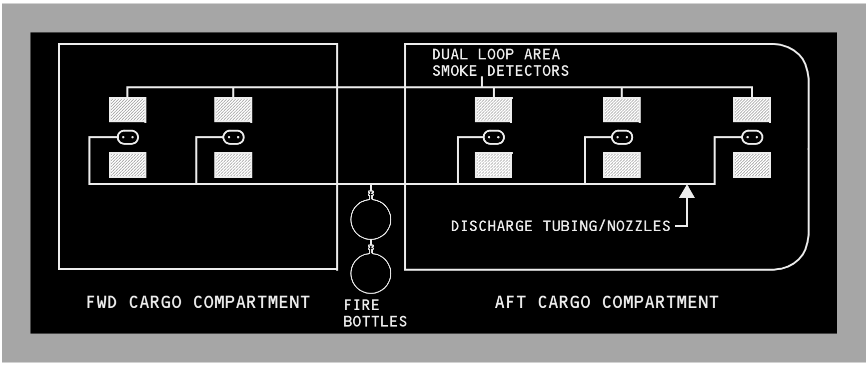
The indications of a cargo compartment fire are:

- the fire warning bell sounds
- both master FIRE WARN lights illuminate
- the FWD/AFT cargo fire warning light(s) illuminates.

Cargo Compartment Fire Extinguishing

Two fire extinguisher bottles are installed in the air conditioning mix bay on the forward wing spar. Detection of a fire in either the forward or aft compartment will cause the FWD or AFT cargo fire warning light to illuminate. The extinguishers are armed by pushing the appropriate cargo fire ARMED switch. Once armed, the first bottle is discharged by pushing the cargo fire DISCH switch. This results in the total discharge of the first bottle contents into the selected compartment. The second bottle discharge is metered to discharge at a reduced flow into the selected compartment. Discharge of the second bottle may be disabled if the system is disarmed. The cargo fire DISCH light illuminates when a bottle is discharged. It may take up to 30 seconds for the light to illuminate. On landing, if the first bottle was discharged and the system remains armed, the second bottle discharge is inhibited.

Cargo Fire Extinguisher Schematic



Lavatory Fire Protection

Lavatory fire protection consists of these systems:

- lavatory smoke detection
- lavatory fire extinguishing (heat activated).

Lavatory Smoke Detection

YA701 - YA710, YK622 - YK971, YL076 - YL544

The lavatory smoke detection system monitors for the presence of smoke. When smoke is detected:

- an aural warning sounds
- the red alarm indicator light on the lavatory smoke detector panel illuminates.

YF048 - YF928, YK973 - YK980, YL545 - YL551, YN531 - YV754
The lavatory smoke detection system monitors for the presence of smoke. When smoke is detected:

- an aural warning sounds
- the red status indicator light on the lavatory smoke detector panel illuminates.

YA701 - YA710, YK622 - YK971, YL076 - YL544
There is no flight deck indication. When smoke is no longer present, ALARM MODE is reset by pressing the INTERRUPT switch.

YF048 - YF928, YK973 - YK980, YL545 - YL551, YN531 - YV754
There is no flight deck indication. When smoke is no longer present, the system automatically resets.

YM482 - YM484
The lavatory smoke detection system monitors for the presence of smoke. When smoke is detected:

- an aural warning sounds
- the red alarm indicator light on the lavatory smoke detector panel illuminates and the appropriate amber lavatory call light will flash
- the amber lavatory SMOKE light on the forward overhead panel illuminates.

YM482 - YM484
When smoke is no longer present, the system automatically resets.

Lavatory Fire Extinguisher System

A fire extinguisher system is located beneath the sink area in each lavatory. When a fire is detected:

- fire extinguisher operation is automatic
- flight deck has no indication of extinguisher discharge.

Fire and Overheat System Tests

The fire and overheat detection systems can be tested by pushing and holding the FAULT/INOP and OVHT/FIRE TEST switch. Extinguisher continuity can be tested by pushing and holding the EXT TEST switch. All test indications clear when switches are released.

FAULT/INOP Test Detection

The fault detection circuits for both the engines and the APU are tested by pushing and holding the FAULT/INOP and OVHT/FIRE TEST switch in the FAULT/INOP position.

The indications for the FAULT/INOP test are:

- both MASTER CAUTION lights illuminate
- the OVHT/DET system annunciator light illuminates
- the FAULT light illuminates
- the APU DET INOP light illuminates.

OVERHEAT/FIRE Test Detection

The overheat and fire detection loops on both engines, the APU, and the fire detector in the wheel well are tested by pushing and holding the FAULT/INOP and OVHT/FIRE TEST switch in the OVHT/FIRE position.

The indications for the OVHT/FIRE test are:

- the fire warning bell sounds
- both master FIRE WARN lights illuminate
- both MASTER CAUTION lights illuminate
- the OVHT/DET system annunciator light illuminates
- both engine fire switches illuminate

YT512 - YV754

- both engine start levers illuminate
- the APU fire switch illuminates
- both ENG OVERHEAT lights illuminate
- the WHEEL WELL fire warning light illuminates if AC power is available
- on the ground, the wheel well APU fire warning horn sounds and the wheel well APU fire warning light flashes.

Extinguisher Test

When the EXT TEST switch is positioned to 1 or 2, the green EXT TEST lights illuminate, verifying circuit continuity from the squib to the engine and APU fire switch.

Cargo Fire System Tests

The cargo fire detection and suppression system can be tested by pushing and holding the cargo fire TEST switch. This sends a test signal to the forward and aft cargo fire detector loops and verifies continuity of the extinguisher bottle squib circuits. All test indications clear when the TEST switch is released

Cargo Fire TEST

The indications for the Cargo Fire test are:

- the fire warning bell sounds
- both master FIRE WARN lights illuminate

- the extinguisher test lights illuminate
- the FWD and AFT cargo fire warning lights illuminate when all detectors in selected loops (s) respond to the fire test
- the cargo fire bottle DISCH light illuminates

Note: The fire warning BELL CUTOUT switch on the Overheat/Fire Protection panel can silence the fire warning bell and extinguish the master FIRE WARN lights

Note: During a Cargo Fire Test, the DETECTOR Fault light will illuminate if one or more detectors in the loop(s) has failed.

Note: Individual detector faults can only be detected by a manually initiated test. The MASTER CAUTION light does not illuminate.

Note: At the end of cargo fire testing, up to a four second delay may occur to allow all applicable indications to extinguish at the same time.

Cargo Fire Extinguisher Test

When the Cargo Fire TEST button is pushed, the green EXT lights illuminate, verifying the fire bottle discharge squib circuit continuity is normal.

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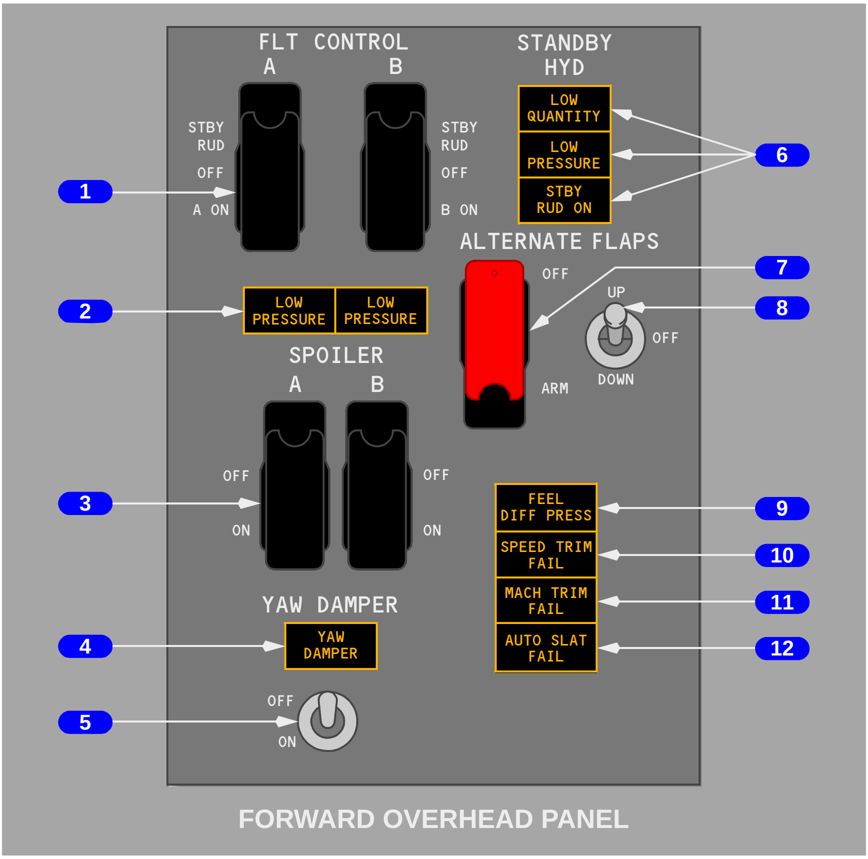
Flight Controls — Chapter 9
Table of Contents — Section TOC

Flight Control Panel



1 FLIGHT CONTROL Switches

STBY RUD - activates standby hydraulic system pump and opens standby rudder shutoff valve to pressurize standby rudder power control unit.

OFF - closes flight control shutoff valve isolating ailerons, elevators and rudder from associated hydraulic system pressure.

ON (guarded position) - normal operating position.

2 Flight Control LOW PRESSURE Lights

Illuminated (amber) -

- indicates low hydraulic system (A or B) pressure to ailerons, elevator and rudder
- deactivated when associated FLIGHT CONTROL switch is positioned to STBY RUD and standby rudder shutoff valve opens.

3 Flight SPOILER Switches

ON (guarded position) – normal operating position.

OFF – closes the respective flight spoiler shutoff valve.

Note: Used for maintenance purposes only.

4 YAW DAMPER Light

Illuminated (amber) – yaw damper is not engaged.

5 YAW DAMPER Switch

OFF – disengages yaw damper.

ON –

- engages main yaw damper to main rudder power control unit if the B FLT CONTROL switch is in the ON position
- engages standby yaw damper to standby rudder power control unit if both the A and B FLT CONTROL switches are in the STBY RUD position.

6 STANDBY HYD Lights

STANDBY HYDRAULIC LOW QUANTITY Light

Illuminated (amber) -

- indicates low quantity in standby hydraulic reservoir
- always armed.

STANDBY HYDRAULIC LOW PRESSURE Light

Illuminated (amber) -

- indicates output pressure of standby pump is low
- armed only when standby pump operation has been selected or automatic standby function is activated.

STBY RUD ON Light

- Illuminated (amber) - indicates the standby rudder system is commanded on to pressurize the standby rudder power control unit.

7 ALTERNATE FLAPS Master Switch

OFF (guarded position) – normal operating position.

ARM – closes TE flap bypass valve, activates standby pump, and arms the ALTERNATE FLAPS position switch.

8 ALTERNATE FLAPS Position Switch

Functions only when the ALTERNATE FLAPS master switch is in ARM.

UP –

- electrically retracts TE flaps
- LE devices remain extended and cannot be retracted by the alternate flaps system.

OFF – normal operating position.

DOWN (spring loaded to OFF) –

- (momentary) fully extends LE devices using standby hydraulic pressure
- (hold) electrically extends TE flaps until released.

9 Feel Differential Pressure (FEEL DIFF PRESS) Light

YA701 - YA704
Armed when the TE flaps are up.

YA705 - YV754
Armed when the TE flaps are up or down.

Illuminated (amber) -

- indicates excessive differential pressure in the elevator feel computer.

YA705 - YV754
Note: Excessive differential pressure can be caused by erroneous activation of the Elevator Feel Shift module.

10 Speed Trim Failure (SPEED TRIM FAIL) Light

Illuminated (amber) –

- indicates failure of the speed trim system
- indicates failure of a single FCC channel when MASTER CAUTION light recall is activated and light extinguishes when Master Caution System is reset.

11 Mach Trim Failure (MACH TRIM FAIL) Light

Illuminated (amber) –

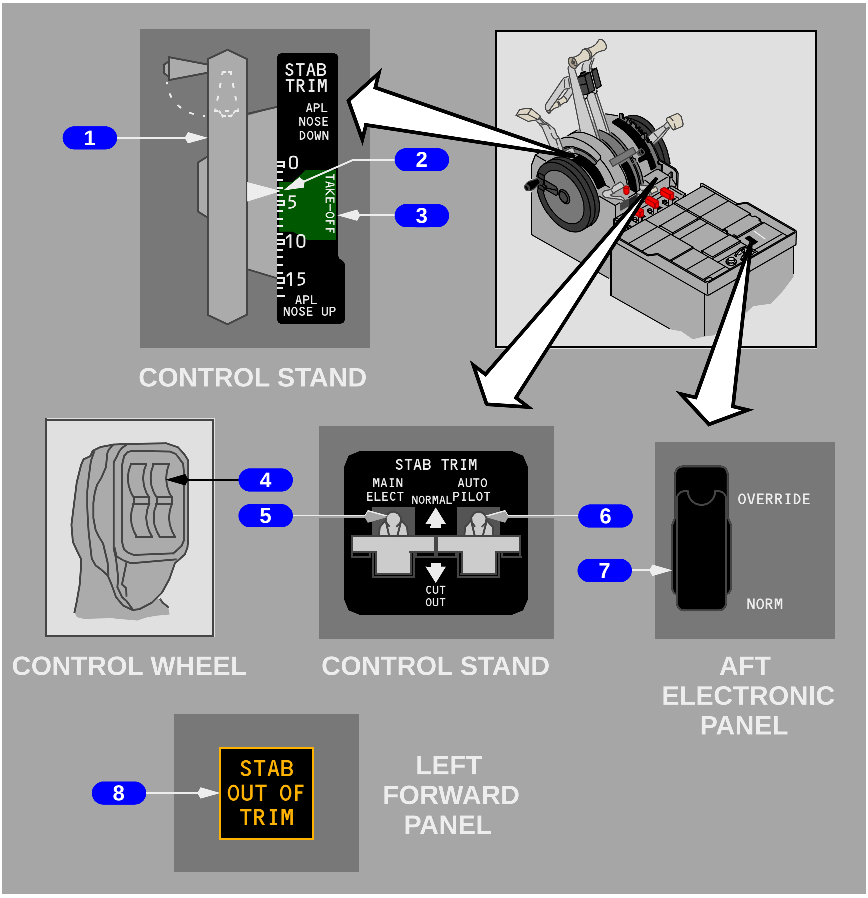
- indicates failure of the mach trim system
- indicates failure of a single FCC channel when MASTER CAUTION light recall is activated and light extinguishes when master caution system is reset.

12 Automatic Slat Failure (AUTO SLAT FAIL) Light

Illuminated (amber) –

- indicates failure of the auto slat system
- indicates failure of a single Stall Management/Yaw Damper (SMYD) computer when illuminated during MASTER CAUTION recall and extinguishes when master caution system is reset.

Stabilizer



1 Stabilizer Trim Wheel

- provides for manual operation of stabilizer
- overrides any other stabilizer trim inputs
- rotates when stabilizer is in motion.

Note: Handle should be folded inside stabilizer trim wheel for normal operation

2 Stabilizer Trim Indicator

Indicates units of airplane trim on the adjacent scale.

3 Stabilizer Trim Green Band Range

Corresponds to allowable range of trim settings for takeoff.

4 Stabilizer Trim Switches (spring-loaded to neutral)

Push (both) –

- electrically commands stabilizer trim in desired direction
- autopilot disengages if engaged.

5 Stabilizer Trim Main Electric (MAIN ELECT) Cutout Switch

NORMAL – normal operating position.

CUTOUT – deactivates stabilizer trim switch operation.

6 Stabilizer Trim AUTOPILOT Cutout Switch

NORMAL – normal operating position.

CUTOUT –

- deactivates autopilot stabilizer trim operation
- autopilot disengages if engaged.

7 Stabilizer Trim Override Switch

OVERRIDE – bypasses the control column actuated stabilizer trim cutout switches to restore power to the Stabilizer Trim Switches

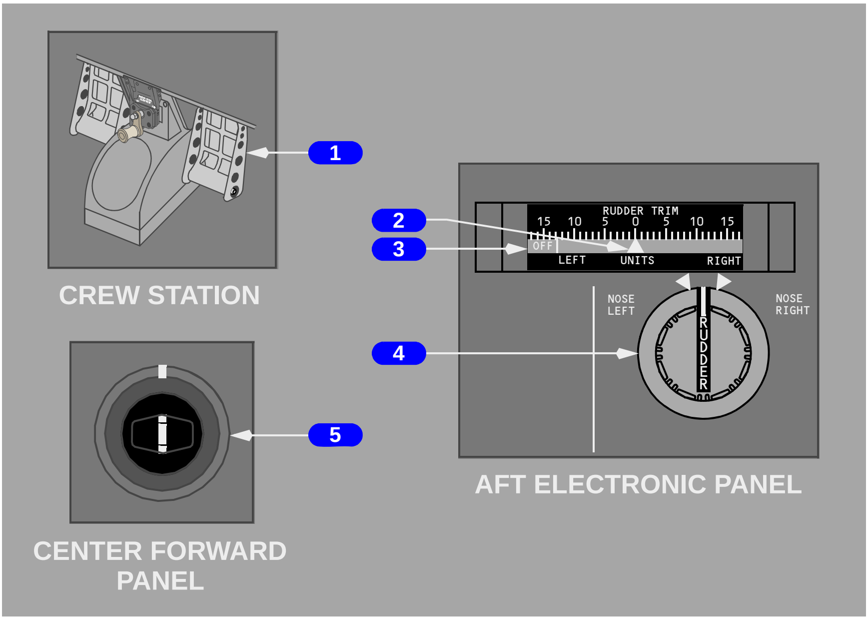
NORM (guarded position) – normal operating position.

8 Stabilizer Out of Trim (STAB OUT OF TRIM) Light

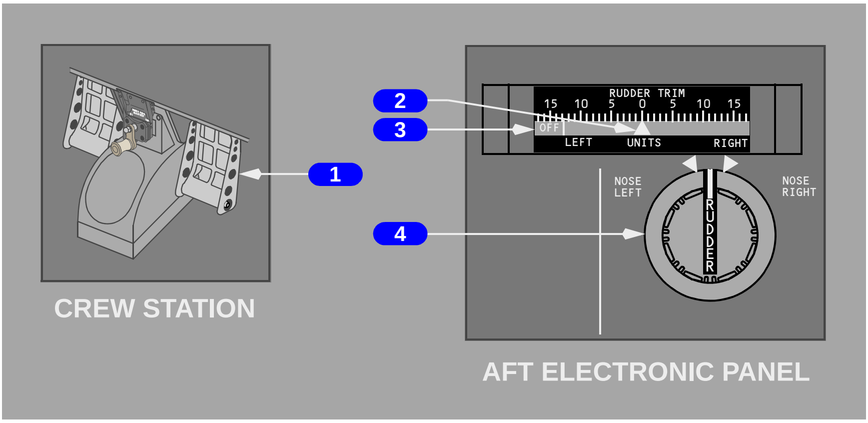
Refer to Chapter 4 – Automatic Flight

Rudder

YA701 - YA706, YA708, YK626, YK627, YK961 - YK966, YK968 - YL077, YM482 - YM484 (SB Changes YA707, YA709, YA710, YK622 - YK625, YK628 - YK630, YK967, YL541 - YL544)



YF048 - YF928, YL545 - YL551, YN531 - YV754 (SB Changes YA707, YA709, YA710, YK622 - YK625, YK628 - YK630, YK967, YL541 - YL544)



1 Rudder Pedals

Push –

- controls rudder position
- permits limited nose gear steering up to 7 degrees each side of center.

2 Rudder Trim Indicator

Indicates units of rudder trim.

3 Rudder Trim OFF Flag

Illuminated (amber) (in view) – rudder trim indicator is inoperative.

4 Rudder Trim Control (spring-loaded to neutral)

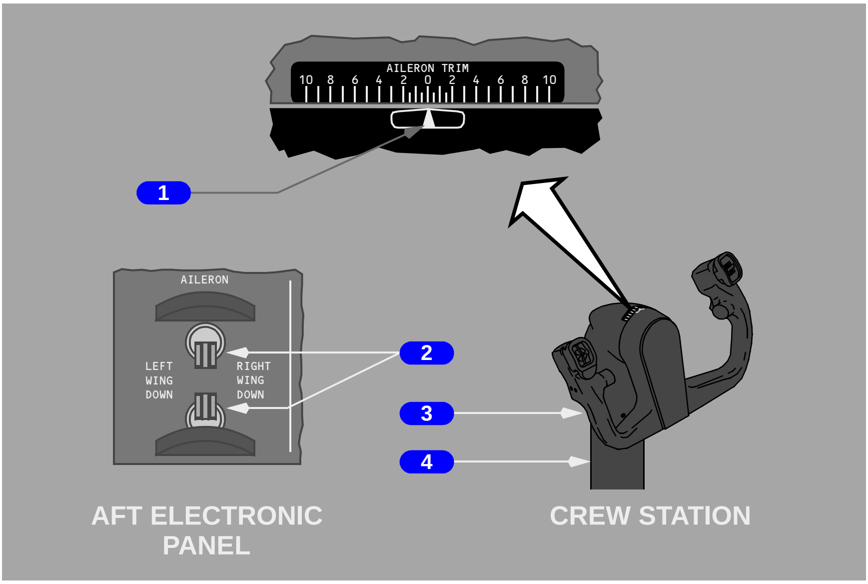
Rotate – electrically trims the rudder in the desired direction.

YA701 - YA706, YA708, YK626, YK627, YK961 - YK966, YK968 - YL077, YM482 - YM484
(SB Changes YA707, YA709, YA710, YK622 - YK625, YK628 - YK630, YK967, YL541 - YL544)

5 YAW DAMPER Indicator

- Indicates main yaw damper movement of rudder
- pilot rudder pedal inputs are not indicated.

Aileron / Elevator / Flight Spoilers



1 AILERON TRIM Indicator

Indicates units of aileron trim.

2 AILERON Trim Switches (spring-loaded to the neutral position)

Movement of both switches repositions the aileron neutral control position.

3 Control Wheel

Rotate – operates ailerons and flight spoilers in desired direction.

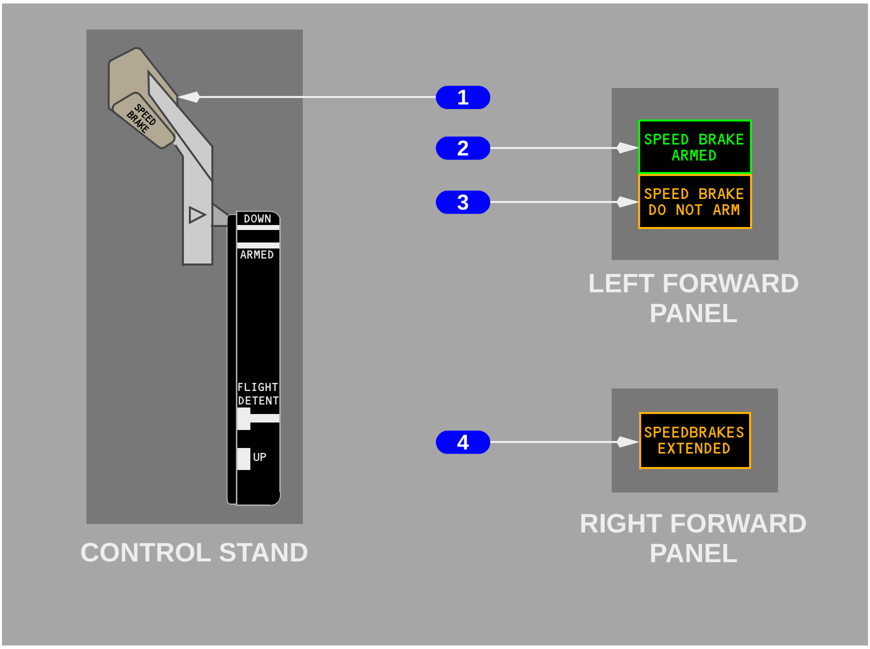
4 Control Column

Push/Pull –

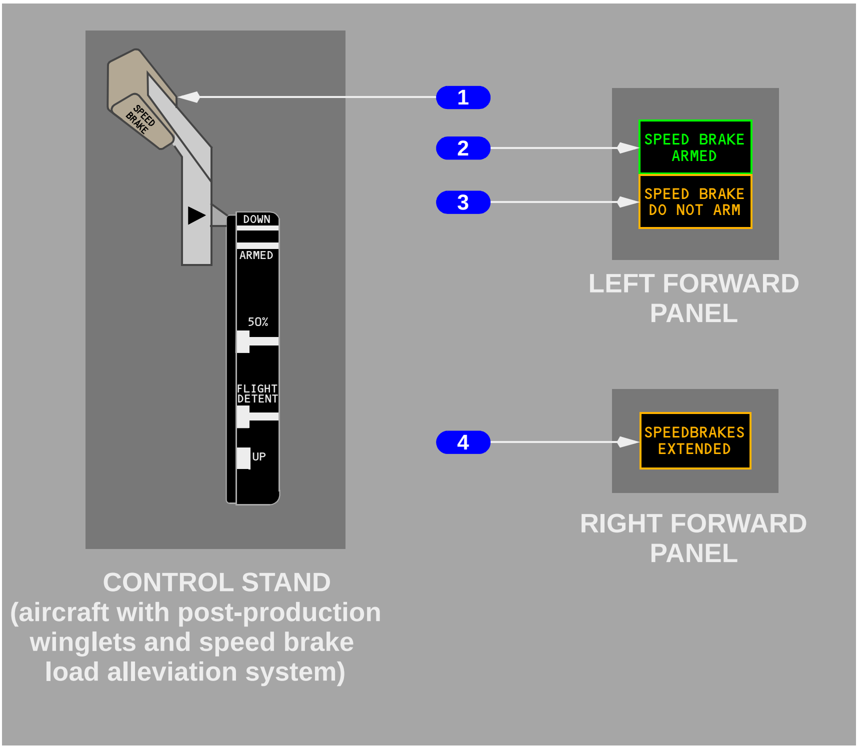
- operates elevators in the desired direction
- movement opposing stabilizer trim stops electric trimming.

Speed Brakes

YA701 - YL551, YS151 - YV754



YM482 - YN534



1 SPEED BRAKE Lever

DOWN (detent) – all flight and ground spoiler panels in faired position.

ARMED –

- automatic speed brake system armed
- upon touchdown, the SPEED BRAKE lever moves to the UP position, and all flight and ground spoilers extend.

YM482 - YN534
50% –

- if the speed brakes are deployed beyond the 50% position and the speed brake load alleviation feature is activated;
  - the speed brake lever moves to this position
  - all flight spoilers retract to one-half of their maximum position for inflight use.

FLIGHT DETENT – all flight spoilers are extended to their maximum position for inflight use.

UP – all flight and ground spoilers are extended to their maximum position for ground use.

2 SPEED BRAKE ARMED Light

Light deactivated when SPEED BRAKE lever is in the DOWN position.

Illuminated (green) – indicates valid automatic speed brake system inputs.

3 SPEED BRAKE DO NOT ARM Light

YA701 - YL551, YS151 - YV754
Light deactivated when SPEED BRAKE lever is in the DOWN position.

Illuminated (amber) –

YA701 - YL551, YS151 - YV754

- indicates abnormal condition or test inputs to the automatic speed brake system, or
- during landing, indicates wheel speed has dropped below 60 kts, and the speedbrake lever is not in the DOWN position.

YM482 - YN534

- indicates an abnormal condition or test input to the speed brake load alleviation system when the flaps are raised, or
- during landing, indicates wheel speed has dropped below 60 kts, and the speedbrake lever is not in the DOWN position.

4 SPEEDBRAKES EXTENDED Light

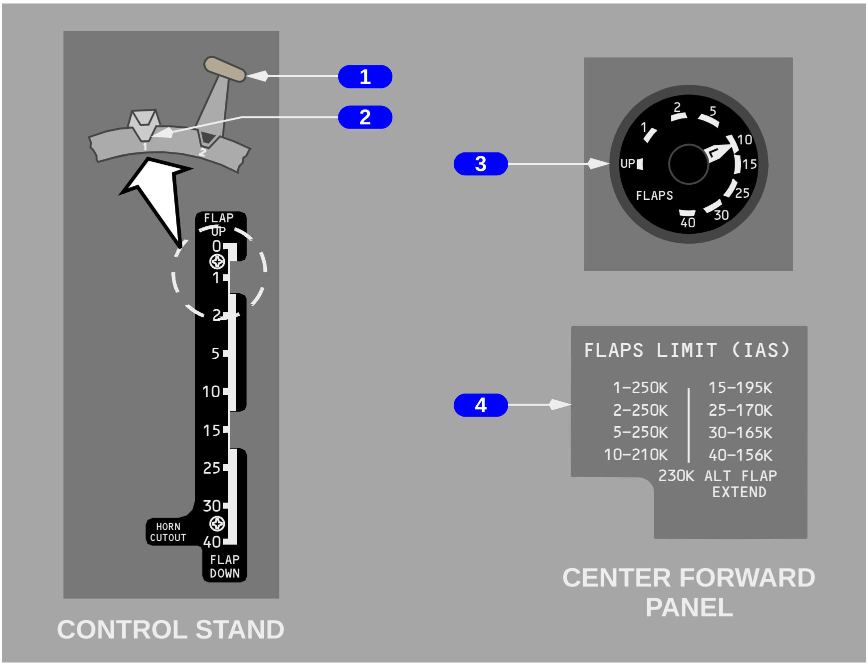
Illuminated (amber) –

- in–flight -
  - SPEED BRAKE lever is beyond the ARMED position, and
  - TE flaps extended more than flaps 10, or
  - radio altitude less than 800 feet
- on the ground -
  - SPEED BRAKE lever is in the DOWN detent,
  - ground spoilers are not stowed.

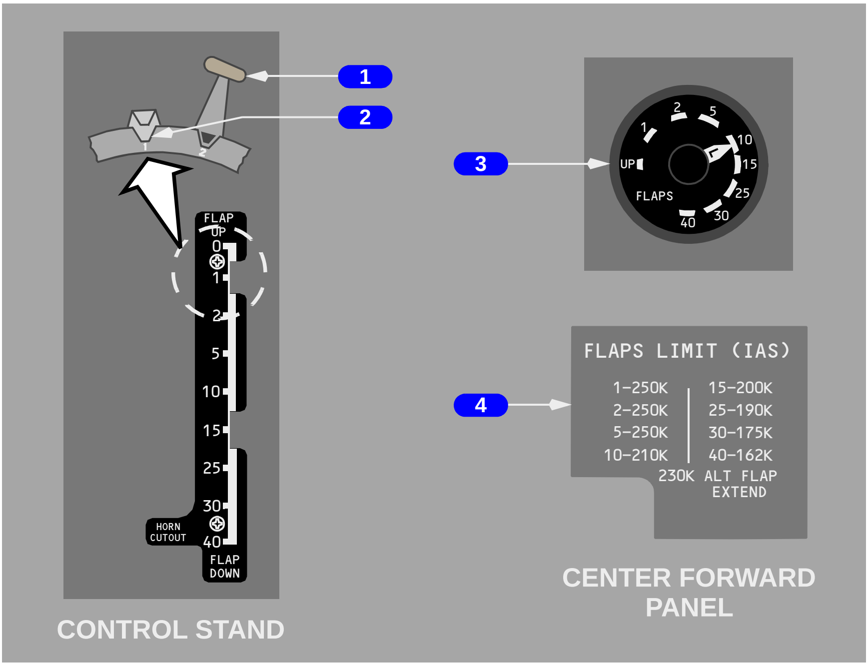
Note: On the ground, the SPEEDBRAKES EXTENDED light does not illuminate when hydraulic system A pressure is less than 750 psi.

Trailing Edge Flaps

YA701 - YA710, YM482 - YN534



YF048 - YL551, YS151 - YV754



1 FLAP Lever

- selects position of flap control valve, directing hydraulic pressure for flap drive unit
- position of the LE devices is determined by selecting TE flap position

YA701 - YT521, YV741 - YV754

- flap lever positions 30 and 40 arms the flap load relief system.

YV604, YV605

- flap lever positions 10, 15, 25, 30, and 40 arms the flap load relief system.

2 Flap Gates

Prevents inadvertent flap lever movement beyond:

- position 1 - to check flap position for one engine inoperative go-around
- position 15 - to check flap position for normal go-around.

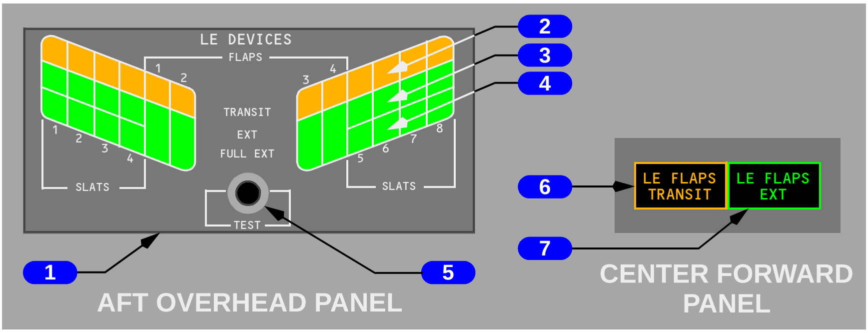
3 Flap Position Indicator

- indicates position of left and right TE flaps
- provides TE flaps asymmetry and skew indication.

4 FLAPS LIMIT Placard

Indicates maximum speed for each flap setting.

Leading Edge Devices



1 Leading Edge Devices (LE DEVICES) Annunciator Panel

Indicates position of individual LE flaps and slats.

Extinguished – related LE device retracted.

2 Leading Edge Devices TRANSIT Lights

Illuminated (amber) – related LE device in transit.

3 Leading Edge Devices Extended (EXT) Lights

Illuminated (green) – related LE slat in extended (intermediate) position.

4 Leading Edge Devices Full Extended (FULL EXT) Lights

Illuminated (green) – related LE device fully extended.

5 Leading Edge Annunciator Panel TEST Switch

Press – tests all annunciator panel lights.

YA701 - YT521, YV741 - YV754

6 Leading Edge Flaps Transit (LE FLAPS TRANSIT) Light

Illuminated (amber) –

- any LE device in transit
- any LE device not in programmed position with respect to TE flaps
- a LE uncommanded motion condition exists (two or more LE flaps or slats have moved away from their commanded position)
- during alternate flap extension until LE devices are fully extended and TE flaps reach flaps 10.

Note: Light is inhibited during autoslat operation in flight.

YV604, YV605

6 Leading Edge Flaps Transit (LE FLAPS TRANSIT) Light

Illuminated (amber) –

- any LE device in transit
- any LE device not in programmed position with respect to TE flaps
- a LE uncommanded motion condition exists (two or more LE flaps or slats have moved away from their commanded position)
- during alternate flap extension until LE devices are fully extended and TE flaps reach flaps 15.

Note: Light is inhibited during autoslat operation in flight.

YA701 - YT521, YV741 - YV754

7 Leading Edge Flaps Extended (LE FLAPS EXT) Light

Illuminated (green) –

- all LE flaps extended and all LE slats in extended (intermediate) position (TE flap positions 1, 2 and 5)
- all LE devices fully extended (TE flap positions 10 through 40).

YV604, YV605

7 Leading Edge Flaps Extended (LE FLAPS EXT) Light

Illuminated (green) –

- all LE flaps extended and all LE slats in extended (intermediate) position (TE flap positions 1, 2, 5, 10, 15, and 25)
- all LE devices fully extended (TE flap positions 30 and 40).

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Flight Controls Chapter 9

System Description Section 20

Introduction

The primary flight control system uses conventional control wheel, column and pedals linked mechanically to hydraulic power control units which command the primary flight control surfaces; ailerons, elevators and rudder. The flight controls are powered by redundant hydraulic sources; system A and system B. Either hydraulic system can operate all primary flight controls. The ailerons and elevators may be operated manually if required. The rudder may be operated by the standby hydraulic system if system A and system B pressure is not available.

The secondary flight controls, high lift devices consisting of Trailing Edge (TE) flaps and Leading Edge (LE) flaps and slats (LE devices), are powered by hydraulic system B. In the event hydraulic system B fails, the TE flaps can be operated electrically. Under certain conditions the Power Transfer Unit (PTU) automatically powers the LE devices. (Refer to Chapter 13, Hydraulics, Power Transfer Unit). They can also be extended using standby hydraulic pressure.

Pilot Controls

The pilot controls consist of:

- two control columns
- two control wheels
- two pairs of rudder pedals
- SPEED BRAKE lever
- FLAP lever
- STAB TRIM cutout switches
- STAB TRIM override switch
- stabilizer trim switches
- stabilizer trim wheel
- AILERON trim switches
- RUDDER trim control
- YAW DAMPER switch
- ALTERNATE FLAPS master switch
- alternate flaps position switch
- FLT CONTROL switches
- flight SPOILER switches

The columns and wheels are connected through transfer mechanisms which allow the pilots to bypass a jammed control or surface.

There is a rigid connection between both pairs of rudder pedals.

The SPEED BRAKE lever allows manual or automatic symmetric actuation of the spoilers.

Flight Control Surfaces

Pitch control is provided by:

- two elevators
- a movable horizontal stabilizer.

Roll control is provided by:

- two ailerons
- eight flight spoilers.

Yaw control is provided by a single rudder. During takeoff, the rudder becomes aerodynamically effective between 40 and 60 knots.

TE flaps and LE flaps and slats provide high lift for takeoff, approach and landing.

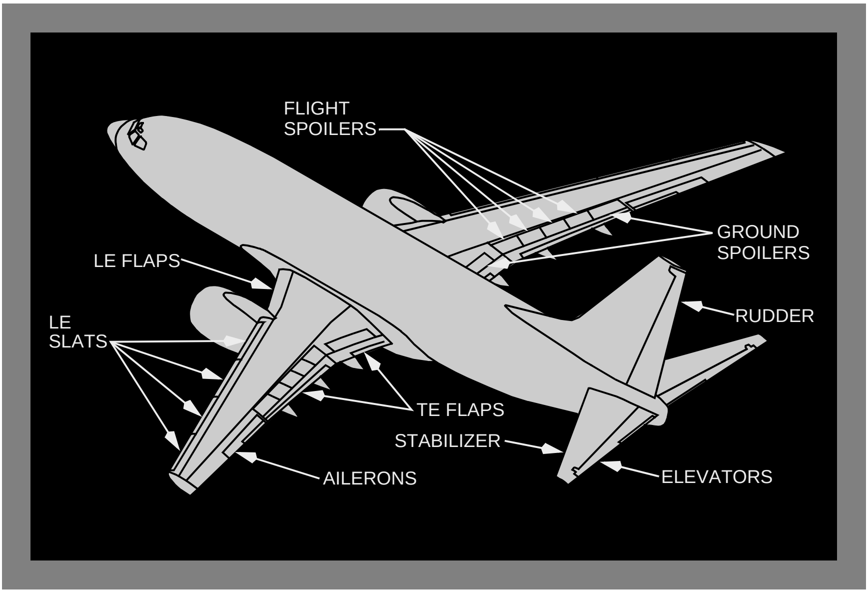
YF048 - YV754

Blended winglets provide enhanced performance, extended range and increased fuel efficiency.

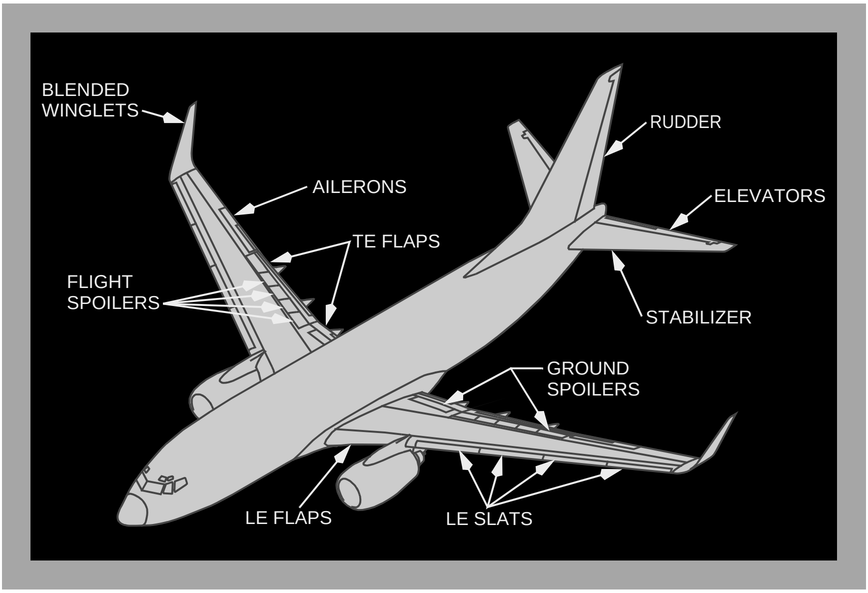
In the air symmetric flight spoilers are used as speed brakes. On the ground symmetric flight and ground spoilers destroy lift and increase braking efficiency.

Flight Control Surfaces Location

YA701 - YA710



YF048 - YV754


BLENDED WINGLETS
AILERONS
TE FLAPS
FLIGHT SPOILERS
RUDDER
ELEVATORS
STABILIZER
GROUND SPOILERS
LE FLAPS
LE SLATS

Roll Control

The roll control surfaces consist of hydraulically powered ailerons and flight spoilers, which are controlled by rotating either control wheel.

Ailerons

The ailerons provide roll control around the airplane’s longitudinal axis. The ailerons are positioned by the pilots' control wheels. The A and B FLT CONTROL switches control hydraulic shutoff valves. These valves can be used to isolate each aileron, as well as the elevators and rudder, from related hydraulic system pressure.

The Captain’s control wheel is connected by cables to the aileron Power Control Units (PCUs) through the aileron feel and centering unit. The First Officer’s control wheel is connected by cables to the spoiler PCUs through the spoiler mixer. The two control wheels are connected by a cable drive system which allows actuation of both ailerons and spoilers by either control wheel. With total hydraulic power failure the ailerons can be mechanically positioned by rotating the pilots' control wheels. Control forces are higher due to friction and aerodynamic loads.

Aileron Transfer Mechanism

If the ailerons or spoilers are jammed, force applied to the Captain’s and the First Officer’s control wheels will identify which system, ailerons or spoilers, is usable and which control wheel, Captain’s or First Officer’s, can provide roll control. If the aileron control system is jammed, force applied to the First Officer’s control wheel provides roll control from the spoilers. The ailerons and the Captain’s control wheel are inoperative. If the spoiler system is jammed, force applied to the Captain’s control wheel provides roll control from the ailerons. The spoilers and the First Officer’s control wheel are inoperative.

Aileron Trim

Dual AILERON trim switches, located on the aft electronic panel, must be pushed simultaneously to command trim changes. The trim electrically repositions the aileron feel and centering unit, which causes the control wheel to rotate and redefines the aileron neutral position. The amount of aileron trim is indicated on a scale on the top of each control column.

If aileron trim is used with the autopilot engaged, the trim is not reflected in the control wheel position. The autopilot overpowers the trim and holds the control wheel where it is required for heading/track control. Any aileron trim applied when the autopilot is engaged can result in an out of trim condition and an abrupt rolling movement when the autopilot is disconnected.

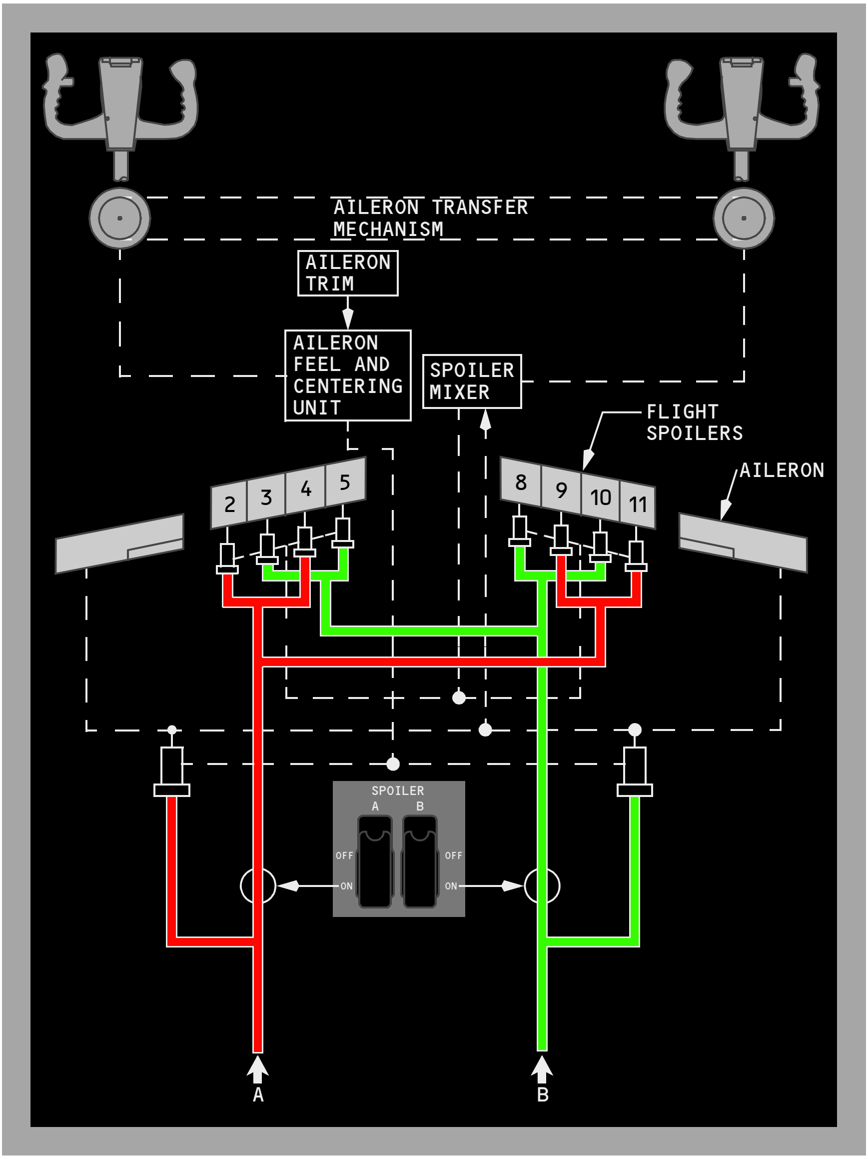
Flight Spoilers

Four flight spoilers are located on the upper surface of each wing. Each hydraulic system, A and B, is dedicated to a different set of spoiler pairs to provide isolation and maintain symmetric operation in the event of hydraulic system failure. Hydraulic pressure shutoff valves are controlled by the two flight SPOILER switches.

Flight spoiler panels are used as speed brakes to increase drag and reduce lift, both in flight and on the ground. The flight spoilers also supplement roll control in response to control wheel commands. A spoiler mixer, connected to the aileron cable-drive, controls the hydraulic power control units on each spoiler panel to provide spoiler movement proportional to aileron movement.

The flight spoilers rise on the wing with up aileron and remain faired on the wing with down aileron. When the control wheel is displaced more than approximately 10°, spoiler deflection is initiated.

Roll Control Schematic



Pitch Control

The pitch control surfaces consist of hydraulically powered elevators and an electrically powered stabilizer. The elevators are controlled by forward or aft movement of the control column. The stabilizer is controlled by autopilot trim or manual trim.

Elevators

The elevators provide pitch control around the airplane's lateral axis. The elevators are positioned by the pilots' control columns. The A and B FLT CONTROL switches control hydraulic shutoff valves for the elevators.

Cables connect the pilots' control columns to elevator Power Control Units (PCUs) which are powered by hydraulic system A and B. The elevators are interconnected by a torque tube. With loss of hydraulic system A and B the elevators can be mechanically positioned by forward or aft movement of the pilots' control columns. Control forces are higher due to friction and aerodynamic loads.

Elevator Control Column Override Mechanism

In the event of a control column jam, an override mechanism allows the control columns to be physically separated. Applying force against the jam will breakout either the Captain's or First Officer's control column. Whichever column moves freely after the breakout can provide adequate elevator control.

Although total available elevator travel is significantly reduced, there is sufficient elevator travel available for landing flare. Column forces are higher and exceed those experienced during manual reversion. If the jam exists during the landing phase, higher forces are required to generate sufficient elevator control to flare for landing. Stabilizer trim is available to counteract the sustained control column force.

Elevator Feel System

The elevator feel computer provides simulated aerodynamic forces using airspeed (from the elevator pitot system) and stabilizer position. Feel is transmitted to the control columns by the elevator feel and centering unit. To operate the feel system the elevator feel computer uses either hydraulic system A or B pressure, whichever is higher. When either hydraulic system or elevator feel pitot system fails, excessive differential hydraulic pressure is sensed in the elevator feel computer and the FEEL DIFF PRESS light illuminates.

Mach Trim System

A Mach trim system provides speed stability at the higher Mach numbers. Mach trim is automatically accomplished above Mach .615 by adjusting the elevators with respect to the stabilizer as speed increases. The flight control computers use Mach information from the ADIRU to compute a Mach trim actuator position. The Mach trim actuator repositions the elevator feel and centering unit which adjusts the control column neutral position.

Stabilizer

The horizontal stabilizer is positioned by a single electric trim motor controlled through either the stab trim switches on the control wheel or autopilot trim. The stabilizer may also be positioned by manually rotating the stabilizer trim wheel.

Stabilizer Trim

Stabilizer trim switches on each control wheel actuate the electric trim motor through the main electric stabilizer trim circuit when the airplane is flown manually. With the autopilot engaged, stabilizer trim is accomplished through the autopilot stabilizer trim circuit. The main electric and autopilot stabilizer trim have two speed modes: high speed with flaps extended and low speed with flaps retracted. If the autopilot is engaged, actuating either pair of stabilizer trim switches automatically disengages the autopilot. The stabilizer trim wheels rotate whenever electric stabilizer trim is actuated.

The STAB TRIM MAIN ELECT cutout switch and the STAB TRIM AUTOPILOT cutout switch, located on the control stand, are provided to allow the autopilot or main electric trim inputs to be disconnected from the stabilizer trim motor.

Control column actuated stabilizer trim cutout switches stop operation of the main electric and autopilot trim when the control column movement opposes trim direction. When the STAB TRIM override switch is positioned to OVERRIDE, electric trim can be used regardless of control column position.

Manual stabilizer control is accomplished through cables which allow the pilot to position the stabilizer by rotating the stabilizer trim wheels. The stabilizer is held in position by two independent brake systems. Manual rotation of the trim wheels can be used to override autopilot or main electric trim. The effort required to manually rotate the stabilizer trim wheels may be higher under certain flight conditions. Grasping the stabilizer trim wheel will stop stabilizer motion.

Stabilizer Trim Operation with Forward or Aft CG

In the event the stabilizer is trimmed to the end of the electrical trim limits, additional trim is available through the use of the manual trim wheels. If manual trim is used to position the stabilizer beyond the electrical trim limits, the stabilizer trim switches may be used to return the stabilizer to electrical trim limits.

Stabilizer Position Indication and Green Band

Stabilizer position is displayed in units on two STAB TRIM indicators located inboard of each stabilizer trim wheel. The STAB TRIM indicators also display the TAKEOFF green band indication.

The trim authority for each mode of trim is limited to:

- Main Electric Trim
    - flaps extended 0.05 to 14.5 units

    YA701 - YA710, YM482 - YN534
    - flaps retracted 4.30 to 14.5 units

    YF048 - YL551, YS151 - YV754
    - flaps retracted 3.95 to 14.5 units
- Autopilot Trim 0.05 to 14.5 units
- Manual Trim -0.20 to 16.9 units.

The green band range of the STAB TRIM indicator shows the takeoff trim range. An intermittent horn sounds if takeoff is attempted with the stabilizer trim outside the takeoff trim range.

Speed Trim System

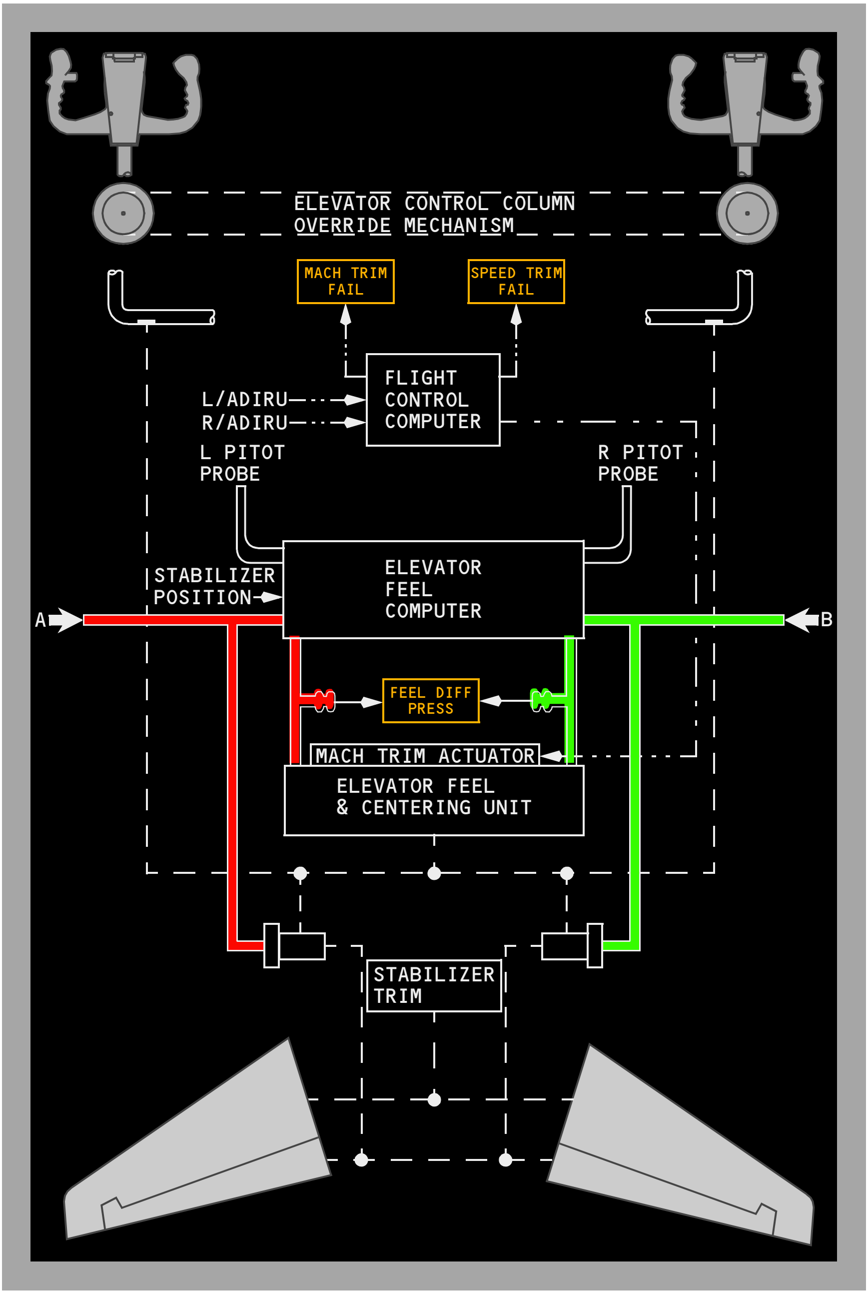
The Speed Trim System (STS) is a speed stability augmentation system designed to improve flight characteristics during operations with a low gross weight, aft center of gravity and high thrust when the autopilot is not engaged. The purpose of the STS is to return the airplane to a trimmed speed by commanding the stabilizer in a direction opposite the speed change. The STS monitors inputs of stabilizer position, thrust lever position, airspeed and vertical speed and then trims the stabilizer using the autopilot stabilizer trim. As the airplane speed increases or decreases from the trimmed speed, the stabilizer is commanded in the direction to return the airplane to the trimmed speed. This increases control column forces to force the airplane to return to the trimmed speed. As the airplane returns to the trimmed speed, the STS commanded stabilizer movement is removed.

STS operates most frequently during takeoffs, climb and go-arounds. Conditions for speed trim operation are listed below:

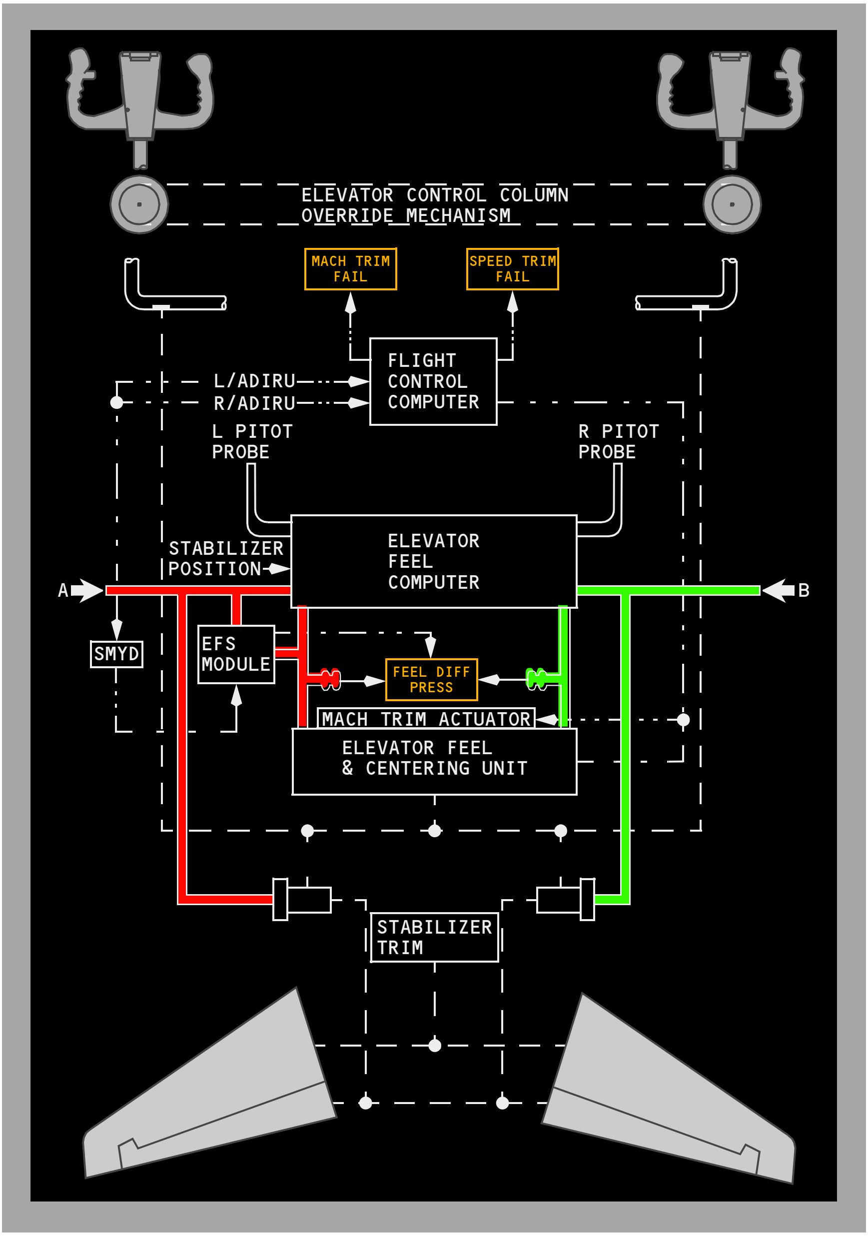
- STS Mach gain is fully enabled between 100 KIAS and Mach 0.60 with a fadeout to zero by Mach 0.68
- 10 seconds after takeoff
- 5 seconds following release of trim switches
- Autopilot not engaged
- Sensing of trim requirement

Pitch Control Schematic

YA701 - YA704



YA705 - YV754


ELEVATOR CONTROL COLUMN
OVERRIDE MECHANISM
MACH TRIM FAIL
SPEED TRIM FAIL
L/ADIRU
R/ADIRU
FLIGHT CONTROL COMPUTER
L PITOT PROBE
R PITOT PROBE
STABILIZER POSITION
ELEVATOR FEEL COMPUTER
A
B
SMYD
EFS MODULE
FEEL DIFF PRESS
MACH TRIM ACTUATOR
ELEVATOR FEEL & CENTERING UNIT
STABILIZER TRIM

Stall Identification

YA705 - YV754

Stall identification and control is enhanced by the yaw damper, the Elevator Feel Shift (EFS) module and the speed trim system. These three systems work together to help the pilot identify and prevent further movement into a stall condition.

During high AOA operations, the Stall Management/Yaw Damper (SMYD) reduces yaw damper commanded rudder movement.

The EFS module increases hydraulic system A pressure to the elevator feel and centering unit during a stall. This increases forward control column force to approximately four times normal feel pressure. The EFS module is armed whenever an inhibit condition is not present. Inhibit conditions are: on the ground, radio altitude less than 100 feet and autopilot engaged. However, if EFS is active when descending through 100 feet RA, it remains active until AOA is reduced below approximately stickshaker threshold. There are no flight deck indications that the system is properly armed or activated.

As airspeed decreases towards stall speed, the speed trim system trims the stabilizer nose down and enables speed trim above stickshaker AOA. With this trim schedule the pilot must pull more aft column to stall the airplane. With the column aft, the amount of column force increase with the onset of EFS module is more pronounced.

Yaw Control

Yaw control is accomplished by a hydraulically powered rudder and a digital yaw damper system. The rudder is controlled by displacing the rudder pedals. The yaw damping functions are controlled through the Stall Management/Yaw Damper (SMYD) computers.

Rudder (with Rudder System Enhancement Program (RSEP) installed)

The rudder provides yaw control about the airplane's vertical axis. The A and B FLT CONTROL switches control hydraulic shutoff valves for the rudder and the standby rudder.

Each set of rudder pedals is mechanically connected by cables to the input levers of the main and standby rudder PCUs. The main PCU consists of two independent input rods, two individual control valves, and two separate actuators; one for Hydraulic system A and one for Hydraulic system B. The standby rudder PCU is controlled by a separate input rod and control valve and powered by the standby hydraulic system. All three input rods have individual jam override mechanisms that allows input commands to continue to be transferred to the remaining free input rods if an input rod or downstream hardware is hindered or jammed.

At speeds above approximately 135 kts, both hydraulic system A and B pressure are each reduced within the main PCU by approximately 25% each. This function limits full rudder authority in flight after takeoff and before landing.

The main rudder PCU contains a Force Fight Monitor (FFM) that detects opposing pressure (force fight) between A and B actuators. This may occur if either system A or B input is jammed or disconnected. The FFM output is used to automatically turn on the Standby Hydraulic pump, open the standby rudder shutoff valve to pressurize the standby rudder PCU, and illuminate the STBY RUD ON, Master Caution, and Flight Control (FLT CONT) lights.

The standby rudder PCU is powered by the standby hydraulic system. The standby hydraulic system is provided as a backup if system A and/or B pressure is lost. With the standby PCU powered the pilot retains adequate rudder control capability. It can be operated manually through the FLT CONTROL switches or automatically. (Refer to Chapter 13, Hydraulics, Standby Hydraulic System)

An amber STBY RUD ON light illuminates when the standby rudder hydraulic system is pressurized. The standby rudder system can be pressurized with either Flight Control switch, automatically during takeoff or landing (Refer to Chapter 13, Hydraulics, Standby Hydraulic System) or automatically by the Force Fight Monitor. The STBY RUD ON light illumination activates Master Caution and Flight Control warning lights on the Systems Annunciation Panel.

Rudder Trim

The RUDDER trim control, located on the aft electronic panel, electrically repositions the rudder feel and centering unit which adjusts the rudder neutral position. The rudder pedals are displaced proportionately. The RUDDER TRIM indicator displays the rudder trim position in units.

Yaw Damper

The yaw damper system consists of a main and standby yaw damper. Both yaw dampers are controlled through Stall Management/Yaw Damper (SMYD) computers. The SMYD computers receive inputs from both ADIRUs, both control wheels and the YAW DAMPER switch. SMYDs provide yaw damper inputs to the main rudder Power Control Unit (PCU) or standby rudder PCU, as appropriate.

YA701 - YA706, YA708, YK626, YK627, YK961 - YK966, YK968 - YL077, YM482 - YM484
(SB Changes YA707, YA709, YA710, YK622 - YK625, YK628 - YK630, YK967, YL541 - YL544)
Either yaw damper is capable of providing dutch roll prevention, gust damping and turn coordination. Yaw damper operation does not result in rudder pedal movement. Only main yaw damper inputs are shown on the yaw damper indicator. The pilot can override either main or standby yaw damper inputs using either the rudder pedals or trim inputs.

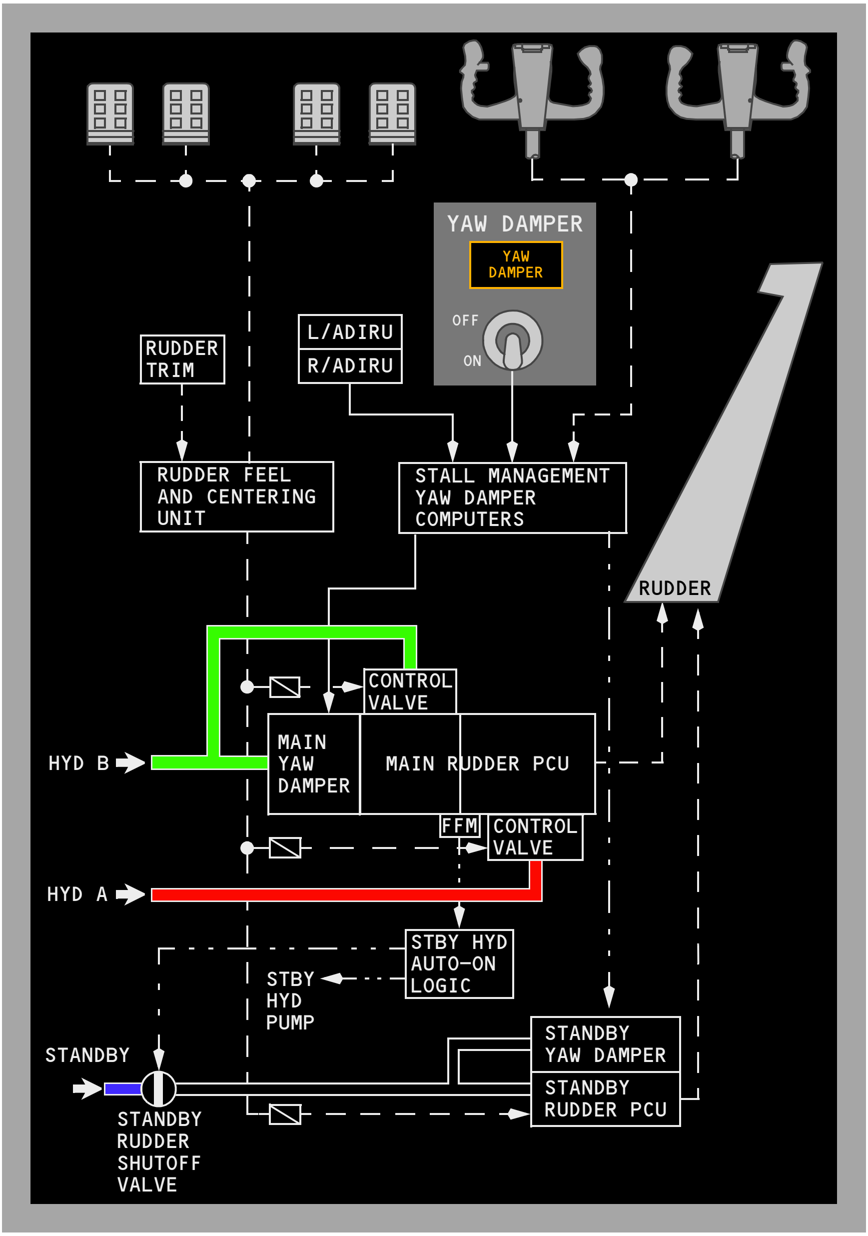
YF048 - YF928, YL545 - YL551, YN531 - YV754
(SB Changes YA707, YA709, YA710, YK622 - YK625, YK628 - YK630, YK967, YL541 - YL544)
Either yaw damper is capable of providing dutch roll prevention, gust damping and turn coordination. Yaw damper operation does not result in rudder pedal movement. The pilot can override either main or standby yaw damper inputs using either the rudder pedals or trim inputs.

During normal operation the main yaw damper uses hydraulic system B and the SMYD computers provide continuous system monitoring. The YAW DAMPER Switch automatically moves to OFF, the amber YAW DAMPER light illuminates and the YAW DAMPER switch cannot be reset to ON when any of the following conditions occur:

- SMYD senses a yaw damper system fault,
- SMYD senses that the yaw damper does not respond to a command,
- B FLT CONTROL switch is positioned to OFF or STBY RUD.

During manual reversion flight (loss of hydraulic system A and B pressure), both FLT CONTROL switches are positioned to STBY RUD. In this case, the YAW DAMPER switch can be reset to ON and the standby hydraulic system powers the standby yaw damper. During Standby Yaw Damper operation, movement of the control wheel sends a signal to the standby rudder PCU to move the rudder. This gives rudder assist to help turn the airplane when control of the ailerons is through manual reversion.

Yaw Control Schematic



Speed Brakes

The speed brakes consist of flight spoilers and ground spoilers. Hydraulic system A powers all four ground spoilers, two on the upper surface of each wing. The SPEED BRAKE lever controls the spoilers. When the SPEED BRAKE lever is actuated all the spoilers extend when the airplane is on the ground and only the flight spoilers extend when the airplane is in the air.

The SPEEDBRAKES EXTENDED light provides an indication of spoiler operation in-flight and on the ground. In-flight, the light illuminates to warn the crew that the speed brakes are extended while in the landing configuration or below 800 feet AGL. On the ground, the light illuminates when hydraulic pressure is sensed in the ground spoiler shutoff valve with the speed brake lever in the DOWN position.

In-Flight Operation

Operating the SPEED BRAKE lever in flight causes all flight spoiler panels to rise symmetrically to act as speed brakes. Caution should be exercised when deploying flight spoilers during a turn, as they greatly increase roll rate. When the speed brakes are in an intermediate position roll rates increase significantly. Moving the SPEED BRAKE lever beyond the FLIGHT DETENT causes buffeting and is prohibited in flight.

YM482 - YN534
The speed brake load alleviation feature limits the deployment of the speed brakes under certain high gross weight/airspeed combinations. Under these conditions, if the speed brakes are deployed to the FLIGHT DETENT, they automatically retract to 50 percent of the FLIGHT DETENT. The SPEED BRAKE lever moves to reflect the position of the speed brakes. Manual override is available. Increased force is needed to move the SPEED BRAKE lever beyond the 50 percent position with load alleviation active. The SPEED BRAKE lever must be held in place when manual override is used between 50 percent and the UP position. The SPEED BRAKE lever will remain stationary if moved to UP with load alleviation active. When load alleviation deactivates, the speed brakes can be manually returned to the FLIGHT DETENT position.

YV604, YV605
A lever stop feature is incorporated into the SPEED BRAKE lever mechanism. The lever stop prevents the SPEED BRAKE lever from being moved beyond the FLIGHT DETENT when the airplane is in flight with the flaps up. In the event of the loss of electrical power the lever stop is removed and full speed brake lever movement is available.

Ground Operation

During landing, the auto speed brake system operates when these conditions occur:

- SPEED BRAKE lever is in the ARMED position
- SPEED BRAKE ARMED light is illuminated
- radio altitude is less than 10 feet
- landing gear strut compresses on touchdown

Note: Compression of any landing gear strut enables the flight spoilers to deploy. Compression of the right main landing gear strut enables the ground spoilers to deploy.

- both thrust levers are retarded to IDLE
- main landing gear wheels spin up (more than 60 kts).

The SPEED BRAKE lever automatically moves to the UP position and the spoilers deploy.

YV604, YV605

Note: Following an all flaps up (no flap) landing, the SPEED BRAKE lever will not move beyond the FLIGHT DETENT and the spoilers will not fully deploy.

If a wheel spin-up signal is not detected, when the air/ground system senses ground mode (any gear strut compresses) the SPEED BRAKE lever moves to the UP position and flight spoiler panels deploy automatically. When the right main landing gear strut compresses, a mechanical linkage opens the ground spoiler interlock valve and the ground spoilers deploy.

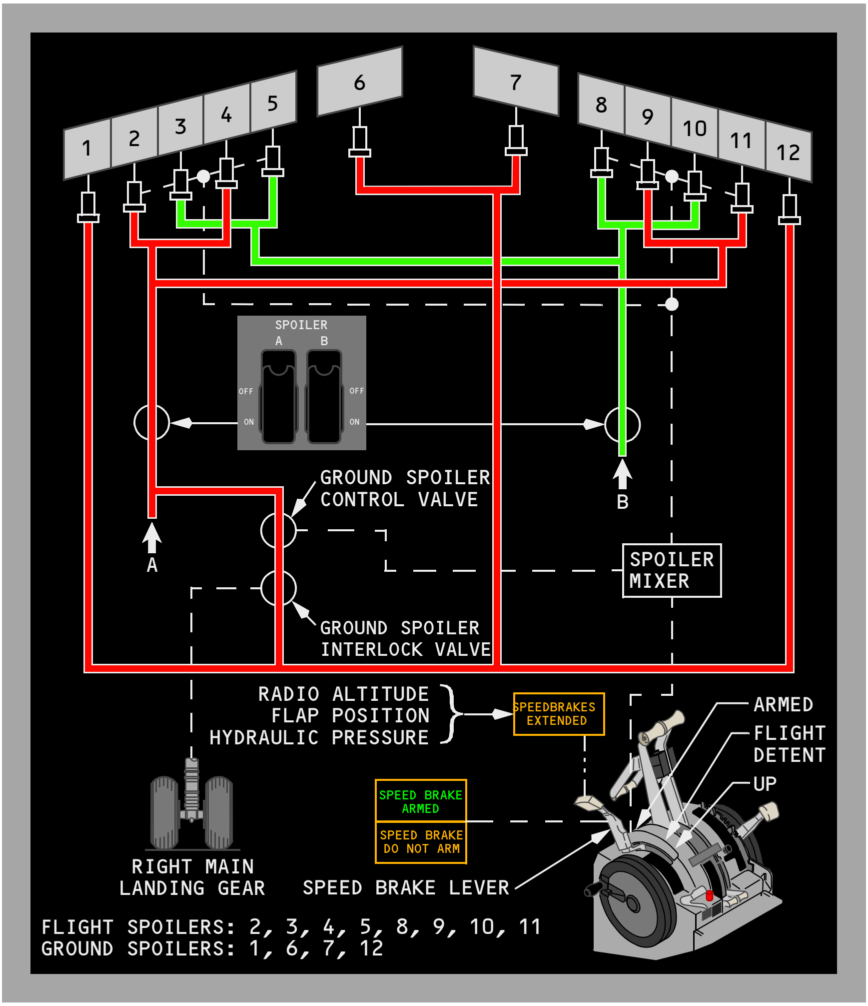
If the SPEED BRAKE lever is in the DOWN position during landing or rejected takeoff, the auto speed brake system operates when these conditions occur:

- main landing gear wheels spin up (more than 60 kts)
- both thrust levers are retarded to IDLE
- reverse thrust levers are positioned for reverse thrust.

The SPEED BRAKE lever automatically moves to the UP position and spoilers deploy.

After an RTO or landing, if either thrust lever is advanced, the SPEED BRAKE lever automatically moves to the DOWN detent and all spoiler panels retract. The spoiler panels may also be retracted by manually moving the SPEED BRAKE lever to the DOWN detent.

Speed Brakes Schematic



Flaps and Slats

The flaps and slats are high lift devices that increase wing lift and decrease stall speed during takeoff, low speed maneuvering and landing.

LE devices consist of four flaps and eight slats: two flaps inboard and four slats outboard of each engine. Slats extend to form a sealed or slotted leading edge depending on the TE flap setting. The TE devices consist of double slotted flaps inboard and outboard of each engine.

YA701 - YV605
TE flap positions 1–15 provide increased lift; positions 15–40 provide increased lift and drag. Flaps 15, 30 and 40 are normal landing flap positions. Flaps 15 is normally limited to airports where approach climb performance is a factor. Runway length and conditions must be taken into account when selecting a landing flap position.

To prevent excessive structural loads from increased Mach at higher altitude, flap extension above 20,000 feet should not be attempted.

Flap and Slat Sequencing

LE devices and TE flaps are normally extended and retracted by hydraulic power from system B. When the FLAP lever is in the UP detent, all flaps and LE devices are commanded to the retracted or up position. Moving the FLAP lever aft allows selection of flap detent positions 1, 2, 5, 10, 15, 25, 30, or 40. The LE devices deployment is sequenced as a function of TE flaps deployment.

YA701 - YT521, YV741 - YV754
When the FLAP lever is moved from the UP position to the 1, 2, or 5 position, the TE flaps extend to the commanded position and the LE:

- flaps extend to the full extended position and
- slats extend to the extend position.

YA701 - YT521, YV741 - YV754
When the FLAP lever is moved beyond the 5 position the TE flaps extend to the commanded position and the LE:

- flaps remain at the full extended position and
- slats extend to the full extended position.

YV604, YV605
When the FLAP lever is moved from the UP position to the 1, 2, 5, 10, 15, or 25 position, the TE flaps extend to the commanded position and the LE:

- flaps extend to the full extended position and
- slats extend to the extend position.

YV604, YV605
When the FLAP lever is moved beyond the 25 position the TE flaps extend to the commanded position and the LE:

- flaps remain at the full extended position and
- slats extend to the full extended position.

The LE devices sequence is reversed upon retraction.

Mechanical gates hinder inadvertent FLAP lever movement beyond flaps 1 for one engine inoperative go–around and flaps 15 for normal go–around.

Indicator lights on the center instrument panel provide overall LE devices position status. The LE DEVICES annunciator panel on the aft overhead panel indicates the positions of the individual flaps and slats.

Flap Load Relief

YA701 - YT521, YV741 - YV754
The Flap Slat Electronic Unit (FSEU) provides a TE flap load relief function which protects the flaps from excessive air loads. This function is operative at the flaps 30 and flaps 40 positions only. The FLAP lever does not move, but the flap position indicator displays flap retraction and re–extension.

YA701 - YT521, YV741 - YV754
When the flaps are set at 40, the TE flaps:

- retract to 30 if airspeed exceeds 163 knots
- re–extend when airspeed is reduced below 158 knots.

YA701 - YT521, YV741 - YV754
When the flaps are set at 30, the TE flaps:

- retract to 25 if the airspeed exceeds 176 knots
- re–extend when airspeed is reduced below 171 knots.

YV604, YV605
The Flap Slat Electronic Unit (FSEU) provides a TE flap load relief function which protects the flaps from excessive air loads. This function is operative at the flaps 10, 15, 25, 30 and flaps 40 positions. The FLAP lever does not move, but the flap position indicator displays flap retraction and re–extension.

YV604, YV605
When the flaps are set at 40, the TE flaps:

- retract to 30 if airspeed exceeds 163 knots
- re–extend when airspeed is reduced below 158 knots.

When the flaps are set at 30, the TE flaps:

- retract to 25 if the airspeed exceeds 176 knots
- re–extend when airspeed is reduced below 171 knots.

When the flaps are set at 25, the TE flaps:

- retract to 15 if the airspeed exceeds 191 knots
- re–extend when airspeed is reduced below 186 knots.

When the flaps are set at 15, the TE flaps:

- retract to 10 if the airspeed exceeds 201 knots
- re–extend when airspeed is reduced below 196 knots.

When the flaps are set at 10, the TE flaps:

- retract to 5 if the airspeed exceeds 211 knots
- re–extend when airspeed is reduced below 206 knots.

Autoslats

Autoslat operation is normally powered by hydraulic system B. An alternate source of power is provided by system A through a Power Transfer Unit (PTU) if a loss of pressure is sensed from the higher volume system B engine driven pump. The PTU uses system A pressure to power a hydraulic motorized pump, pressurizing system B fluid to provide power for the autoslat operation. (Refer to Chapter 13, Hydraulics, Power Transfer Unit)

YA701 - YT521, YV741 - YV754
At flap positions 1, 2, and 5 an autoslat function is available that moves the LE slats to full extended if the airplane approaches a stall condition.

YA701 - YT521, YV741 - YV754
The autoslat system is designed to enhance airplane stall characteristics at high angles of attack during takeoff or approach to landing. When TE flaps 1 through 5 are selected, the LE slats are in the extend position. As the airplane approaches the stall angle, the slats automatically begin driving to the full extended position prior to stick shaker activation. The slats return to the extend position when the pitch angle is sufficiently reduced below the stall critical attitude.

YV604, YV605
At flap positions 1, 2, 5, 10, 15, and 25 an autoslat function is available that moves the LE slats to full extended if the airplane approaches a stall condition.

YV604, YV605
The autoslat system is designed to enhance airplane stall characteristics at high angles of attack during takeoff or approach to landing. When TE flaps 1 through 25 are selected, the LE slats are in the extend position. As the airplane approaches the stall angle, the slats automatically begin driving to the full extended position prior to stick shaker activation. The slats return to the extend position when the pitch angle is sufficiently reduced below the stall critical attitude.

Alternate Extension

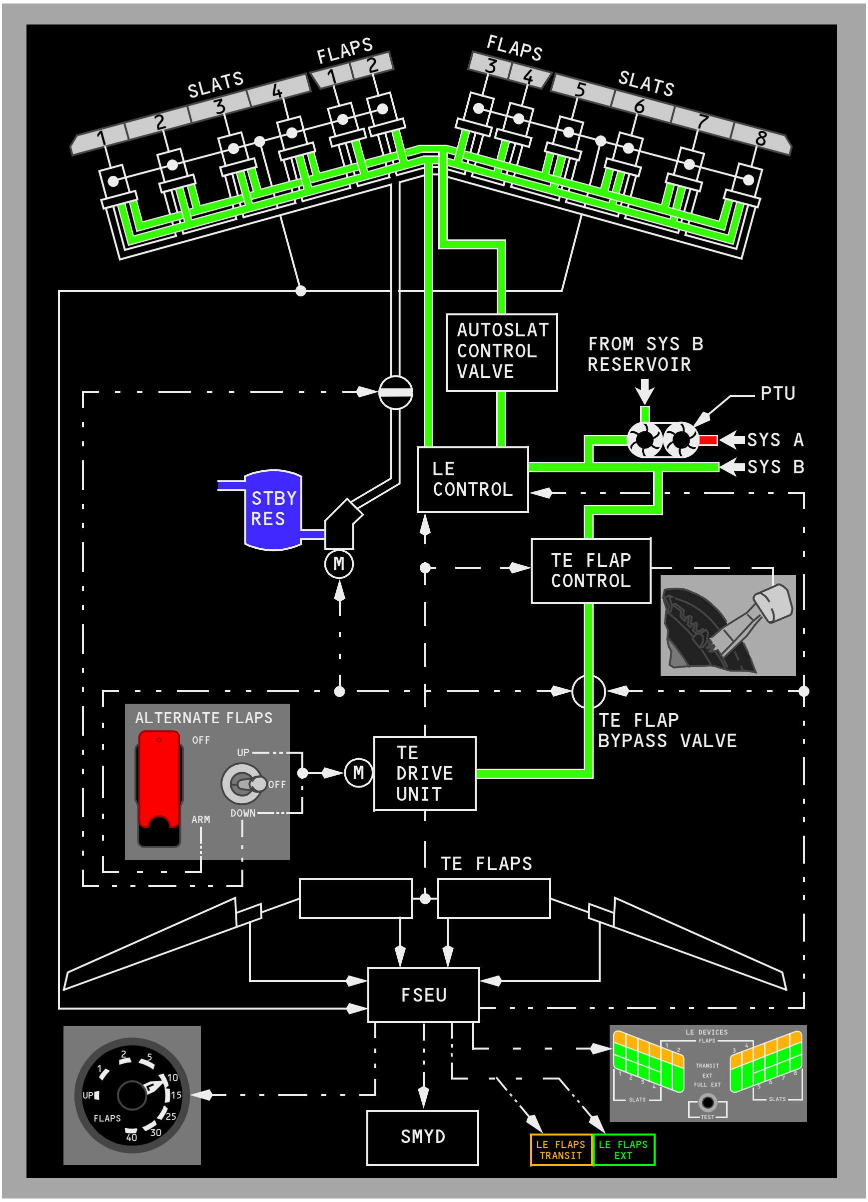
In the event that hydraulic system B fails, an alternate method of extending the LE devices and extending and retracting the TE flaps is provided.

The TE flaps can be operated electrically through the use of two alternate flap switches. The guarded ALTERNATE FLAPS master switch closes a flap bypass valve to prevent hydraulic lock of the flap drive unit and arms the alternate flaps position switch. The ALTERNATE FLAPS position switch controls an electric motor that extends or retracts the TE flaps. The switch must be held in the DOWN position until the flaps reach the desired position. No asymmetry or skew protection is provided through the alternate (electrical) flap drive system.

When using alternate flap extension the LE flaps and slats are driven to the full extended position using power from the standby hydraulic system. In this case the ALTERNATE FLAPS master switch energizes the standby pump and the ALTERNATE FLAPS position switch, held in the down position momentarily, fully extends the LE devices.

Note: The LE devices cannot be retracted by the standby hydraulic system.

Leading Edge Devices and Trailing Edge Flaps Schematic



Asymmetry and Skew Detection and Protection

The Flap Slat Electronic Unit (FSEU) continuously monitors the position of wing LE and TE high lift devices. If a device on one wing does not align with the symmetrical device on the other wing, there is an asymmetry condition. A skew condition occurs when symmetrical TE flaps do not operate at the same rate causing the panels to twist during extension or retraction. Should a skew occur, the FSEU automatically protects against roll by maintaining flap symmetry.

Trailing Edge Flap Position Indication

Wing TE position indications come from the FSEU. When the FSEU detects a TE asymmetry or skew condition, the FSEU:

- closes the TE flap bypass valve
- displays a needle split on the flap position indicator
- shows position of left and right wing trailing edge flaps.

Leading Edge Device Improper Position Indication

Wing LE position indications come from the FSEU. When the FSEU detects a LE device in an improper position, the LE FLAPS TRANSIT light remains illuminated and one of the following indications is displayed on the LE DEVICES annunciator panel:

- TRANSIT (amber) - Leading edge devices are in transit, or are not in the selected position
- EXT (green) - Leading edge slats and flaps in extend position, or are in the selected position
- FULL EXT (green) - Leading edge slats are in the full extend position
- no lights illuminated - Leading edge devices are in the retract position.

Uncommanded Motion Detection, Protection and Indication

The FSEU provides protection from uncommanded motion by the LE devices or TE flaps.

Leading Edge Uncommanded Motion

Uncommanded motion is detected when no TE flap position or autoslat command is present and:

- two LE flaps move on one wing, or
- two or more slats move on one wing.

The FSEU shuts down the LE control and illuminates the amber LE FLAPS TRANSIT light.

In addition, to prevent uncommanded motion from occurring on the LE devices during cruise, the FSEU maintains pressure on the retract lines and depressurizes the extend and full extend lines.

Trailing Edge Uncommanded Motion

Uncommanded motion is detected when no FLAP lever or flap load relief command is present and the TE flaps:

- move away from the commanded position
- continue to move after reaching a commanded position, or
- move in a direction opposite to that commanded.

The FSEU shuts down the TE drive unit by closing the TE flap bypass valve. The TE flap shutdown cannot be reset by the flight crew and they must use the alternate flap system to control TE flaps. The shutdown is indicated by the flap position indicator disagreeing with the FLAP lever position. There is no flap needle split.

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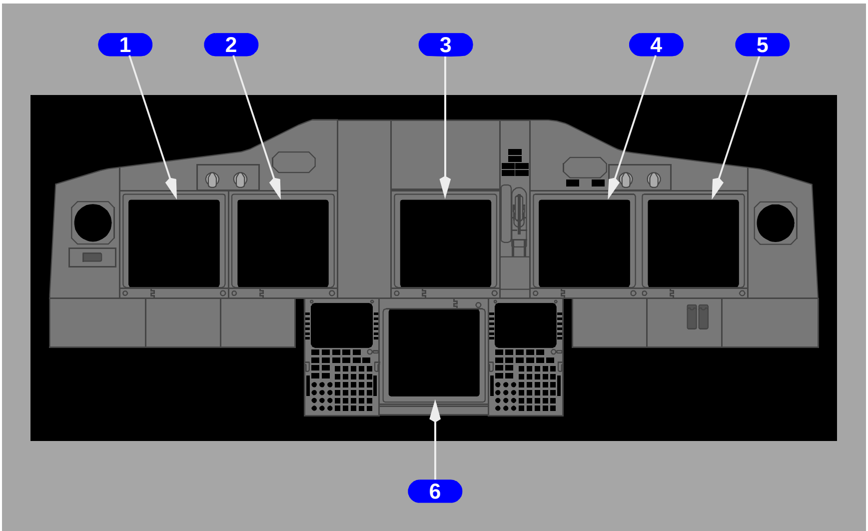
Flight Instruments, Displays Chapter 10

Table of Contents Section TOC

PFD/ND Display System – Overview

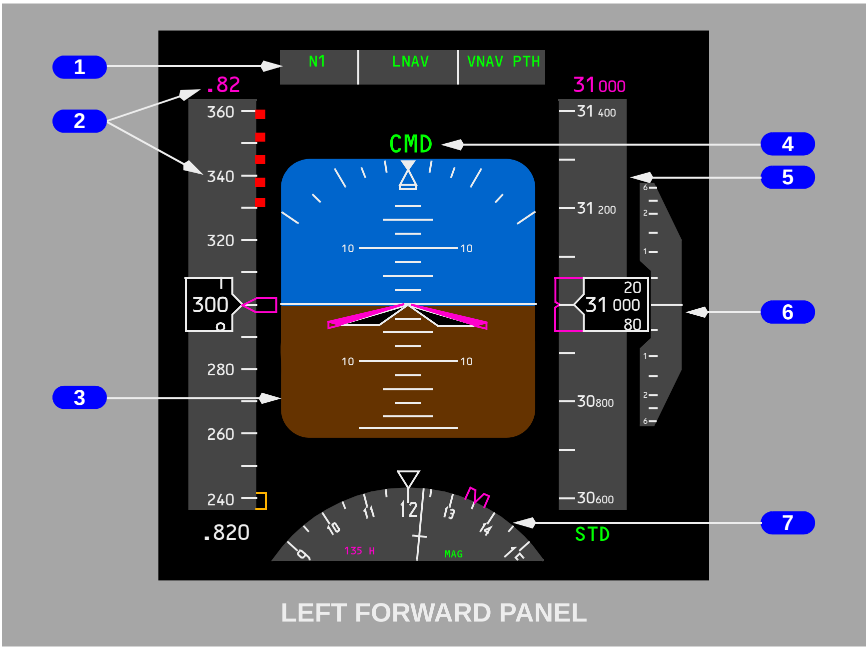
Display Units



LEFT, CENTER AND RIGHT FORWARD PANEL

- **1** Captain Outboard Display Unit
- **2** Captain Inboard Display Unit
- **3** Upper Display Unit
- **4** First Officer Inboard Display Unit
- **5** First Officer Outboard Display Unit
- **6** Lower Display Unit

Captain Outboard Display



1 Flight Mode Annunciator

Displays current flight modes; refer to Chapter 4, Automatic Flight.

2 Airspeed/Mach Indications

3 Attitude Indications

4 Autopilot, Flight Director System Status

5 Altitude Indications

6 Vertical Speed Indications

7 Heading/Track Indications

Captain Inboard Display

YA701 - YA706

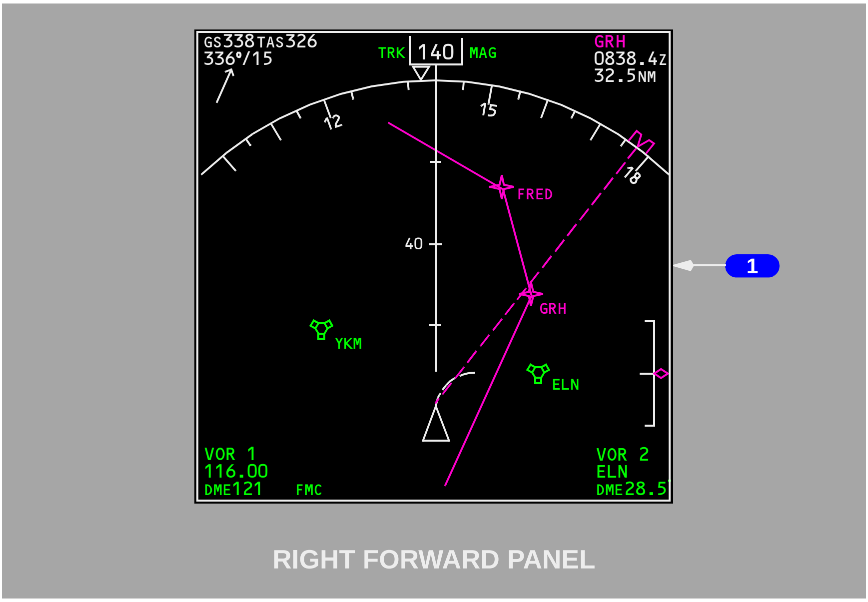
YA707 - YV754

1 Navigation Display

Displays map, approach, VOR, or plan modes as selected on the EFIS control panel.

First Officer Inboard Display

YA701 - YA706

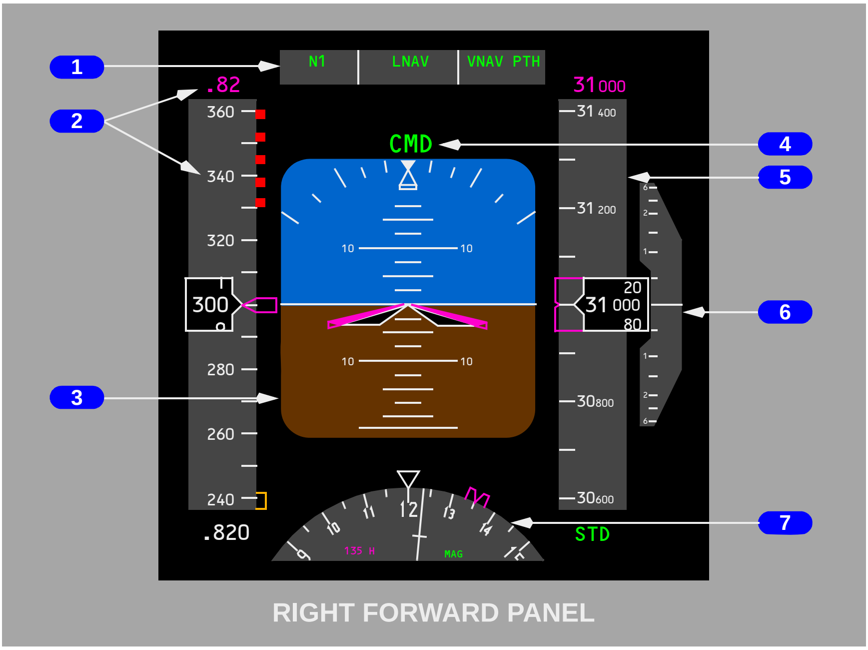


YA707 - YV754

1 Navigation Display

Displays map, approach, VOR, or plan modes as selected on the EFIS control panel.

First Officer Outboard Display



1 Flight Mode Annunciator

Displays current flight modes; refer to Chapter 4, Automatic Flight.

2 Airspeed/Mach Indications

3 Attitude Indications

4 Autopilot, Flight Director System Status

5 Altitude Indications

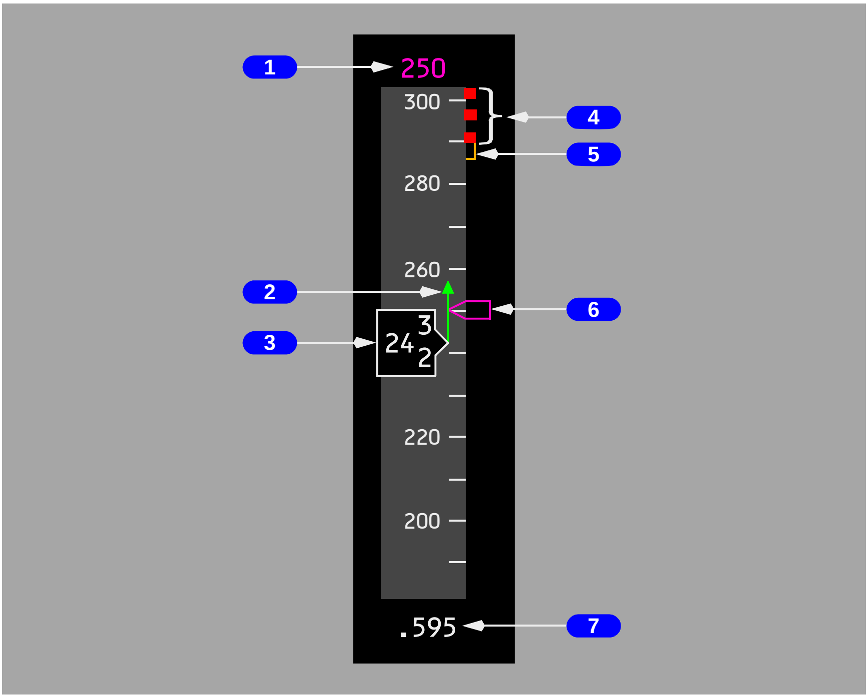
6 Vertical Speed Indications

7 Heading/Track Indications

PFD Airspeed Indications

Airspeed Indications – General

The PFD airspeed indication displays air data inertial reference system (ADIRS) airspeed and other airspeed related information.



1 Selected Speed (magenta)

Displays target airspeed:

- indicates the airspeed manually selected in the IAS/MACH window
- indicates the FMC computed airspeed when the IAS/MACH window is blank.

2 Speed Trend Vector (green)

Tip of arrow indicates predicted airspeed in the next 10 seconds based on the current airspeed and acceleration.

3 Current Airspeed (white)

Indicates current calibrated airspeed in knots.

When current airspeed decreases into the minimum maneuver speed amber bar:

- airspeed readout box turns amber and flashes for 10 seconds

YF048 - YF928, YK976 - YK980, YL545 - YL551, YN531 - YN534, YS180 - YS190, YT501 - YV754

- voice alert annunciate “Airspeed Low, Airspeed Low” once
- box returns to white when airspeed is above minimum maneuver speed.

4 Maximum Operating Speed (red and black)

Bottom of the bar indicates the maximum speed as limited by the lowest of the following:

- Vmo/Mmo
- landing gear placard speed
- flap placard speed.

5 Maximum Maneuver Speed/High Speed Buffet (amber)

When flaps are up, the bottom of the amber bar indicates the maximum maneuver speed. This airspeed provides 1.3g maneuver capability to high speed buffet (or an alternative approved maneuver capability set in the FMC maintenance pages). The bar may be displayed when operating at high altitude at relatively high gross weights.

Note: 1.3g maneuver capability occurs at 40 degrees of bank in level flight.

6 Speed Bug (magenta)

Points to the airspeed:

- manually selected in the IAS/MACH window
- indicates the FMC computed airspeed when the IAS/MACH window is blank.

When the selected speed is off scale, the bug is parked at the top or bottom of the tape, with only one half bug visible.

YA701 - YA710, YM482 - YM484

7 Current Mach (white)

Indicates current Mach number:

- displays when airspeed is 0.40 Mach and above
- blanks when airspeed decreases below 0.40 Mach.

YF048 - YL551, YN531 - YV754

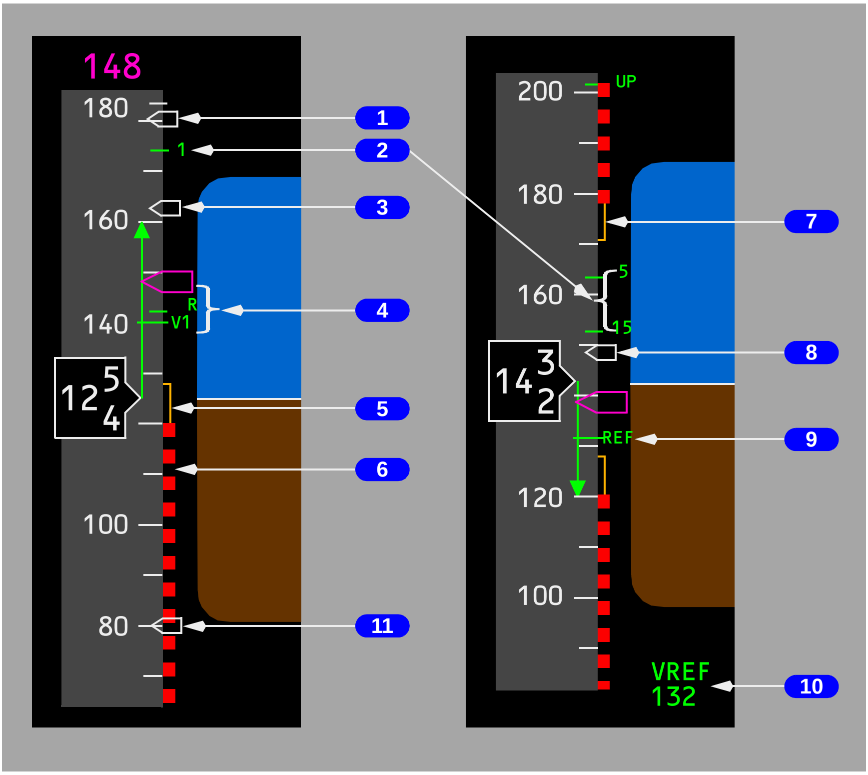
7 Current Mach/Groundspeed (white)

Indicates current Mach or groundspeed:

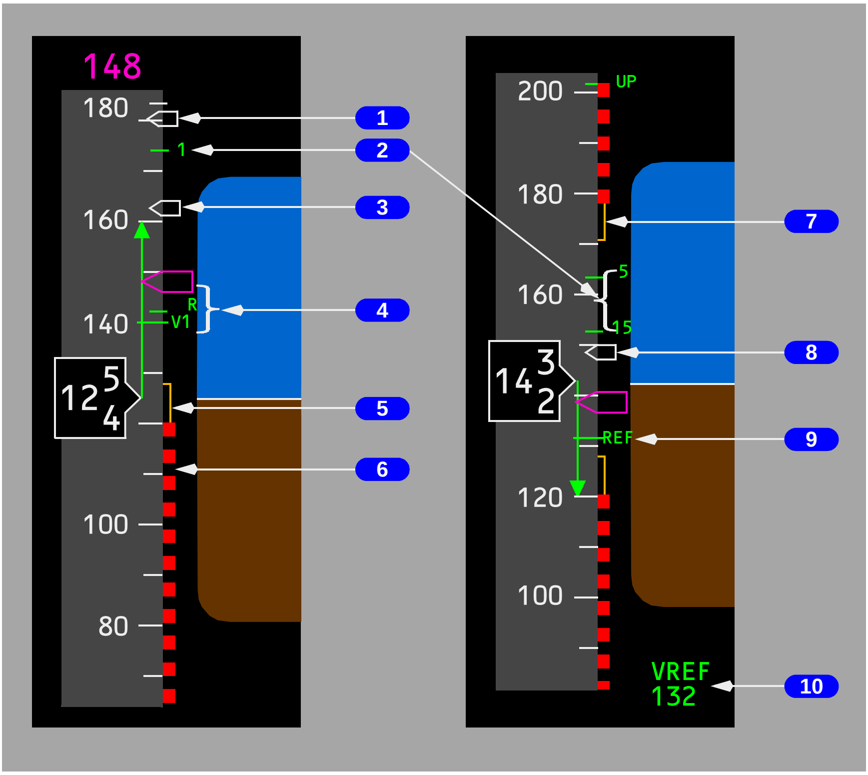
- displays Mach when airspeed is 0.40 Mach and above
- displays groundspeed when airspeed decreases below 0.40 Mach
- when transitioning from Mach to groundspeed or from groundspeed to Mach, a white box shows around the numeric value for 10 seconds.

Airspeed Indications – Takeoff and Approach

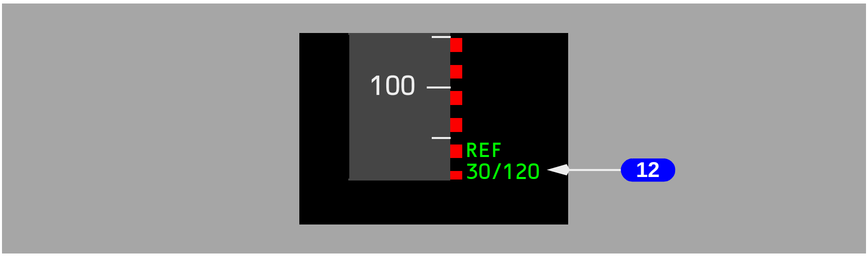
YF048 - YL551, YN531 - YV754



YA701 - YA710, YM482 - YM484



YF048 - YL551, YN531 - YV754



1 Bug 5 (white)

Displayed if speed reference selector on the engine display control panel is in the bug 5 position or SET position and a value greater than 60 knots has been selected. Not available if the speed reference selector is in the AUTO position.

2 Flaps Maneuvering Speeds (green)

Indicates flap maneuvering speed for the displayed flap position:

- displayed after gross weight is entered in the CDU or after takeoff gross weight is set with the speed reference selector
- when the V2+15 bug is displayed for takeoff, the flap maneuvering speed bug for the current flap setting is not displayed, except for flaps 1 takeoff
- numbered flap maneuvering speed bugs are removed when flap lever is moved to flaps 30 or 40
- flap bugs inhibited if less than VREF +4
- UP bug not displayed above approximately 20,000 feet altitude.

3 V2+15 (white)

Displayed for takeoff.

Removed when either of the following occurs:

- at first flap retraction
- when VREF is entered in the CDU.

4 Takeoff Reference Speeds (green)

Indicates V1 (decision speed “V1”) and VR (rotation speed “VR”) as selected on the CDU TAKEOFF REF page (refer to Chapter 11, Flight Management, Navigation) or as set with the SPD REF selector switch:

- amber NO VSPD is displayed on the ground if V1 and VR are not selected on the CDU or are not set with the SPD REF selector
- displayed for takeoff when speed is greater than 80 knots
- removed at lift–off
- V1 speed is displayed at the top of airspeed indication when selected and value is off scale
- V1 is automatically called out by voice aural.

5 Minimum Maneuver Speed (amber)

The amber bar is displayed with the first flap retraction after takeoff or when a valid Vref is entered.

Top of amber bar indicates minimum maneuver speed. This airspeed provides

- 1.3g maneuver capability to stick shaker below approximately 20,000 ft.
- 1.3g maneuver capability to low speed buffet (or an alternative approved maneuver capability set in the FMC maintenance pages) above approximately 20,000 ft.

Note: 1.3g maneuver capability occurs at 40 degrees of bank in level flight.

CAUTION: Reduced maneuver capability exists when operating within the amber regions below the minimum maneuver speed or above the maximum maneuver speed. During non-normal conditions the target speed may be below the minimum maneuver speed.

6 Minimum Speed (red and black)

Top of bar indicates the speed at which stick shaker occurs.

7 Maximum Maneuver Speed/Next Flap Position Placard Speed (amber)

Shortly after takeoff the amber bar may be displayed until airspeed exceeds 160 knots or until first flap retraction.

When flaps are not up, the bottom of the amber bar indicates the placard speed for the next normal flap setting. The display logic is based on a normal flap setting sequence of 1, 5, 15, 30, 40. The bar is removed when the flap handle is moved to the landing flap setting selected on the APPROACH REF page or when the flap lever is moved to flaps 40. It is also removed with any flap retraction.

YA701 - YA710, YM482 - YN534

8 VREF+15 (white)

Displayed with selection of VREF.

YF048 - YL551, YS151 - YV754

8 VREF+20 (white)

Displayed with selection of VREF.

9 Landing Reference Speed (green)

Indicates REF (reference speed) as selected on the CDU APPROACH REF page (refer to Chapter 11, Flight Management, Navigation) or as set with the speed reference selector on the engine display control panel.

REF speed is displayed at the bottom of airspeed indication when selected and value is off scale.

YA701 - YV750

10 Speed Reference Display (green)

Displayed if the airspeed and/or weight is entered via the speed reference selector on the engine display control panel:

- on the ground, V1, VR, and takeoff gross weight may be selected; if VREF is selected, INVALID ENTRY is displayed
- in flight, VREF and landing gross weight may be selected; if V1 or VR is selected, INVALID ENTRY is displayed
- removed when the speed reference selector is moved to the SET position.

YV751 - YV754

10 Speed Reference Display (green)

Reflects the selection on the N1/SPD REF SET display:

- label can say V1, VR, WT KLBS, WT KG, MAN SPD, and INVALID ENTRY.
- numerics show the value for the given selection.
- MAN SPD indicates that the SPD REF setting is in SET and not in AUTO.

YF048 - YL551, YN531 - YV754

11 80 Knot Airspeed Bug (white)

Indicates 80 knots:

- displayed automatically during preflight
- removed at first flap retraction or when VREF is entered.

YF048 - YL551, YN531 - YV754

12 Flap/VREF Speed Annunciation (green)

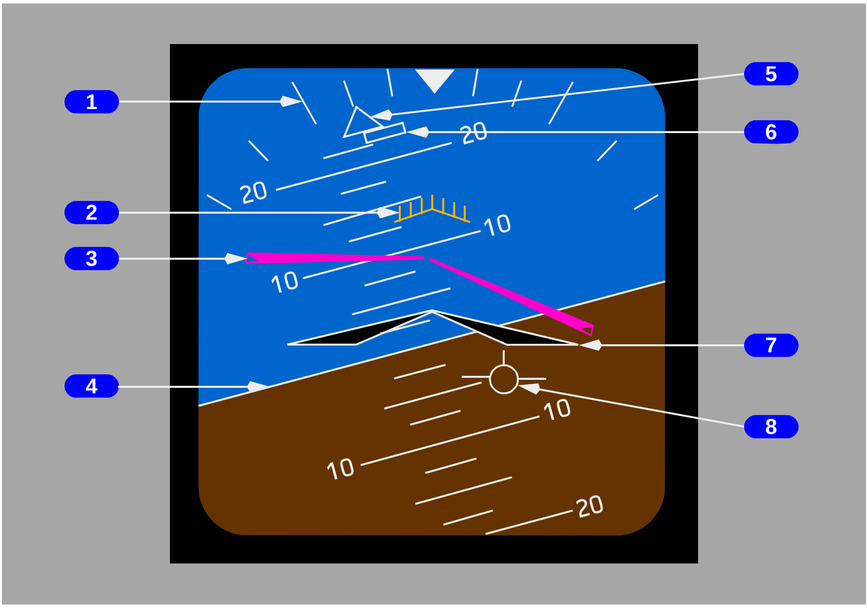
Indicates selected landing flap position and VREF as selected on the CDU APPROACH REF page:

- displayed for flaps 15, 30 and 40
- not shown for VREF set with the speed reference selector.

PFD – Attitude Indications

Attitude Indications – General

The attitude indication displays ADIRS attitude information.



1 Bank Scale (white)

Provides fixed reference for the bank pointer; scale marks are at 0, 10, 20, 30, 45, and 60 degrees.

2 Pitch Limit Indication (amber)

Indicates pitch limit (stick shaker activation for existing flight conditions).

- displayed when the flaps are not up.

YA707 - YV754

- displayed at slow speeds with the flaps up.

3 Flight Director Bar (magenta)

Indicates flight director steering commands. (Refer to Chapter 4, Automatic Flight).

4 Horizon Line and Pitch Scale (white)

Indicates the horizon relative to the airplane symbol; pitch scale is in 2.5 degree increments.

5 Bank Pointer

Indicates bank angle; fills and turns amber if bank angle is 35 degrees or more.

- indicates direction towards wings level.

6 Slip/Skid Indication

Displaces beneath the bank pointer to indicate slip or skid:

- fills white at full scale deflection
- turns amber if bank angle is 35 degrees or more; fills amber if the slip/skid indication is also at full scale deflection.

7 Airplane Symbol

Indicates airplane attitude relative to the horizon.

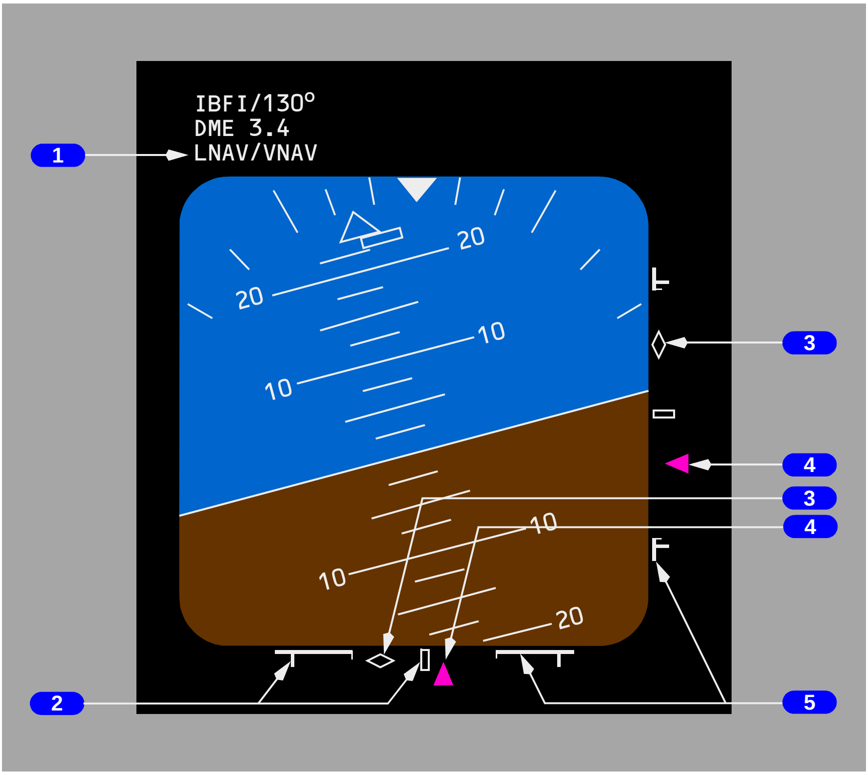
8 Flight Path Vector (FPV) Indication (white)

Displays flight path angle and drift when selected on the EFIS control panel:

- flight path angle is displayed relative to the horizon line
- drift angle is displayed relative to display center.

Navigation Performance Scales (NPS) Indications

YL545 - YL551, YN531 - YV754



1 **Scale ID Annunciation (white)**

- displayed above the left corner of ADI
- indicates the source of displayed deviation for each scale
- displayed when LNAV, VNAV, HDG SEL, or TO/GA are engaged
- displayed when current aircraft position is laterally within 1nm or 2 x RNP of the flight plan route – will go out of NPS if lateral limits exceeded
- Possible annunciations include:
  - LNAV/VNAV – (LNAV and VNAV deviations)
  - LOC/VNAV – (ILS localizer course with VNAV deviation)
  - LNAV/ G/S – (LNAV deviation with glideslope)
  - ILS – (ILS approach)

YV751 - YV754

- GLS – (GLS approach)

2 NPS Deviation Scale

- lateral NPS deviation scale represents current FMC lateral RNP
- vertical NPS deviation scale represents current FMC vertical RNP
- displayed if an approach mode is not engaged and either HDG SEL, TO/GA, LNAV or any VNAV mode is engaged.

3 Anticipation Cues

- displayed if valid approach course deviation information is being received while corresponding NPS deviation scale and pointer are displayed
- an unfilled white diamond symbol.
- if engaged lateral mode subsequently transitions to LOC, lateral NPS deviation indications will be removed, and normal ILS localizer indications will be displayed
- if engaged vertical mode subsequently transitions to G/S, vertical NPS deviation indications will be removed, and normal ILS G/S indications will be displayed.

4 NPS Pointer

- a filled magenta symbol when it is not parked at deflection limit
- an unfilled pointer outline when at deflection limit
- indicates lateral/vertical paths relative to the airplane

YL545 - YL551, YN531 - YV750

- will flash for 10 seconds if deviation is within ANP bar limits for 10 continuous seconds.

YV751 - YV754

- will flash for 10 seconds if deviation is within ANP bar limits for 5 continuous seconds.

5 Actual Navigation Performance (ANP) Bars

- lateral/vertical indication of available flight technical error remaining based on total system error
- lateral ANP bars can be displayed in all phases of flight
- vertical ANP bars can be displayed only after reaching top-of-descent
- originate from outer scale and expand inward as a function of increasing ANP relative to RNP
- will just touch at center of scale when ANP equals RNP

YL545 - YL551, YN531 - YV750

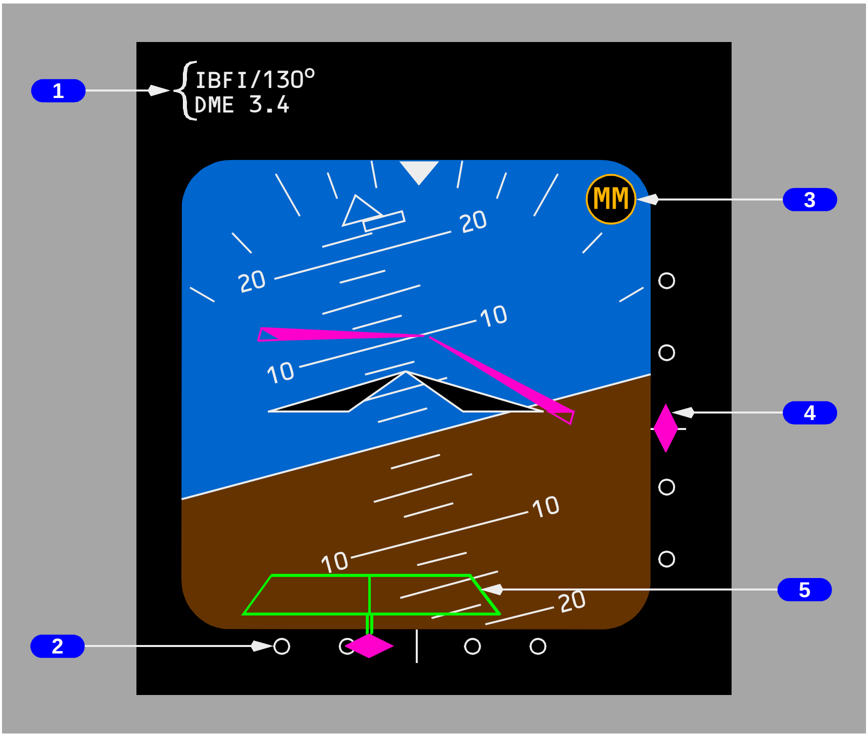
- turn from white to amber if current deviation is within the ANP bar limits for 10 continuous seconds.

YV751 - YV754

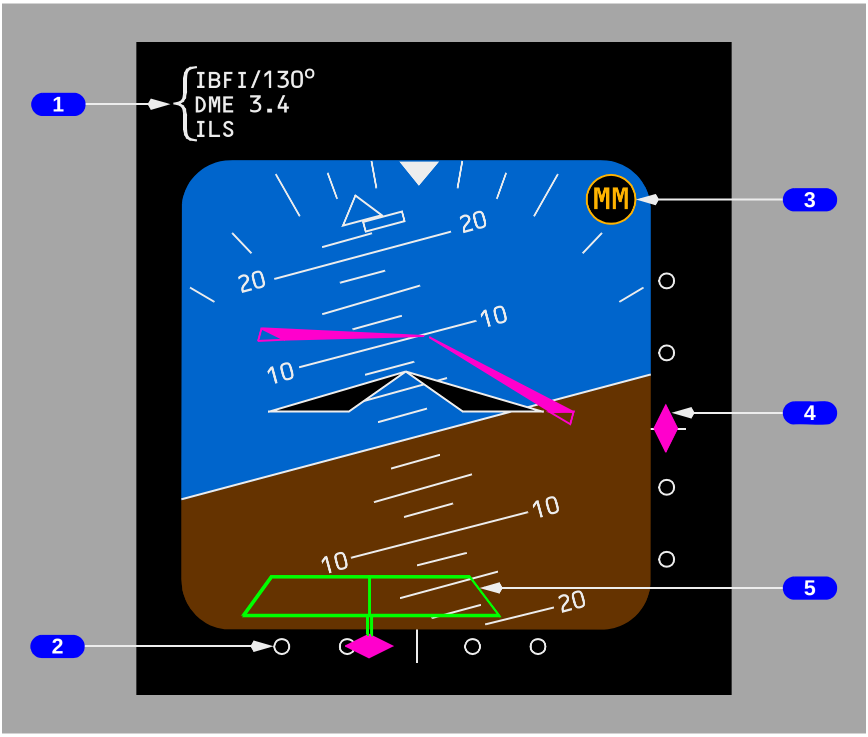
- turn from white to amber if current deviation is within the ANP bar limits for 5 continuous seconds.

Instrument Landing System Indications

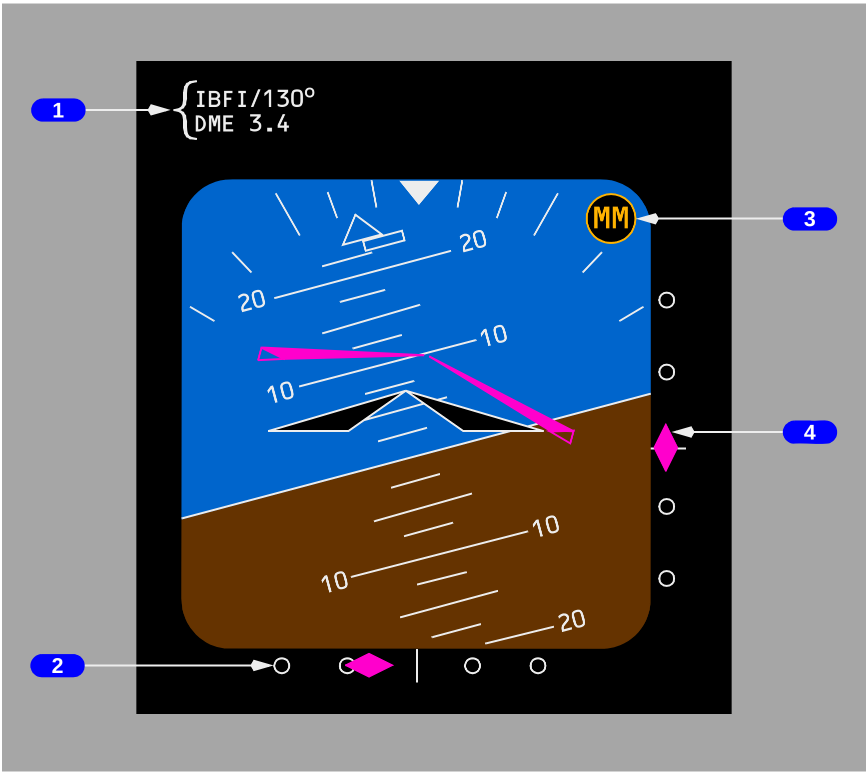
YF048 - YL551, YN531 - YV750



YV751 - YV754



YA701 - YA710, YM482 - YM484



1 Approach Reference

Displays the selected ILS frequency or identifier, approach course, ILS/DME/FMC distance and source annunciation.

YV751 - YV754
Displays the selected GLS identifier, channel, selected course, GLS approach distance and source annunciation.

If the tuned ILS frequencies disagree (for longer than one minute of time), the frequency turns amber with an amber horizontal line until set identically.

If the approach courses entered in the MCP disagree (for longer than one minute of time), the course turns amber with an amber horizontal line through it.

YV751 - YV754
If the Pilot’s and First Officer’s tuned GLS channels or approach courses disagree for more than one minute, the indication turns amber with an amber horizontal line until set identically.

2 Localizer Pointer and Deviation Scale

The pointer:

- indicates localizer position relative to the airplane
- in view when the localizer signal is received
- fills in solid magenta when within 2 ½ dots from center.

The scale:

- indicates deviation
- in view when the localizer frequency is tuned
- expands when the localizer is engaged and deviation is slightly more than ½ dot.

At low radio altitudes with autopilot engaged the scale turns amber and the pointer flashes to indicate excessive localizer deviation.

Below 1,000 feet AGL, with LNAV engaged and LOC armed, the localizer scale turns amber and the pointer flashes if the localizer is not captured.

Each pilot's deviation alerting system self-tests upon becoming armed at 1500 feet radio altitude. This self-test generates a two second LOC deviation alerting display on each attitude indicator.

3 Marker Beacon symbol

Flashes (and audible) when over one of the marker beacons:

OM (cyan) – outer marker beacon (two dashes per second).

MM (amber) – middle marker beacon (alternate dot and dash).

IM (white) – inner marker beacon (only dots).

4 Glideslope Pointer and Deviation Scale

The pointer:

- indicates glideslope position
- in view when the glideslope signal is received
- fills in solid magenta when within 2 ½ dots from center.
- the pointer is not displayed when the track and the front course on the mode control panel differ by more than 90 degrees (backcourse).

The scale:

- indicates deviation
- in view when the localizer frequency is tuned.

At low radio altitudes with autopilot engaged the scale turns amber and the pointer flashes to indicate excessive glideslope deviation.

Each pilot's deviation alerting system self-tests upon becoming armed at 1500 feet radio altitude. This self-test generates a two second G/S deviation alerting display on each attitude indicator.

YF048 - YL551, YN531 - YV754

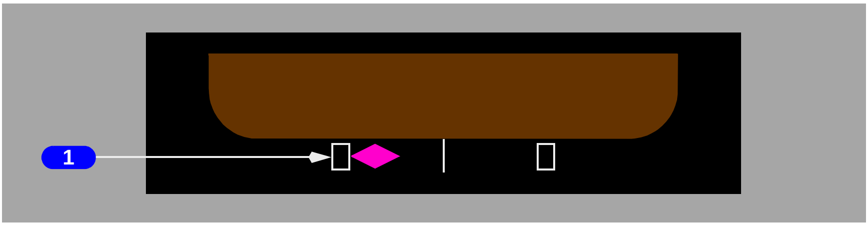
5 Rising Runway (green with magenta stem)

Displayed when:

- localizer signal usable and pointer is in view.
- radio altitude is less than 2500 feet.

Rises towards airplane symbol when radio altitude is below 200 feet.

Expanded Localizer Indications



1 Expanded Localizer Scale

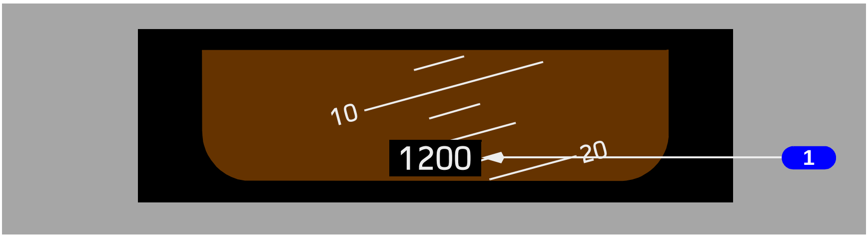
Displayed when the autopilot or flight director is in LOC mode, deviation is slightly more than ½ dot and track is within 5 degrees of the MCP selected course.

As deviation increases, the deviation pointer remains filled in solid magenta and parks at the limit of the expanded scale. Once the deviation reaches the equivalent of 2.4 dots from center on the standard scale, the pointer becomes unfilled.

Reverts to standard scale when out of LOC mode, and groundspeed is less than 30 knots or radio altitude is greater than 200 feet.

A rectangle equals ½ dot deviation.

Radio Altitude Indications

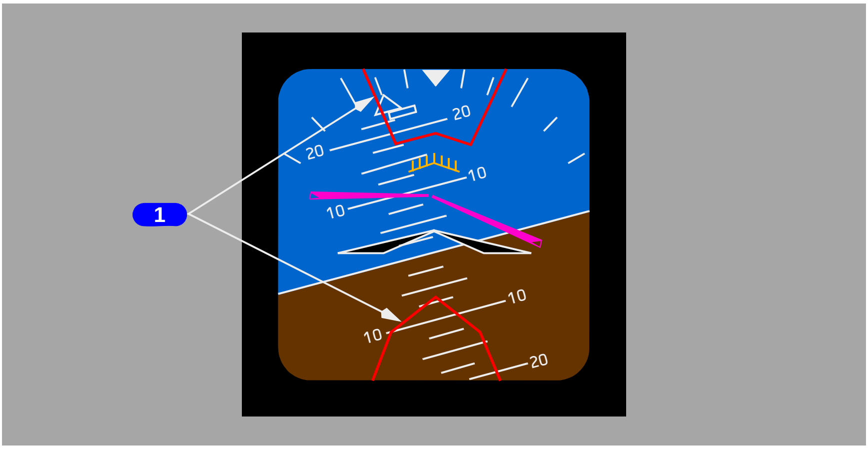


1 Radio Altitude

Displays current radio altitude:

- displayed below 2500 feet AGL
- box highlighted white for 10 seconds upon descent below 2500 feet
- turns amber when below radio altitude minimums.

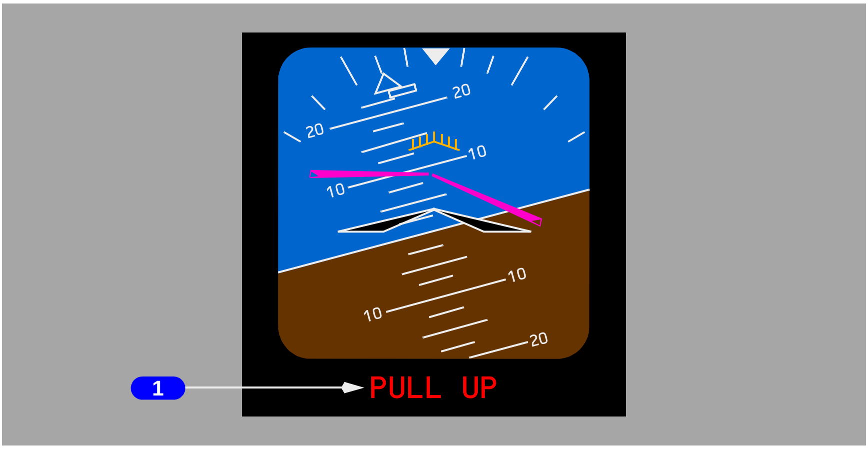
Traffic Alert and Collision Avoidance Indications



1 Traffic Alert and Collision Avoidance System Pitch Command (red)

The area(s) inside the red lines indicate(s) the pitch region(s) to avoid in order to resolve the traffic conflict. The airplane symbol must be outside the TCAS pitch command area(s) to ensure traffic avoidance. Refer to Chapter 15, Warning Systems.

GPWS Annunciations



1 GPWS Annunciations (red)

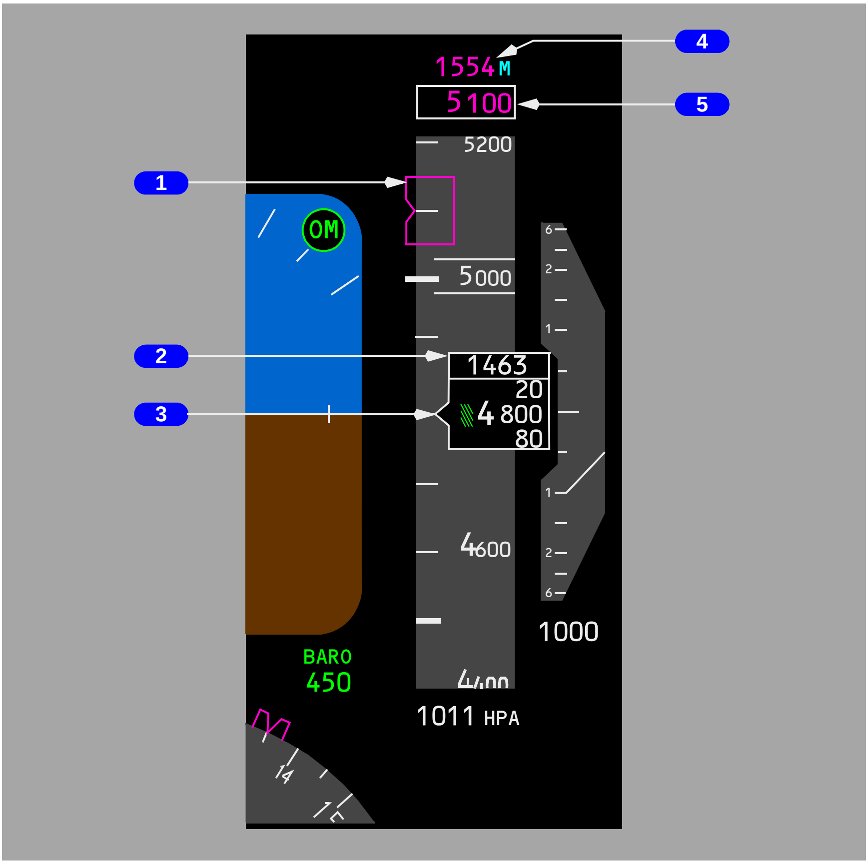
Displays WINDSHEAR or Pull UP alert.

Refer to Chapter 15, Warning Systems.

PFD – Altitude Indications

Altitude Indications– General

The altitude indication displays ADIRS altitude and other altitude related information.



1 **Selected Altitude Bug (magenta)**

Indicates the altitude set in the MCP altitude window.

When the selected altitude is off scale, the bug is parked at the top or bottom of the tape, with only one half the bug visible.

2 **Metric Digital Readout (readout and box–white, metric symbol–cyan)**

Displays current altitude in meters when MTRS is selected on the EFIS control panel.

3 Current Altitude

Displays current altitude in increments of thousands, hundreds and twenty feet:

- for positive values of altitude below 10,000 feet, a green crosshatch symbol is displayed
- a negative sign appears when altitude below zero feet is displayed
- readout box becomes bold to denote altitude acquisition
- readout box is highlighted in amber and flashes to denote altitude deviation (refer to Chapter 4, Automatic Flight and Chapter 15, Warning Systems).

4 Metric Selected Altitude Readout (readout–magenta, metric symbol–cyan)

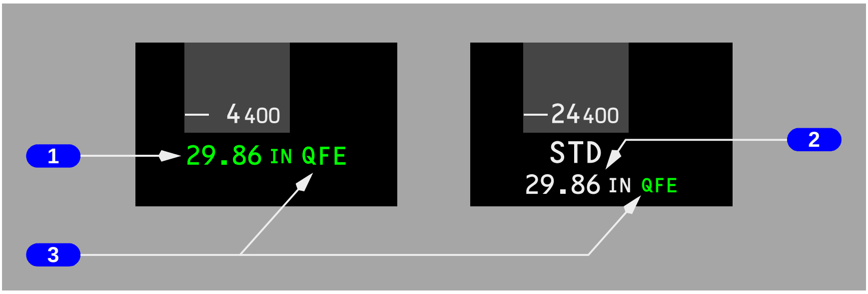
Displays MCP altitude in meters when MTRS is selected on the EFIS control panel.

5 Selected Altitude (magenta)

Displays the altitude set in the MCP altitude window.

The selected altitude box appears in white during an altitude alert. For more information, refer to Chapter 15, Warning Systems.

Barometric Indications



1 Barometric Settings (green)

Indicates the barometric setting in either inches of mercury (IN) or hectopascals (HPA) as selected on the EFIS control panel.

Display is boxed amber if numeric is set and airplane is climbing above transition altitude, or if STD is set and descending below transition flight level.

2 Preselected Barometric Setting (white)

STD is displayed when the Barometric Standard (STD) switch is selected on the EFIS control panel.

When STD is displayed, a barometric setting can be preselected on the EFIS control panel barometric selector and is displayed in small white characters below STD.

3 QFE Altitude Reference (green)

Indicates QFE altitude reference if selected on the CDU APPROACH REF Page or TAKEOFF REF Page 2/2.

When selected, QFE is boxed for 10 seconds.

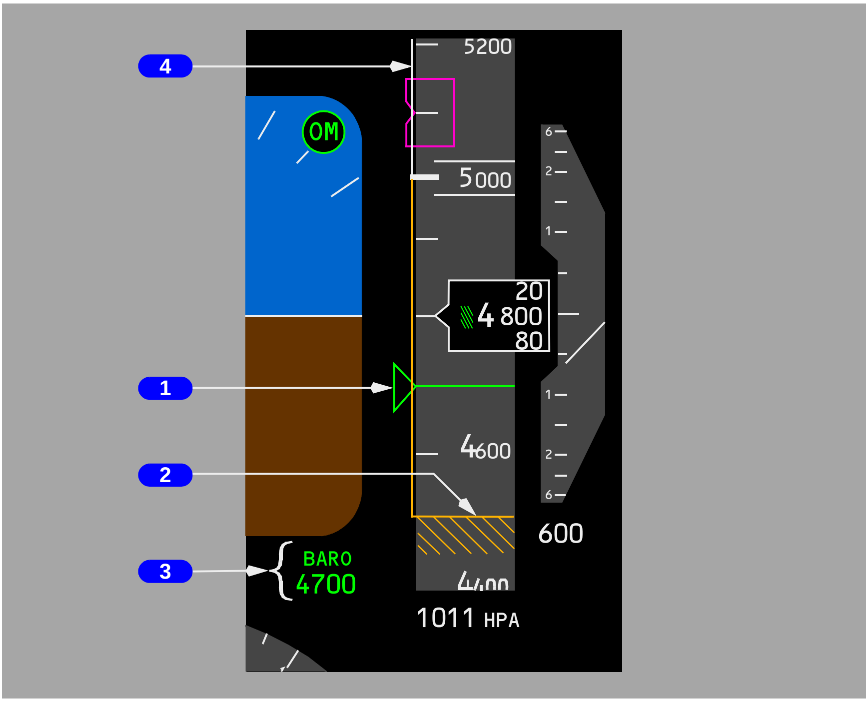
The altitude tape is shaded green during QFE operation.

When QNH is selected, the green shading is removed; QNH is displayed for 10 seconds, then blanks.

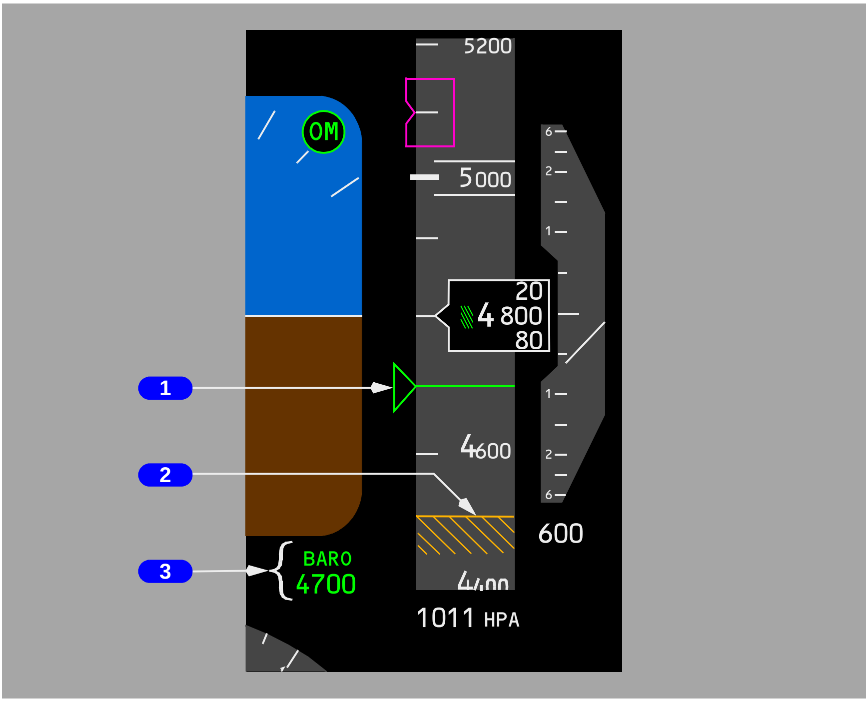
When STD is displayed, QFE in small white characters is displayed below STD, and a QFE altimeter setting can be preselected.

Landing Altitude/Minimums Indications

YF048 - YL551, YN531 - YV754



YA701 - YA710, YM482 - YM484



1 BARO Minimums Pointer (green)

Indicates the barometric minimums selected on the EFIS control panel:

- pointer and line turn amber when airplane descends below selected minimum altitude
- reset with the RST switch on the EFIS control panel.

After the pointer is set with the BARO position, moving the Minimums Reference selector to RADIO displays Radio Minimums information, but allows the Baro Pointer to remain.

2 Landing Altitude Indication (amber)

The crosshatched area indicates:

- the FMC landing altitude for the destination runway or airport, or
- the landing altitude for departure runway or airport until 400 NM from departure or one-half the distance to destination, whichever occurs first.

3 Minimums Reference/Altitude (green)

Displays approach minimum reference and altitude set by the MINS selector on the EFIS control panel:

BARO –

- displayed when selector is set to BARO, minimums are in feet MSL
- turns amber and flashes for 3 seconds when airplane descends below selected minimum altitude
- changes back to green:
  - when passing the selected minimum altitude plus 75 feet during go–around
  - at touchdown
  - after pressing the RST switch on the EFIS control panel.

RADIO –

- displayed when selector is set to RADIO, minimums are in feet AGL
- blank when an altitude less than 0 feet is selected
- turns amber and flashes for 3 seconds when airplane descends below selected minimum altitude
- changes back to green:
  - when passing the selected minimum altitude plus 75 feet during go–around
  - at touchdown
  - after pressing the RST switch on the EFIS control panel.

YF048 - YL551, YN531 - YV754

4 Landing Altitude Reference Bar

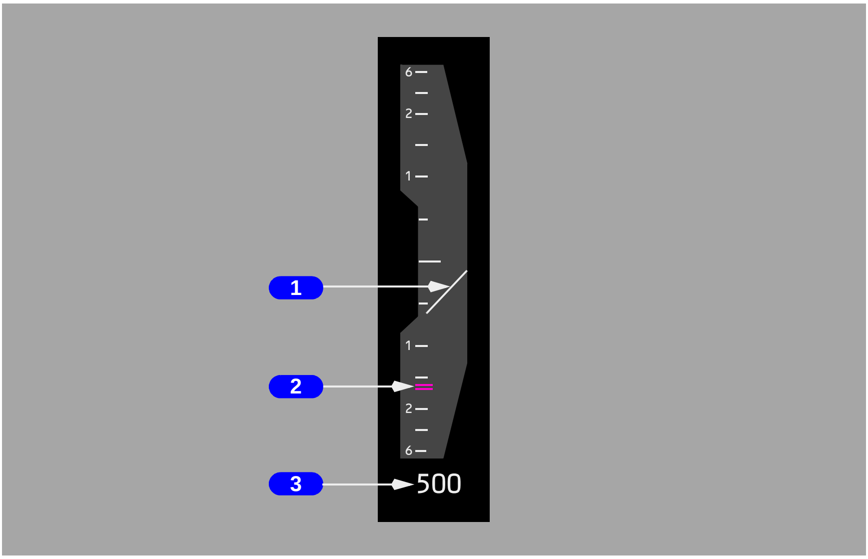
Indicates height above touchdown:

- White bar – 500 to 1000 feet above landing altitude
- Amber bar – 0 to 500 feet above landing altitude.

PFD – Vertical Speed Indications

Vertical Speed Indications – General

The vertical speed indication displays ADIRS instantaneous vertical speed.



1 **Vertical Speed Pointer (white)**

Indicates current vertical speed.

2 **Selected Vertical speed Bug (magenta)**

Indicates the speed selected in the MCP vertical speed window with V/S pitch mode engaged.

3 **Vertical speed (white)**

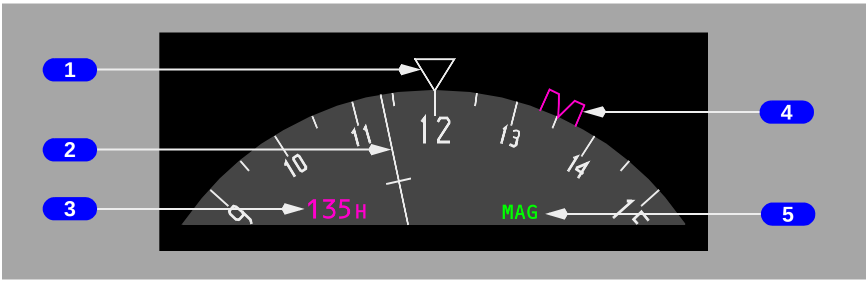
Displays vertical speed when greater than 400 feet per minute.

The display is located above the vertical speed indication when climbing and below when descending.

PFD – Heading and Track Indications

Heading and Track Indications– General

The heading and track indications display current FMC/ADIRS heading, track and other information.



1 Current Heading Pointer (white)

Indicates current heading.

2 Track Pointer (white)

Indicates current track.

3 Selected Heading (magenta)

Digital display of the selected heading bug.

4 Selected Heading Bug (magenta)

Indicates the heading selected on the mode control panel. If the selected heading exceeds the display range, the bug parks on the side of the compass rose in the direction of the shorter turn to the heading.

5 Magnetic/True Heading Annunciation (green)

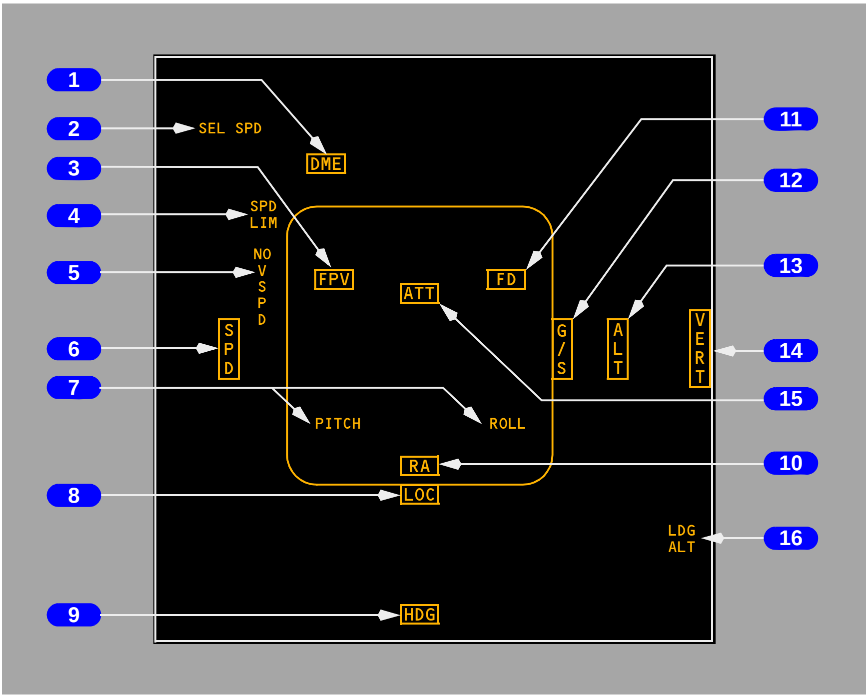
Displays selected heading reference:

- MAG indicates display is oriented relative to magnetic north
- TRU indicates display is oriented relative to true north; a white box is displayed continuously around TRU
- transition from TRU to MAG results in a green box around MAG for 10 seconds
- when TRU is displayed and the airplane descends more than 2000 feet at a descent rate greater than – 800 feet per minute, an amber box is drawn around TRU; the box flashes for 10 seconds, then turns steady amber.

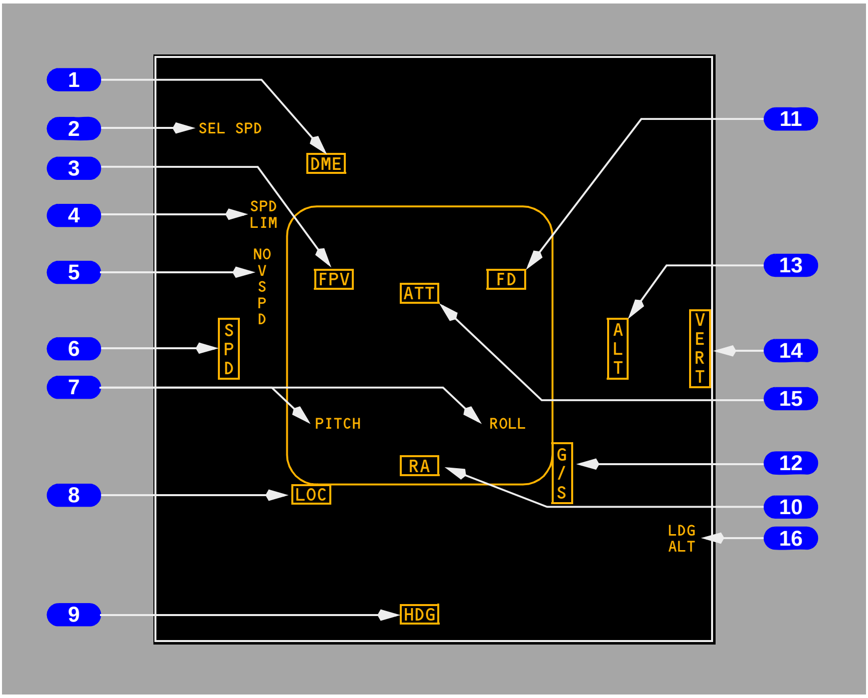
PFD Failure Flags

The flag replaces the appropriate display to indicate system failure.

YA701 - YV750



YV751 - YV754



1 Distance Measuring Equipment (amber)

The DME system has failed.

2 Selected Speed (amber)

The selected airspeed data is invalid.

3 Flight Path Vector Flag (amber)

FPV is selected on the EFIS control panel, but has failed. De–selection of FPV removes the flag.

4 Speed Limit Flag (amber)

Displays related with stick shaker or maximum operating speed has failed:

- if the stick shaker warning has failed, the red and black stick shaker speed bar is removed
- if the maximum operating speed has failed, the red and black maximum operating speed bar is removed.

5 No V Speeds Flag (amber)

Displayed when the aircraft is on the ground and both V1 (decision speed) and VR (rotation speed) are not valid or are set to less than 80 knots.

6 Speed Flag (amber)

Speed indication is inoperative.

7 Pitch/Roll Comparator Annunciation (amber)

PITCH displayed when Captain’s and F/O’s pitch angle displays differ by more than 5 degrees.

ROLL displayed when Captain’s and F/O’s roll angle displays differ by more than 5 degrees.

8 Localizer Flag (amber)

An ILS frequency is tuned and localizer course indication has failed.

9 Heading Flag (amber)

Heading information failed. Heading cannot be displayed.

10 Radio Altitude Flag (amber)

Radio altitude indication has failed.

11 Flight Director Flag (amber)

The flight director has failed.

12 Glideslope Flag (amber)

An ILS frequency is tuned and glideslope indication has failed.

13 Altitude Flag (amber)

The altitude display has failed.

14 Vertical Speed Flag (amber)

Vertical speed has failed.

15 Attitude Flag (amber)

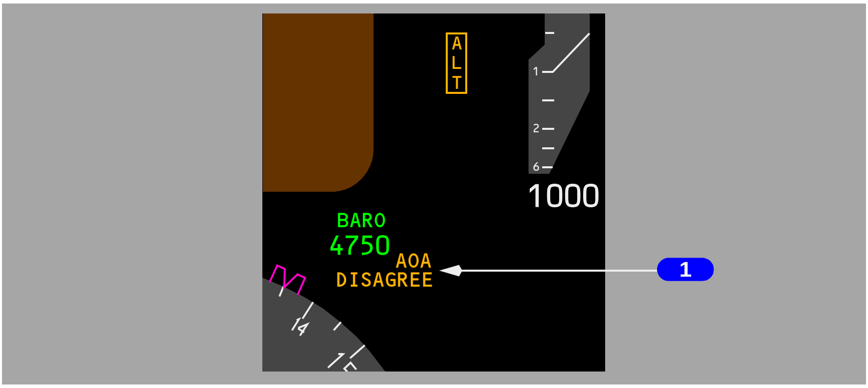
The attitude display has failed.

16 Landing Altitude Flag (amber)

The landing altitude input is not available or invalid.

PFD Annunciations and Alerts

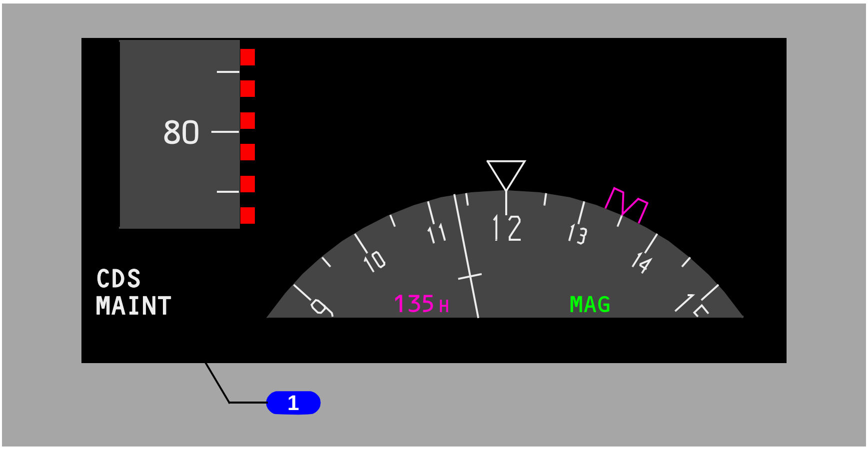
Angle of Attack (AOA) Disagree Alert



1 AOA Disagree Alert (amber)

Indicates the Captain’s (left) and First Officer’s (right) angle of attack values disagree by more than 10 degrees for more than 10 continuous seconds.

Display System Annunciations



1 Display System Annunciations

When there is a problem with the DEU display system, one of the following indications will appear in the lower left corner of the primary flight display:

CDS MAINT (white) – A dispatchable CDS fault has occurred. Displayed on the ground only, prior to start of the second engine.

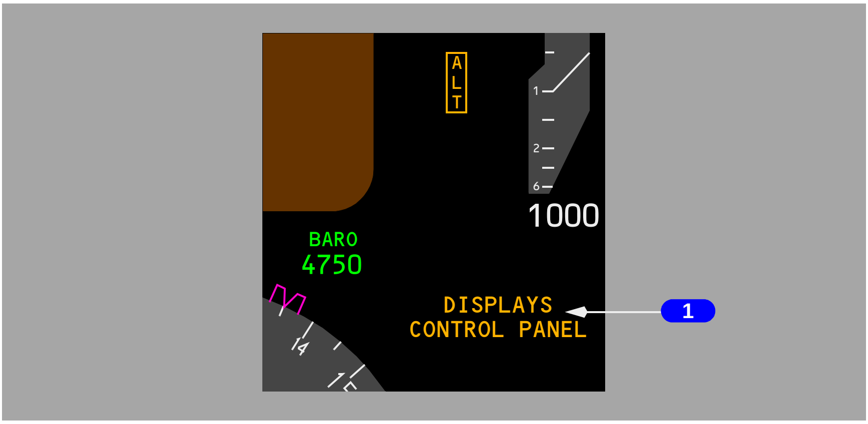
CDS FAULT (amber) – A non-dispatchable CDS fault has occurred. Displayed on the ground only, prior to start of the second engine.

YA701 - YV750
DSPLY SOURCE (amber) – A DEU has failed.

YV751 - YV754
DSPLY SOURCE 1 or 2 (amber) – DEU 1 has failed or DEU 2 has failed.

- If a DEU fails above FL220 –
  - the autopilot and flight directors are not affected
- If a DEU fails during climb or descent below FL220 with the failed side autopilot engaged –
  - the flight director pitch command bar is removed from both pilots' displays
  - the flight director pitch command bar reappears at ALT ACQ
  - the autopilot engages in CWS P
  - LVL CHG, VNAV, and V/S are not available with the failed side autopilot
- If a DEU fails during level flight below FL220 with the failed side autopilot engaged –
  - climb or descent to a new altitude is only possible in CWS P
- If a DEU fails in the approach mode above 400 feet with both flight directors on –
  - the flight director pitch and roll command bars are removed from the display on the failed side
- If a DEU fails prior to engaging the second autopilot for a dual autopilot approach –
  - engagement of the second autopilot is inhibited.

Displays Control Panel Annunciation (EFIS CP)



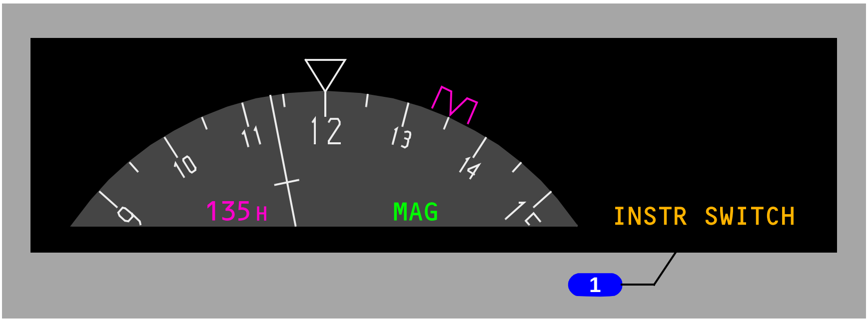
1 Displays Control Panel Annunciation (amber)

Indicates a failed EFIS control panel on the affected side. When DISPLAYS CONTROL PANEL appears in the lower right hand corner of the display, altitude information is removed.

With the CONTROL PANEL select switch on the overhead panel in:

- BOTH ON 1 – Both the Captain's and First Officer's CDS displays and baro are controlled from the left EFIS panel
- NORMAL – Left EFIS panel controls Captain's CDS displays and baro, Right EFIS panel controls First Officer's CDS displays and baro
- BOTH ON 2 – Both the Captain's and First Officer's CDS displays and baro are controlled from the right EFIS panel.

Instrument Switch Annunciation

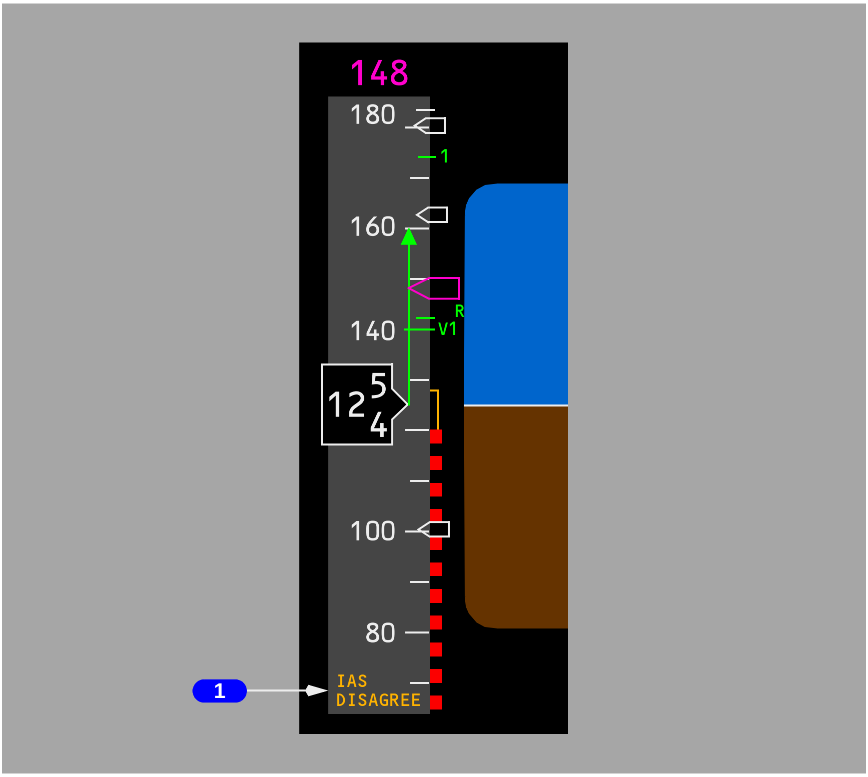


1 INSTR SWITCH Annunciation (amber)

Indicates both the Captain's and First Officer's displays are using the same source of IRU data.

Displayed when the IRS switch on the overhead panel is not in the NORMAL position. See Chapter 11, Section 10, for Inertial Reference System Transfer Switch information.

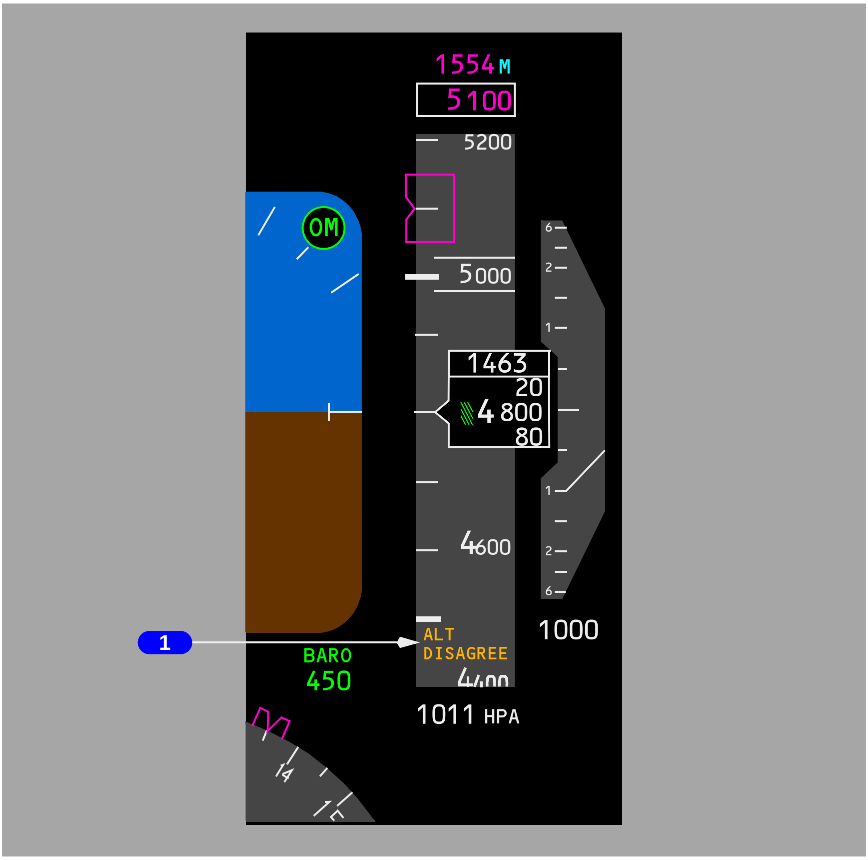
Airspeed Disagree Alert



1 Airspeed Disagree Alert (amber)

Indicates the Captain’s and F/O’s airspeed indications disagree by more than 5 knots for 5 continuous seconds.

Altitude Disagree Alert

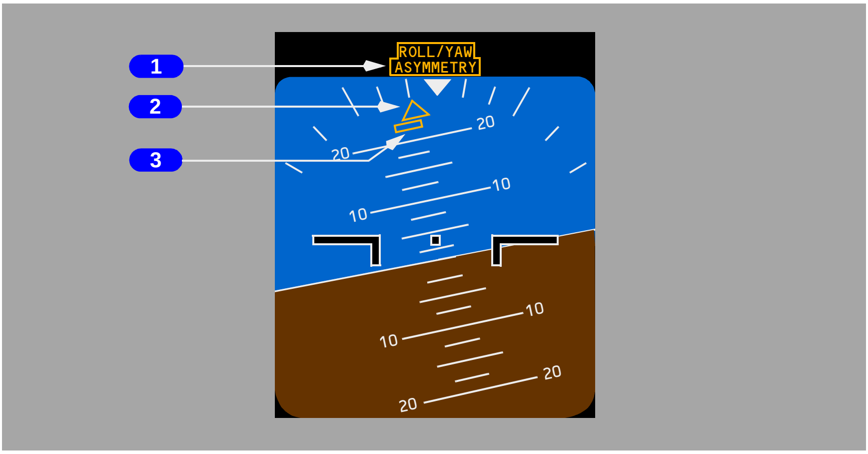


1 Altitude Disagree Alert (amber)

Indicates the Captain’s and F/O’s altitude indications disagree by more than 200 feet for more than 5 continuous seconds.

Roll/Yaw Asymmetry Alert

YV751 - YV754



1 Roll/Yaw Asymmetry Alert (amber)

Autopilot is engaged in single channel and requires more than 75% of the autopilot roll authority due to unusual asymmetric forces acting on the airplane's longitudinal axis.

The ROLL/YAW ASYMMETRY alert:

- replaces the active autopilot status annunciation.
- is replaced with ROLL AUTHORITY when 100% of the autopilot roll authority is required.
- is replaced by the active autopilot status annunciation when less than 50% of the autopilot roll authority is required.

2 Bank Pointer (amber)

With ROLL/YAW ASYMMETRY or ROLL AUTHORITY alert active:

- bank pointer outline will turn amber.

With ROLL AUTHORITY alert active:

- bank pointer will fill amber if bank angle exceeds 15 degrees.

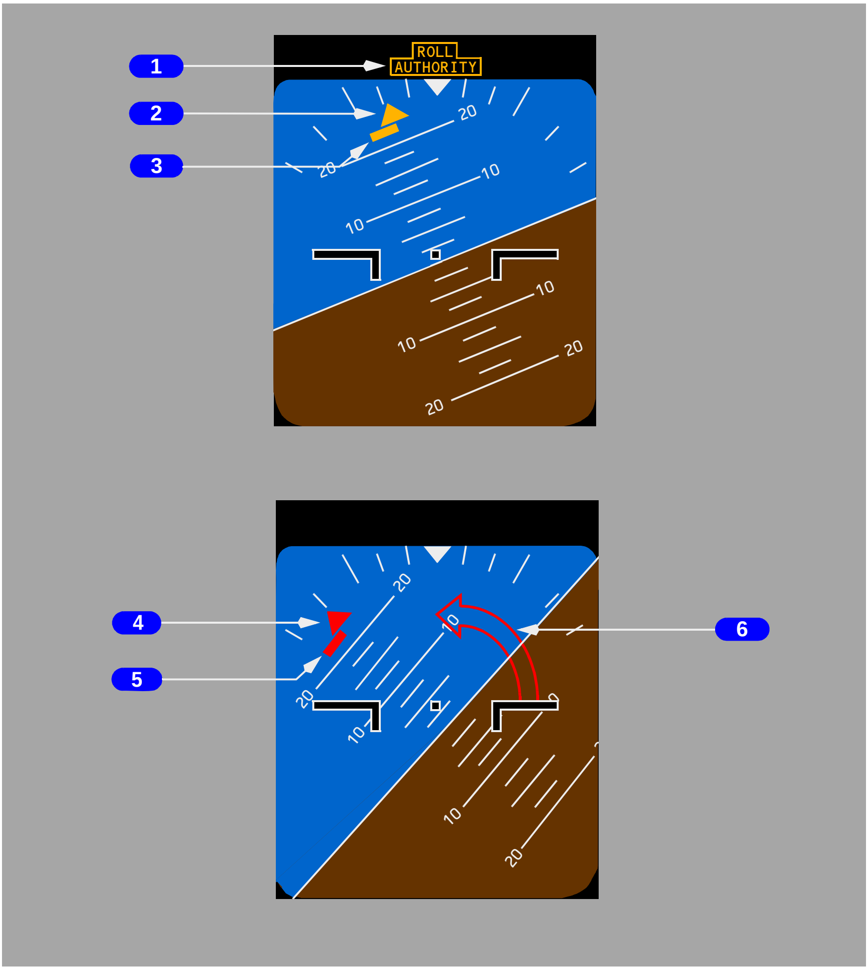
3 Slip/Skid Indication (amber)

With ROLL/YAW ASYMMETRY or ROLL AUTHORITY alert active:

- slip/skid indication outline will turn amber.
- slip/skid indication will fill amber if deflected greater than 25% of its width,

Roll Authority Alert

YV751 - YV754



1 Roll Authority Alert (amber)

Autopilot is engaged in single channel and requires 100% of the autopilot roll authority due to unusual asymmetric forces acting on the airplane’s longitudinal axis.

The ROLL AUTHORITY alert:

- replaces the active autopilot status annunciation.
- is replaced by the active autopilot status annunciation when less than 100% of the autopilot roll authority is required.

2 Bank Pointer (amber)

With ROLL/YAW ASYMMETRY or ROLL AUTHORITY alert active:

- bank pointer outline will turn amber.

With ROLL AUTHORITY alert active:

- bank pointer will fill amber if bank angle exceeds 15 degrees.

3 Slip/Skid Indication (amber)

With ROLL/YAW ASYMMETRY or ROLL AUTHORITY alert active:

- slip/skid indication outline will turn amber.
- slip/skid indication will fill amber if deflected greater than 25% of its width,

4 Bank Pointer (red)

When roll command arrow shown:

- bank pointer fills red.

5 Slip/Skid Indication (red)

When roll command arrow shown:

- slip/skid indication outline will turn red.
- slip/skid indication will fill red if it is deflected greater than 25% of its width.

6 Roll Command Arrow (red)

The roll command arrow points in the shortest direction to wings level. If the bank angle passes 180 degrees, the roll command arrow points in the new shortest direction to wings level. The roll command arrow is displayed with or without the autopilot engaged.

The roll command arrow is shown when bank angle exceeds:

- 45 degrees if the pitch attitude is 25 degrees or less.
- 65 degrees if the pitch attitude is greater than 25 degrees.

The roll command arrow is removed:

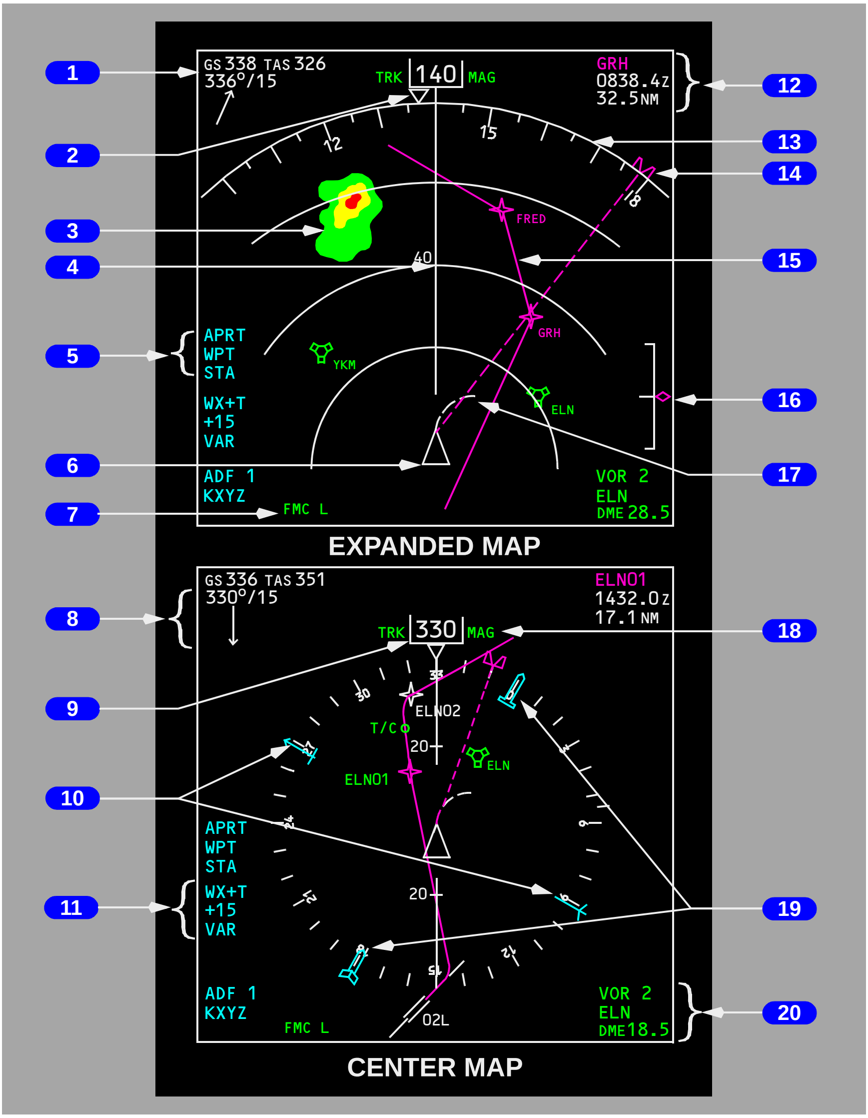
- when the bank angle is less than 35 degrees for 2 seconds, or;
- immediately if the bank angle is less than 10 degrees.

Navigation Displays – MAP Mode

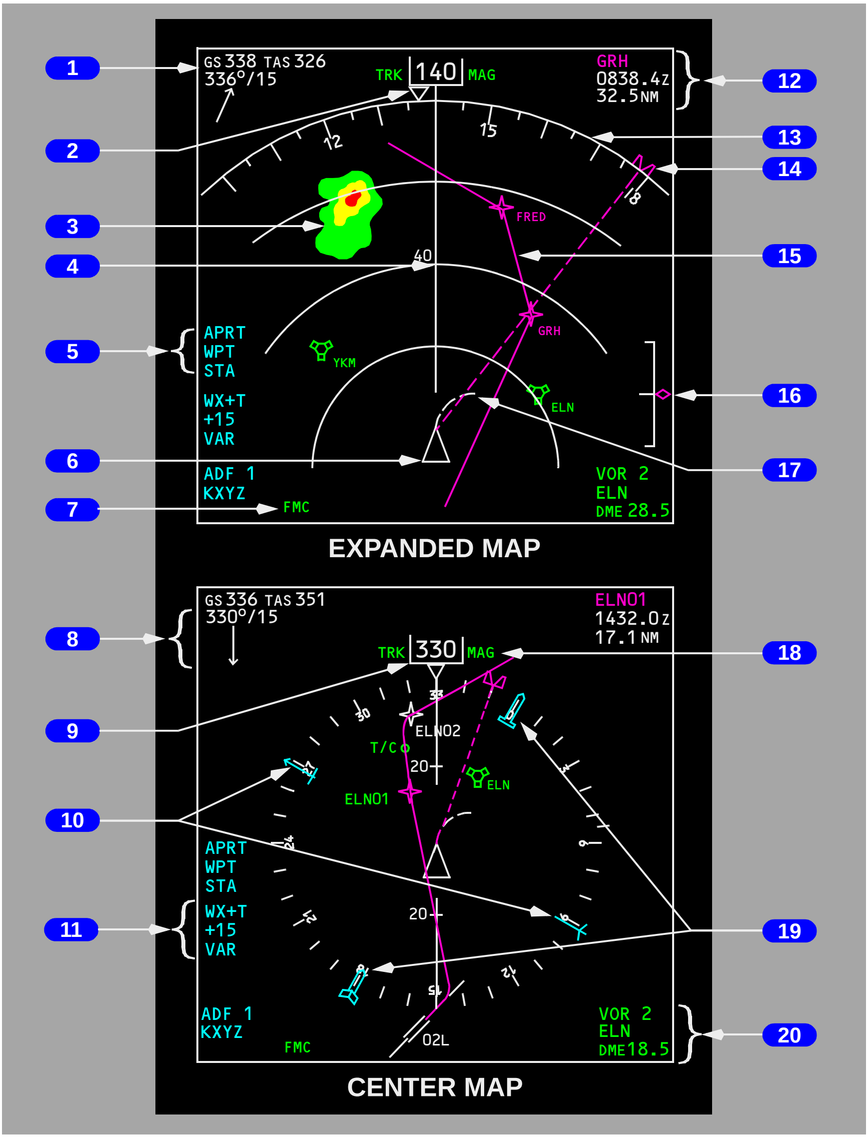
Note: Refer to Section 41 of this chapter for a detailed explanation of the navigation symbology shown on the following pages.

Expanded and Center MAP Modes

YA707 - YV754



YA701 - YA706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GS 338 TAS 326
336°/15
TRK 140 MAG
GRH
0838.4Z
32.5NM
12
15
FRED
40
GRH
YKM
ELN
APRT
WPT
STA
WX+T
+15
VAR
ADF 1
KXYZ
FMC
VOR 2
ELN
DME 28.5
EXPANDED MAP
GS 336 TAS 351
330°/15
TRK 330 MAG
ELN01
1432.0Z
17.1NM
33
30
ELN02
T/C
20
ELN
ELN01
APRT
WPT
STA
WX+T
+15
VAR
ADF 1
KXYZ
FMC
02L
VOR 2
ELN
DME18.5
CENTER MAP

1 **Groundspeed/True Airspeed**

2 **Heading Pointer**

3 **Weather Radar Returns**

4 **Track Line and Range Scale**

5 **Map Options**

6 **Airplane Symbol**

7 **Map Source Annunciation**

8 **Wind Direction/Speed/Arrow**

9 **Current Track**

10 **Number 1 VOR/ADF Pointer**

11 **Weather Radar Annunciations**

12 **Active Waypoint/ETA/Distance–To–Go**

13 **Compass Rose**

14 **Selected Heading Bug**

15 **Active LNAV Route**

16 **Vertical Deviation Scale and Pointer**

17 **Position Trend Vector**

18 **Magnetic/True Reference**

19 **Number 2 VOR/ADF Pointer**

20 **VOR/ADF Selection, Ident/Frequency, VOR DME**

Vertical Situation Display (VSD)

YF048 - YF928, YK624 - YK630, YK966 - YL551, YN531 - YV754

The VSD represents a profile view of the airplane and its environment along the current track. Information shown within the cyan dashed lines (enroute corridor) on the ND is shown in profile on the VSD.

Vertical Situation Display (VSD) - Reference Scales

1 Enroute Swath

Indicates area mapped by the VSD.

2 Altitude Reference Scale

Displays altitude in reference to the vertical position of the airplane symbol, terrain, and other objects in the VSD background display.

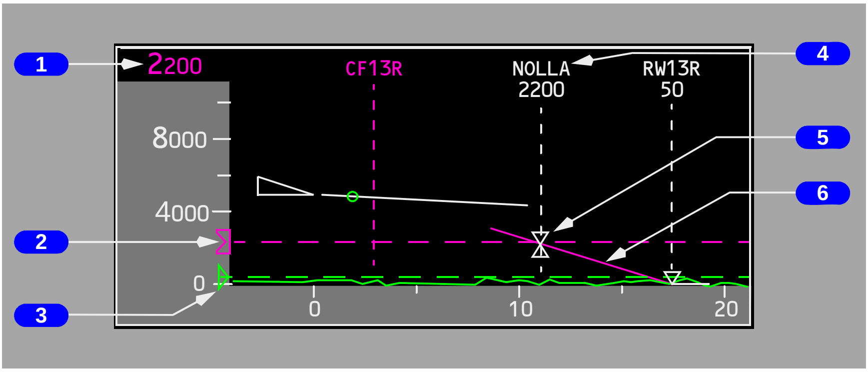
3 Airplane Symbol

Indicates current airplane altitude (bottom of the triangle) and lateral position (point of the triangle) relative to terrain.

4 Horizontal Reference Scale

Displays range in nautical miles. Actual range shown on VSD is one half the range selected on the EFIS control panel.

Vertical Situation Display (VSD) - General Background



1 MCP Selected Altitude Readout

Displays the altitude set in the MCP altitude window.

2 Selected Altitude Bug

Indicates the altitude set in the MCP altitude window.

When the selected altitude is off scale, the bug is parked at the top or bottom, with only one half the bug visible. The dashed line does not park.

3 BARO Minimums Pointer

Indicates the barometric minimums selected on the EFIS control panel:

- pointer and dashed line turn amber when airplane descends below selected minimum altitude
- reset with the RST switch on the EFIS control panel.

After the pointer is set with the BARO position, moving the Minimums Reference selector to RADIO displays only the pointer.

4 Waypoint ID and Anchor Line

Displayed with any altitude constraint directly beneath. Dashed vertical line depicts lateral position.

5 Altitude Constraint Symbol

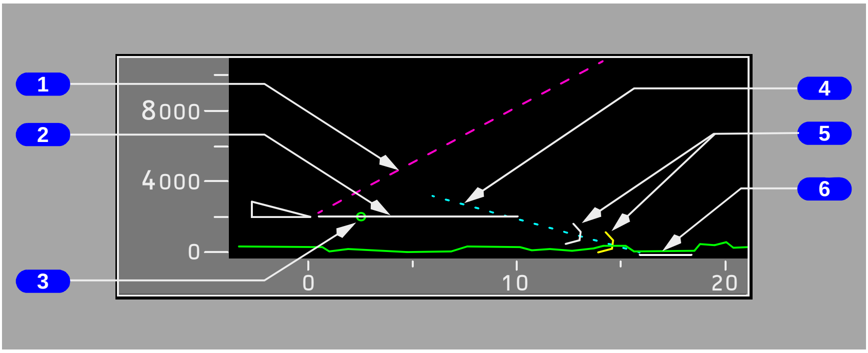
Displayed as triangle(s) on waypoint anchor line.

6 FMC Approach Glide Path Angle Line

Displayed for approaches that include a designated approach angle.

- extends 10 NM for situational awareness
- anchored to the missed approach waypoint, not the runway.
- manual altitude corrections do not change the displayed Navigation Database defined glidepath.

Vertical Situation Display (VSD) - Flight Path Background



1 MCP Selected Vertical Speed (V/S)

Displays the selected vertical speed as a dashed target angle line when the MCP V/S mode is selected.

2 Vertical Flight Path Vector

Indicates current flight path angle as a function of vertical speed and ground speed. The length of the vector is fixed at one half of the VSD range.

3 Range to Target Speed Dot (RTSD)

Indicates where the airplane will achieve the FMC or MCP target speed.

- dot is blanked within 5 knots of target speed
- dot reappears if speed increases 10 knots or more faster than target speed
- replaced with an unfilled dot at vector end if target speed will not be achieved within length of the vertical flight path vector line.

4 3-Degree Reference Line

Displayed for approaches that do not have a designated approach angle.

- dashed line extends 10 NM for situational awareness
- anchored to the runway threshold
- for reference only, line may intersect terrain.

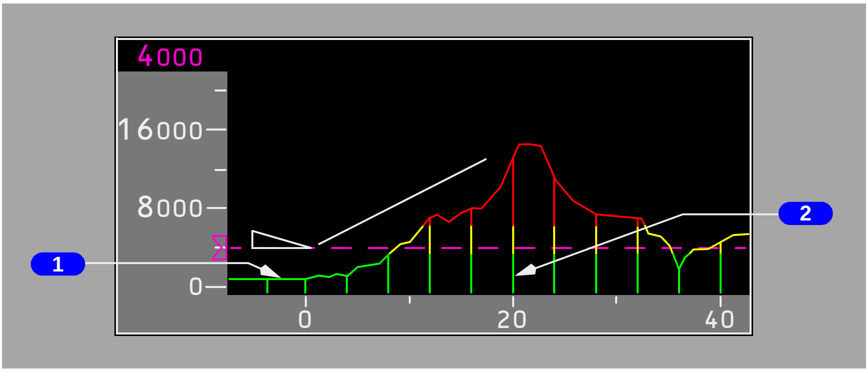
5 Decision Gates

Displayed on the FMC approach glide path angle line or 3 degree reference line at 500 feet and 1000 feet above field elevation.

6 Runway

Represents the selected runway.

Vertical Situation Display (VSD) - Terrain Background



1 Terrain Profile Line

Represents the highest terrain within the enroute swath.

- highest points of the terrain below and ahead of the airplane
- terrain is depicted so the true altitude separation between the airplane and terrain is shown
- terrain behind the airplane is drawn equal to the terrain at the current position
- VSD terrain uses the same color coding that is used to depict EGPWS terrain on the lateral map –
- green: terrain is more than 500 feet (250 feet gear down) below the airplane
- amber: terrain ranges from 500 feet below (250 feet gear down) to 2000 feet above the airplane
- red: terrain is 2000 feet above the airplane.

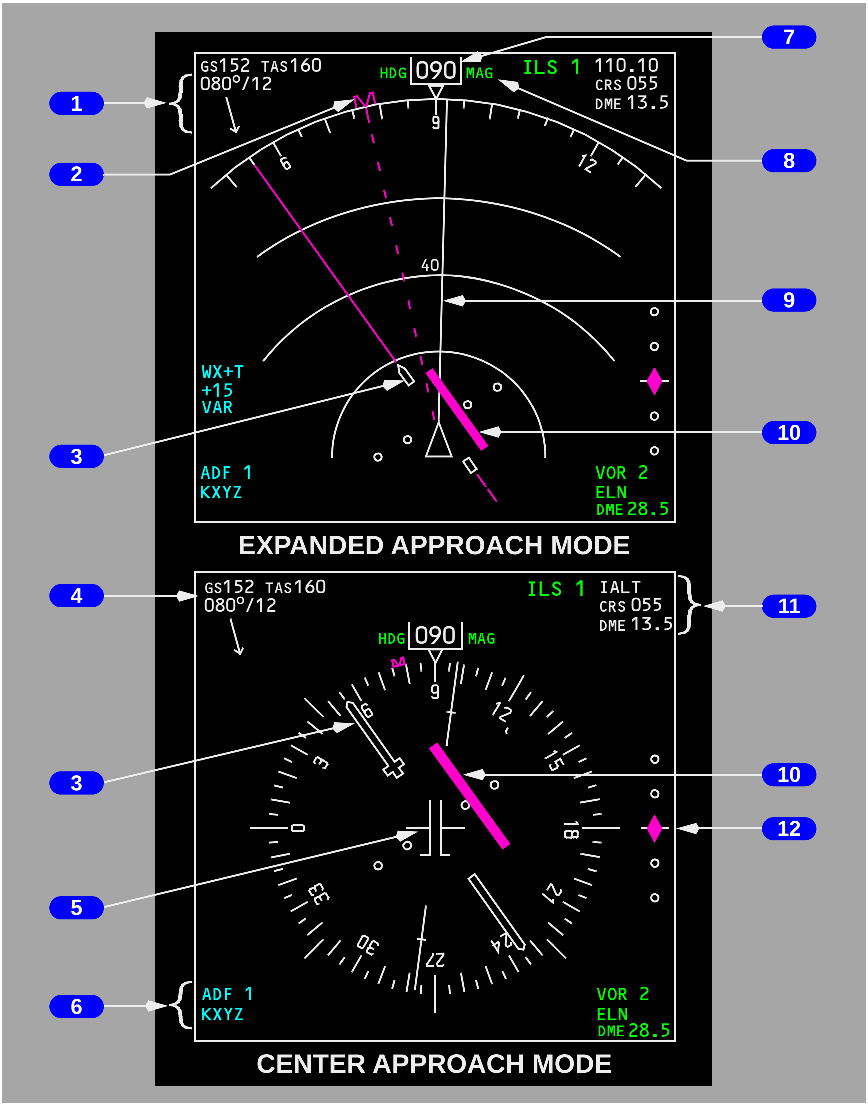
Note: See Chapter 15, Section 10, for Terrain Warnings.

2 Vertical Support Lines

Vertical terrain vectors placed at constant intervals along the terrain profile line.

Navigation Displays – Approach Mode

Expanded and Center Approach Modes



1 Wind Direction/Speed/Arrow

2 Selected Heading Bug

3 Selected Course Pointer

4 Groundspeed/True Airspeed

5 Airplane symbol

6 VOR/ADF Selection/Ident or Frequency/VOR DME

7 Current Heading

8 Magnetic/True Reference

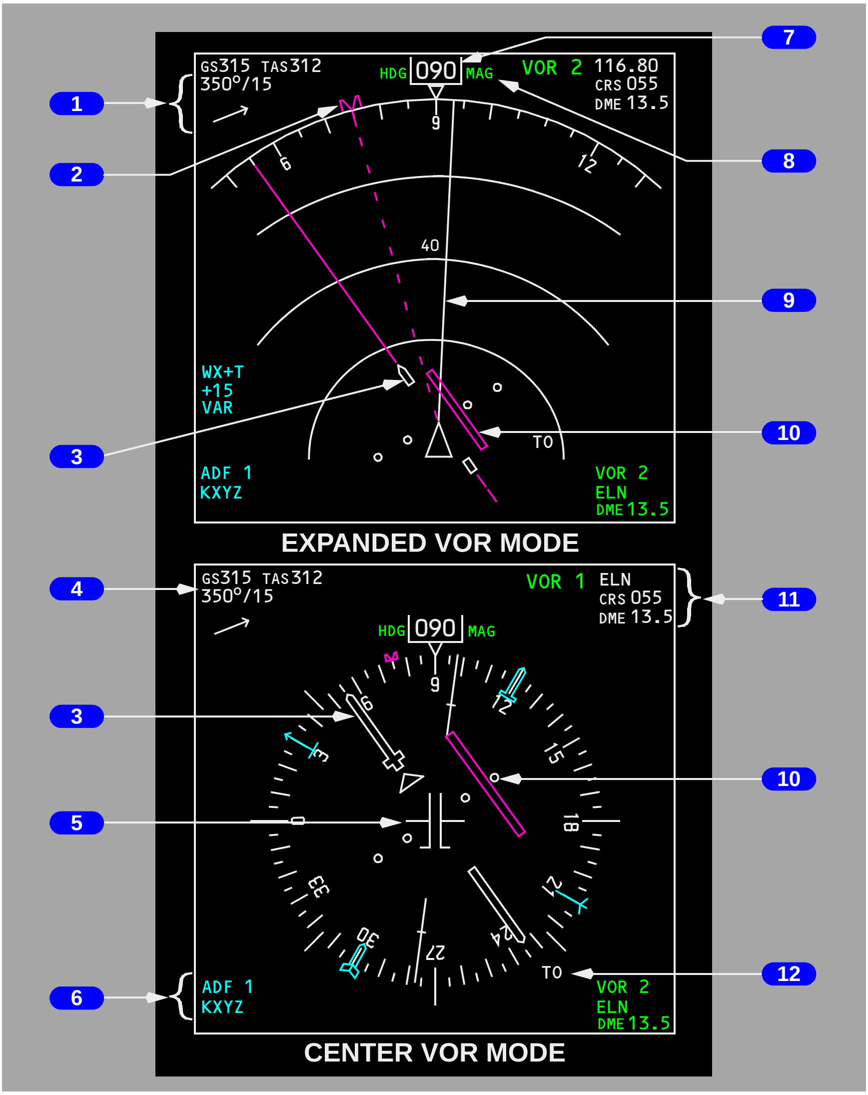
9 Track Line

10 Localizer Deviation Indication and Scale

11 Reference ILS Frequency or Ident/Course/DME

12 Glideslope Pointer and Scale

Navigation Displays – VOR Mode
Expanded and Center VOR Modes



1 Wind Direction/Speed/Arrow

2 Selected Heading Bug

3 Selected Course Pointer

4 Groundspeed/True Airspeed

5 Airplane symbol

6 VOR/ADF Selection/Ident or Frequency/VOR DME

7 Current Heading

8 Magnetic/True Reference

9 Track Line

10 Course Deviation Indication and Scale

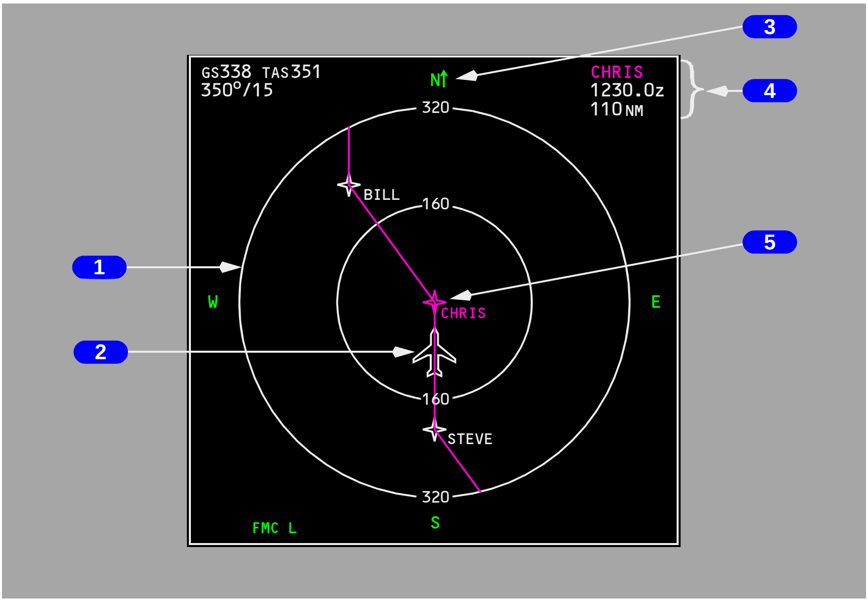
11 Reference VOR Receiver/Frequency or Ident/Course/DME

12 TO/FROM Indication and TO pointer

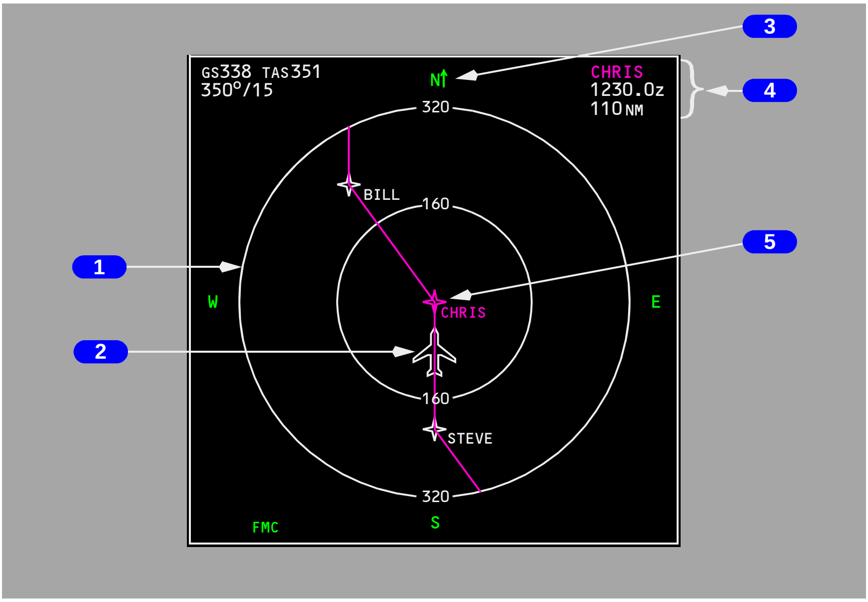
Navigation Displays – Plan Mode

Plan Mode

YA707 - YV754



YA701 - YA706



1 **Range Circle**

2 **Airplane Symbol**

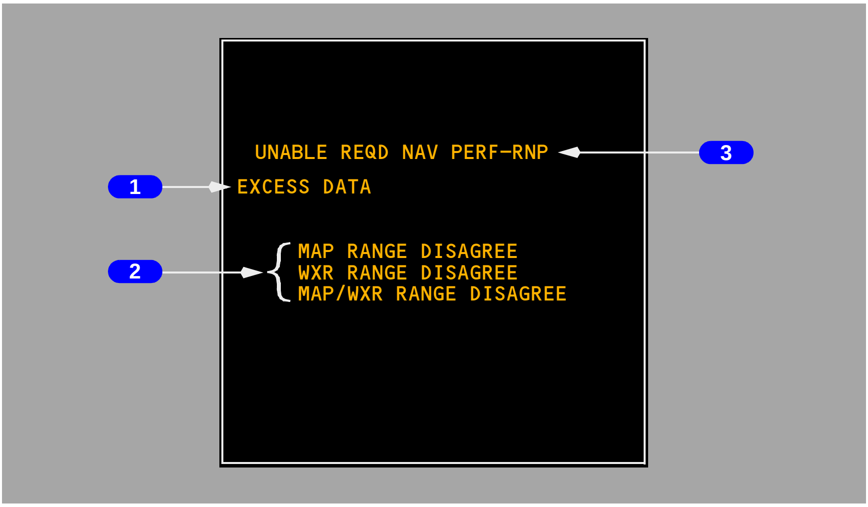
3 **True North Up Arrow**

4 **Active Waypoint Information**

5 **Center Waypoint**

The waypoint located at the display center is identified as CTR on the CDU RTE LEGS page.

Navigation Displays – Advisory Messages
Navigation Advisory Messages



1 Excess Data Annunciation (amber)

The amount of map information sent to the primary display system is too great to display. When this occurs, the system removes some information from the display.

The message can be cleared by:

- decluttering - removing unnecessary navigation information.
- reducing the display range.
- deselecting one or more of the EFIS MAP switches (STA, WPT, ARPT, DATA, POS).

2 Range Disagreement Annunciations (amber)

MAP RANGE DISAGREE – Indicates selected range on the EFIS control panel is different than the MAP display range.

WXR RANGE DISAGREE – Indicates selected range on the EFIS control panel is different than the WXR display range.

MAP/WXR RANGE DISAGREE – Indicates selected range on the EFIS control panel is different than the MAP and WXR display ranges.

3 Nav Advisory Message (amber)

UNABLE REQD NAV PERF– RNP – Displayed in MAP modes when FMC actual navigation performance is not sufficient for the displayed RNP. Refer to Chapter 11, Section 60, FMC Messages.

Mode/Frequency Disagree Annunciation

1 EFIS MODE/NAV FREQ DISAGREE (amber)

The ILS or VOR source annunciation corresponds to the position selected on the EFIS control panel and the tuned VOR/ILS frequency.

The annunciation is displayed:

- if APP is selected with a VOR frequency tuned
- if VOR is selected with an ILS frequency tuned.

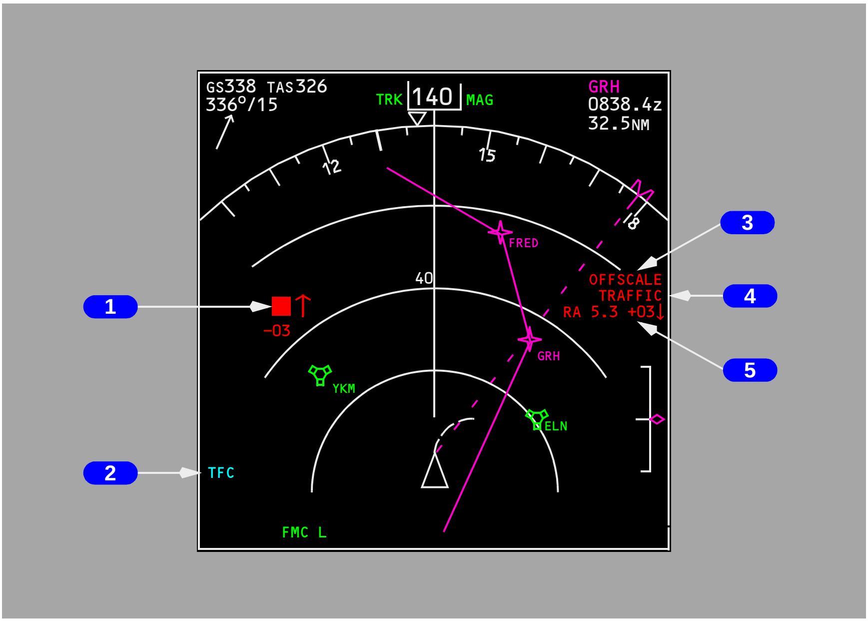
The DME display and ILS/VOR frequency at the upper right corner display dashes.

The localizer deviation bar, VOR course deviation bar and glideslope pointer are not displayed.

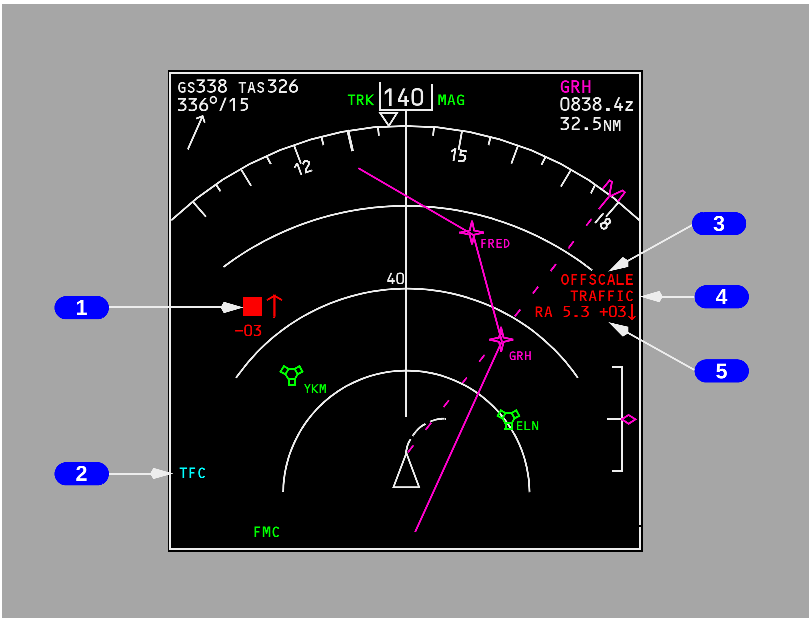
The annunciation is displayed in the expanded APP, center APP, expanded VOR and center VOR modes.

TCAS Messages

YA707 - YV754



YA701 - YA706



1 TCAS Traffic Symbols

Note: Refer to Section 41 of this chapter for a detailed explanation of the traffic symbology.

Indicates position of traffic targets.

Displayed in expanded MAP, center MAP, expanded APP and expanded VOR modes and TFC is selected on the EFIS control panel.

2 TCAS Annunciations

TFC (cyan) – Indicates TFC selected on EFIS control panel in expanded MAP, center MAP, expanded APP and expanded VOR.

TCAS TEST (cyan) – TCAS in test mode.

TA ONLY (cyan) – TCAS TA mode only.

TCAS OFF (amber) – TCAS off.

3 Offscale (red or amber)

TA (amber) or RA (red) is beyond the selected display range and TFC is selected on the EFIS control panel.

4 Traffic (red or amber)

Displayed during a TA (amber) or RA (red) condition whether or not TFC is selected on the EFIS control panel.

5 No–Bearing Messages (red or amber)

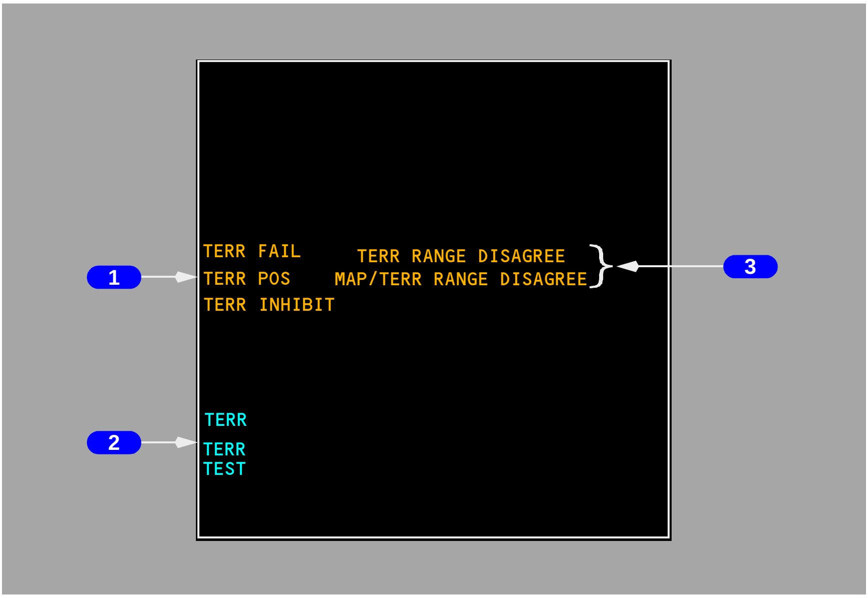
Textual description of TA (amber) or RA (red) traffic with no associated bearing.

Message provides traffic type, range in NM, altitude and a vertical motion arrow.

A maximum of two messages can be displayed simultaneously.

TFC selected on the EFIS control panel.

Look-Ahead Terrain Messages (GPWS)



1 Terrain Status Annunciation (amber)

TERR FAIL – Look-ahead terrain alerting and display have failed.

TERR POS – Look-ahead terrain alerting and display unavailable due to position uncertainty.

TERR INHIBIT – GPWS terrain inhibit switch in TERR INHIBIT position.

2 Terrain Mode Annunciation (cyan)

TERR – Terrain display enabled (manual or automatic display).

TERR TEST – GPWS is operating in self-test mode.

3 Terrain Range Status Annunciation (amber)

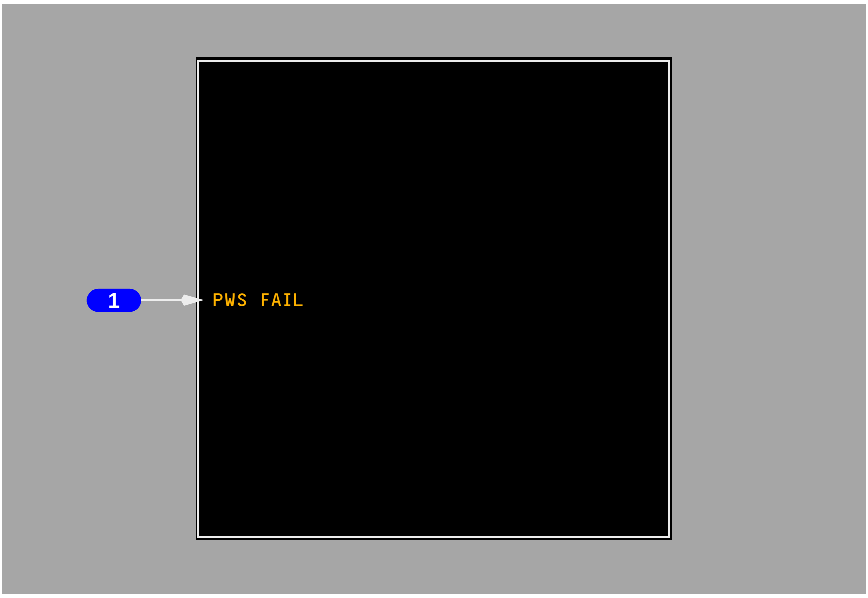
TERR RANGE DISAGREE –

- terrain display enabled, and
- terrain output range disagrees with selected EFIS control panel range.

MAP/TERR RANGE DISAGREE –

- terrain display enabled, and
- terrain output range disagrees with selected EFIS control panel range, and
- map display output range disagrees with selected EFIS control panel range.

Predictive Windshear System (PWS) Message



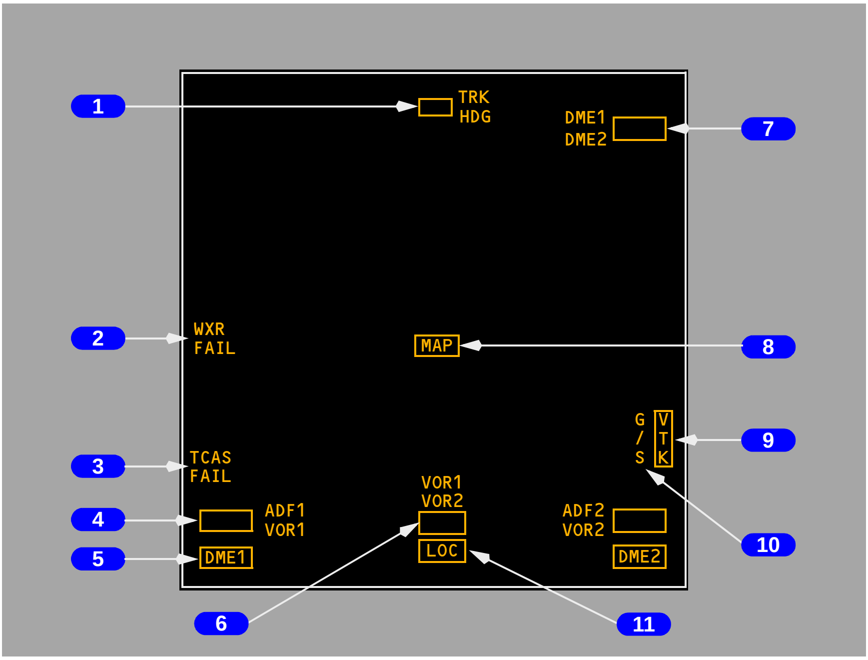
1 PWS FAIL Annunciation (amber)

Predictive windshear alerting and display have failed.

Navigation Displays – Failure Indications and Flags

Dashes replace numbers if there is no computed information. Failure flags replace symbols or failure messages are displayed, as appropriate.

Center MAP, Expanded MAP, APP, & VOR Modes



1 Track Failure Flag (expanded and center MAP modes)

Track information failed. Track cannot be displayed.

2 Weather Radar Annunciations (expanded and center MAP, expanded APP, expanded VOR modes)

WXR FAIL – Weather radar has failed. No weather data are displayed.

WXR WEAK – Weather radar calibration fault.

WXR ATT – Attitude stabilization for antenna has been lost.

WXR STAB – Antenna stabilization is off.

WXR DSP – Range data input has failed. Only displayed in WXR TEST

YF048 - YL551, YN531 - YV754
AUTOTILT FAIL – Automatic radar mode has failed.

3 TCAS Failure Flag (expanded and center MAP, expanded VOR, expanded APP, PLAN modes)

TCAS has failed.

4 ADF 1 and ADF 2 or VOR 1 and VOR 2 Failure Flag (expanded and center MAP, expanded APP, expanded VOR modes)

ADF or VOR has failed.

5 DME 1 and DME 2 Failure Flag (expanded and center MAP, expanded APP, expanded VOR modes)

Selected VOR DME has failed.

6 VOR 1, 2 Failure Flag (expanded VOR mode)

VOR has failed.

7 Reference VOR DME (expanded VOR mode) and Reference ILS DME (expanded APP mode)

Reference VOR or ILS DME has failed.

8 MAP Failure Flag (expanded and center MAP, PLAN modes)

The related FMC generated map display has failed.

9 Vertical Track Failure Flag (expanded and center MAP modes)

FMC vertical track data is invalid.

10 ILS Glideslope Failure Flag (expanded APP mode)

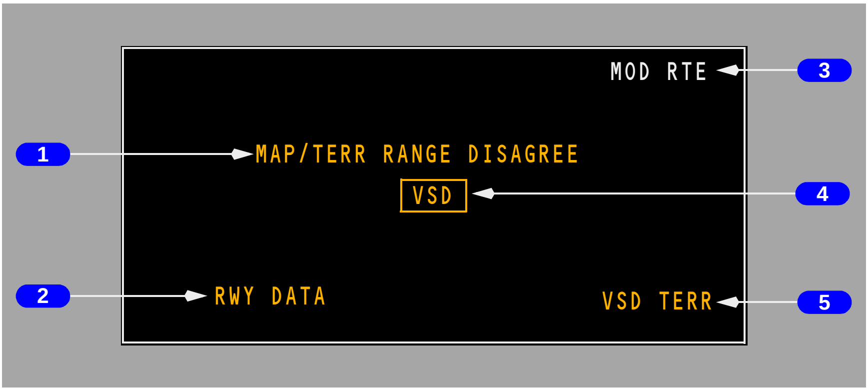
ILS glideslope has failed.

11 ILS Localizer Failure Flag (expanded APP mode)

ILS localizer course indication has failed.

Vertical Situation Display (VSD)

YF048 - YF928, YK624 - YK630, YK966 - YL551, YN531 - YV754



1 Range Disagreement Annunciations (amber)

MAP RANGE DISAGREE – Indicates selected range on the EFIS control panel is different than the MAP display range.

TERR RANGE DISAGREE – Indicates selected range on the EFIS control panel is different than the Terrain display range.

MAP/TERR RANGE DISAGREE – Indicates selected range on the EFIS control panel is different than the MAP and Terrain display ranges.

2 Runway Data Annunciation (amber)

FMC runway data is not available.

3 Route Waypoints Modification Annunciation (white)

FMC active route is being modified. Only active waypoint is displayed.

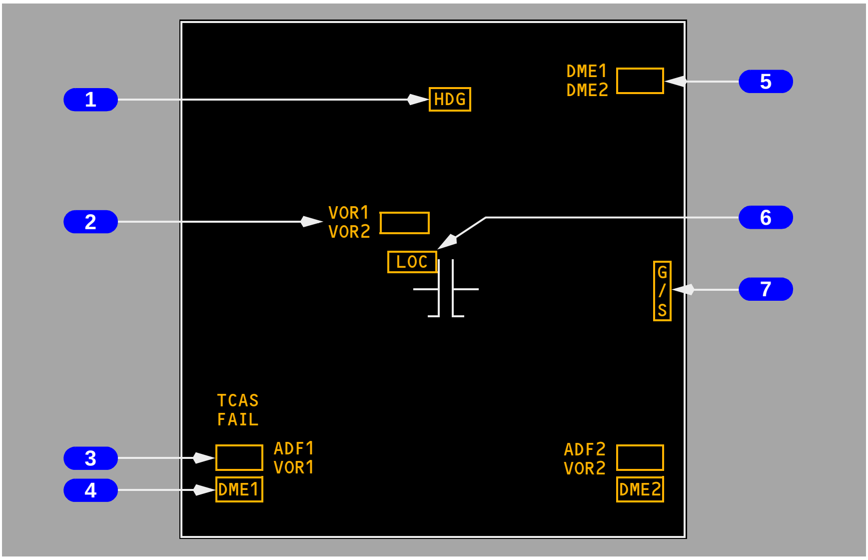
4 VSD Failure Flag (amber)

VSD cannot be displayed.

5 Terrain Data Failure Annunciation (amber)

EGPWS terrain data is not available. Annunciation is replaced with VSD TERR INHIBIT when GPWS control panel TERR INHIBIT switch is in the inhibit position.

Center APP and Center VOR Modes



1 Heading Failure Flag (center APP, center VOR modes)

Heading indication failed. Heading cannot be displayed.

2 VOR Failure Flag (center VOR mode)

VOR has failed.

3 ADF 1 and ADF 2 or VOR 1 and VOR 2 Failure Flag (center APP, center VOR modes)

VOR or ADF has failed.

4 DME 1 and DME 2 Failure Flag (center APP, center VOR modes)

Selected VOR DME has failed.

5 Reference VOR DME (center VOR mode) and Reference ILS DME (center APP mode)

Reference VOR or ILS DME has failed.

6 ILS Localizer Failure Flag (center APP mode)

ILS localizer course indication has failed.

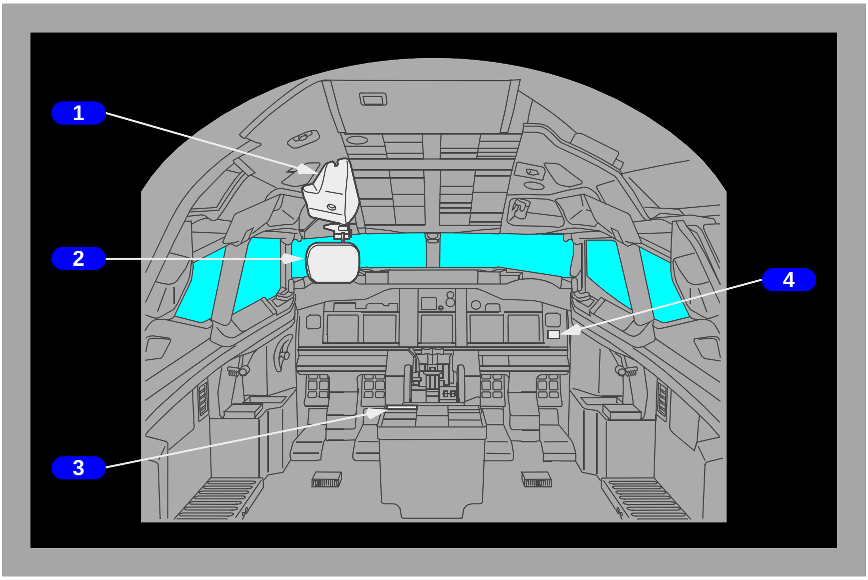
7 ILS Glideslope Failure Flag (center APP mode)

ILS glideslope has failed.

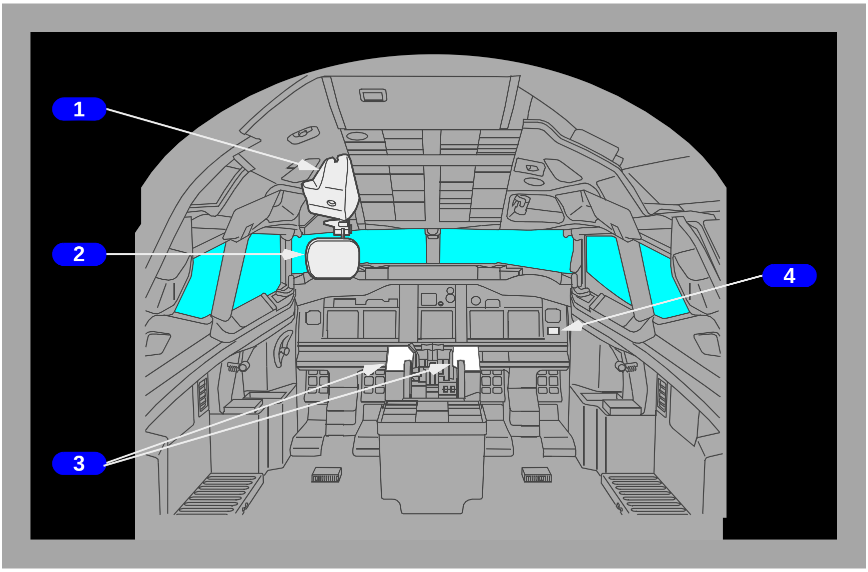
This Section Applies to YK622 - YK625, YS179 - YS190

System Components

YK622 - YK625



YS179 - YS190



1 Overhead Unit

Contains the CRT and projection optics to display the symbolic image on the combiner.

2 Combiner

Combines displayed flight symbology with the pilot’s view through window No. 1.

YK622 - YK625

3 Control Panel

Used for data entry and to select modes of operation.

YS179 - YS190

3 Multipurpose Display and Control Unit (MCDU)

Used for data entry and to select modes of operation.

4 Annunciator

Provides system status and warning annunciations during a CAT III approach.

Combiner Display

The combiner displays symbology and fault indications for the HUD system. Display modes of operation include:

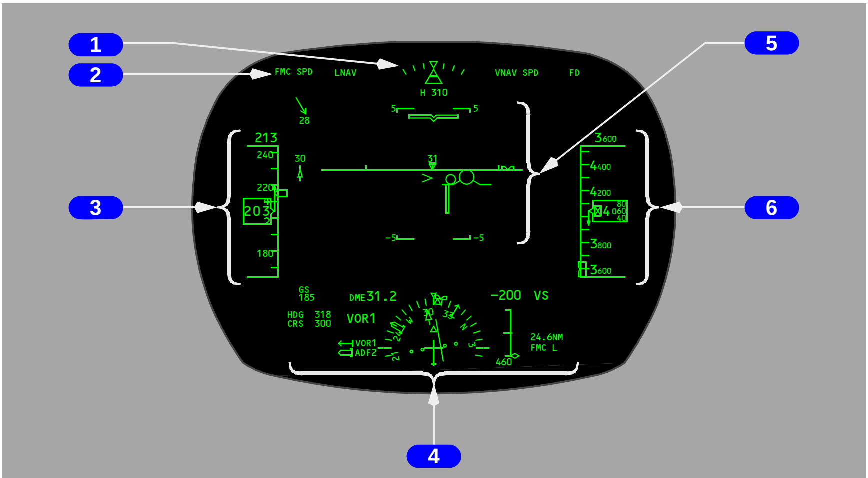
- Primary (PRI)
- AIII approach
- Instrument Meteorological Conditions (IMC) approach
- Visual Meteorological Conditions (VMC) approach.

Typical display modes are shown below.

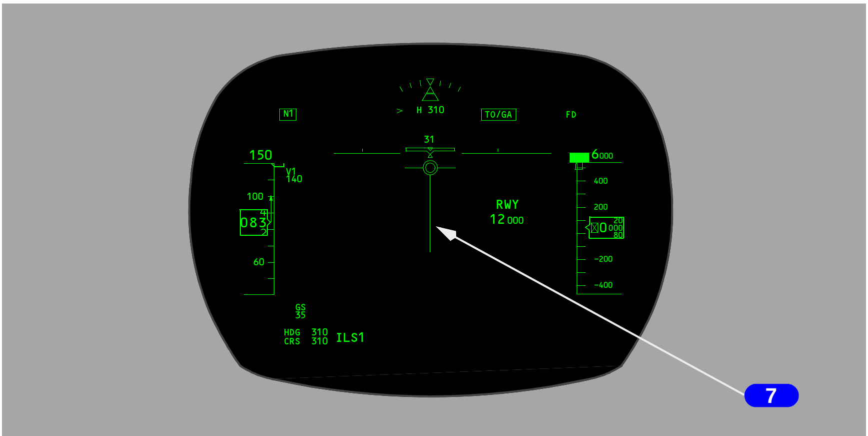
Note: Not all symbols are represented in this section. Refer to Section 10-42, Head-Up Display System, Symbology, for a complete listing of HUD system symbology.

Primary (PRI) Mode Display

The primary mode can be used for all phases of flight from takeoff to landing including low visibility takeoff and landing rollout operations.



PRI (IN FLIGHT) MODE



PRI (TAKEOFF) MODE

1 Bank Scale and Pointer

2 Flight Mode Annunciations (FMAs)

Refer to Chapter 4, Automatic Flight.

3 Airspeed Indications

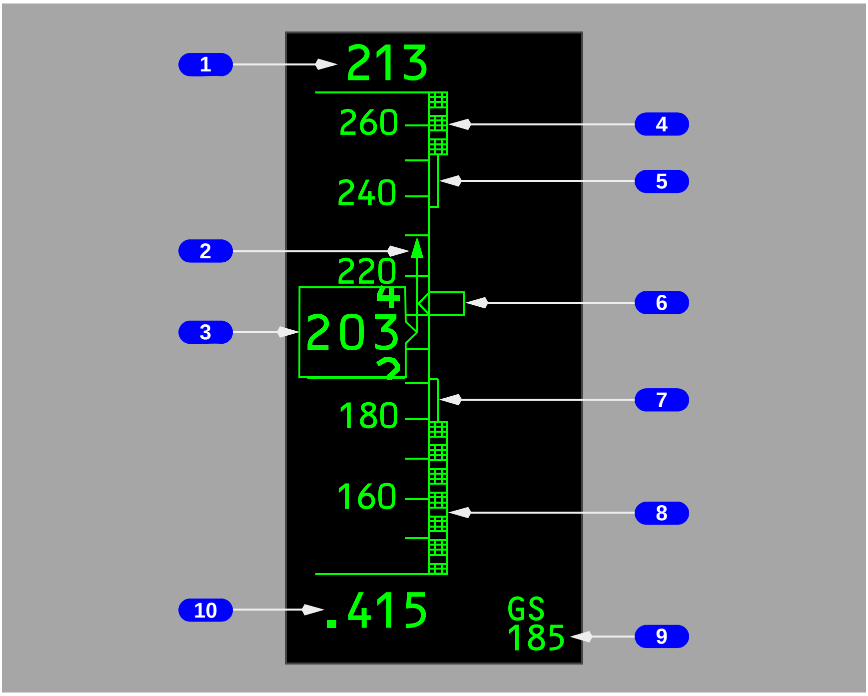
4 Navigation Indications

5 Attitude Indications

6 Altitude Indications

7 Ground Localizer Line

Airspeed Indications - General



1 Selected Speed (all modes)

Displays target airspeed:

- manually selected in the IAS/MACH window
- indicates the FMC computed airspeed when the IAS/MACH window is blank.

2 Speed Trend Vector (PRI in flight, PRI ground modes)

Tip of arrow indicates predicted airspeed in the next 10 seconds based on the current airspeed and acceleration.

3 Computed Airspeed (PRI in flight, PRI ground modes)

Indicates current computed airspeed in knots.

Displayed relative to a vertical scale along the edge of the tape and as a digital value.

4 Maximum Speed (PRI in flight mode)

Bottom of bar indicates the maximum speed as limited by the lowest of the following:

- Vmo/Mmo
- landing gear placard speed
- flap placard speed.

Inhibited on the ground.

5 Maximum Maneuver Speed (PRI in flight mode)

When flaps are up, the bottom of the bar indicates the maximum maneuver speed. This airspeed provides 1.3g maneuver capability to high speed buffet (or an alternative approved maneuver capability set in the FMC maintenance pages). The bar may be displayed when operating at high altitude at relatively high gross weights.

Note: 1.3g maneuver capability occurs at 40 degrees of bank in level flight.

When flaps are not up, the bottom of the bar indicates the placard speed for the next normal flap setting. The display logic is based on a normal flap setting sequence of 1, 5, 15, 30, 40. The bar is removed when the flap handle is moved to the landing flap setting selected on the APPROACH REF page or when the flap lever is moved to flaps 40. It is also removed with any flap retraction.

6 Speed Bug (PRI in flight, PRI ground modes)

Points to the airspeed:

- manually selected in the IAS/MACH window
- indicates the FMC computed airspeed when the IAS/MACH window is blank.

When the selected speed is off scale, the bug is parked at the top or bottom of the tape, with only one half bug visible.

7 Minimum Maneuver Speed (PRI in flight, PRI ground modes)

Top of the bar indicates minimum maneuver speed. This airspeed provides

- 1.3g maneuver capability to stick shaker below approximately 20,000 ft.
- 1.3g maneuver capability to low speed buffet (or an alternative approved maneuver capability set in the FMC maintenance pages) above approximately 20,000 ft.

Note: 1.3g maneuver capability occurs at 40 degrees of bank in level flight.

CAUTION: Reduced maneuver capability exists when operating within the regions below the minimum maneuver speed or above the maximum maneuver speed. During non-normal conditions the target speed may be below the minimum maneuver speed.

8 Minimum Speed (PRI in flight mode)

Top of bar indicates the speed at which stick shaker occurs.

Inhibited on the ground.

9 Ground Speed (all modes)

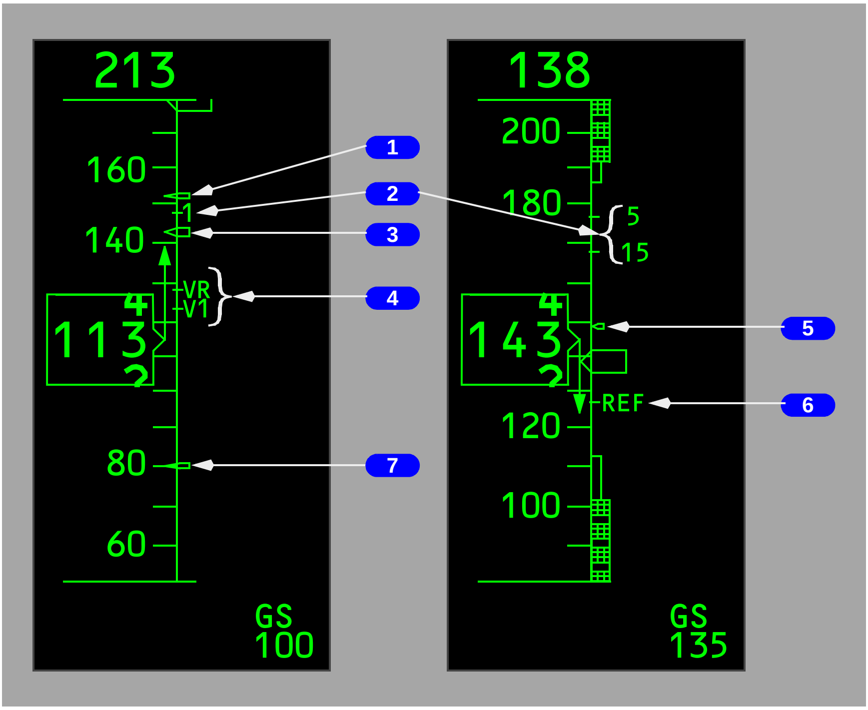
Indicates current ground speed in one knot increments.

10 Mach Speed (PRI in flight)

Indicates current mach speed when mach increases above .400 and removed when mach decreases below .380.

Note: In other than the PRI mode, the airspeed scale and associated symbols are replaced with a digital readout. The readout is positioned relative to the flight path vector. If the flight path vector is not displayed, the readout is positioned relative to the airplane reference symbol.

Airspeed Indications - Takeoff and Approach



1 Bug 5 (PRI in flight, PRI ground modes)

Displayed if speed reference selector on the engine display control panel is in the bug 5 position or SET position and a value greater than 60 knots has been selected. Not available if the speed reference selector is in the AUTO position.

2 Flaps Maneuvering Speeds (PRI in flight mode)

Indicates flap maneuvering speed for the displayed flap position.

3 V2+15 (PRI in flight mode)

Displayed for takeoff.

Removed when either of the following occurs:

- at first flap retraction
- when VREF is entered in the CDU.

4 Takeoff Reference Speeds (PRI ground mode)

Indicates V1 (decision speed) and VR (rotation speed) as selected on the CDU TAKEOFF REF page (refer to Chapter 11, Flight Management, Navigation) or as set with the speed reference selector on the engine display control panel.

5 VREF+20 (PRI in flight, PRI ground modes)

Displayed after selection of VREF.

6 Landing Reference Speed (PRI in flight, PRI ground modes)

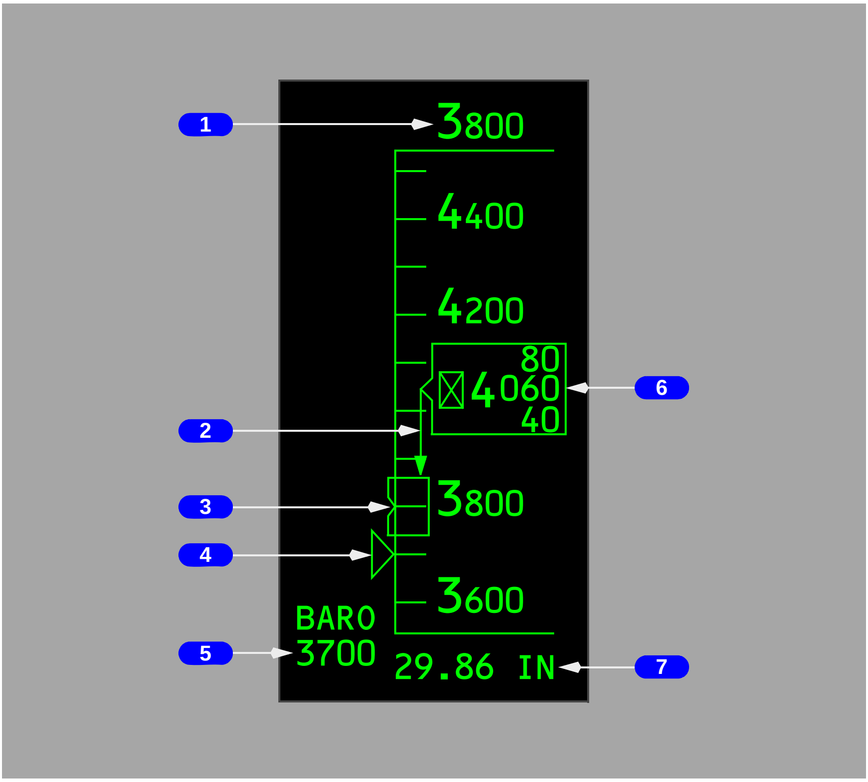
Indicates REF (reference speed) as selected on the CDU APPROACH REF page (refer to Chapter 11, Flight Management, Navigation) or as set with the speed reference selector on the engine display control panel. Replaced by a digital readout when off-scale at the bottom of the airspeed tape.

7 80 Knot Airspeed Bug (PRI in flight, PRI ground modes)

Indicates 80 knots:

- displayed automatically during preflight
- removed at first flap retraction or when VREF is entered.

Altitude Indications



1 Selected Altitude (PRI in flight, PRI ground modes)

Displays the altitude set in the MCP altitude window.

2 Altitude Trend Vector (PRI in flight mode)

Tip of arrow indicates predicted altitude in the next 6 seconds based on the current vertical speed.

3 Selected Altitude Bug (PRI in flight, PRI ground modes)

Points to the altitude set in the MCP altitude window.

When the selected altitude is off scale, the bug is parked at the top or bottom of the tape, with only one half bug visible.

4 BARO Minimums Pointer (PRI in flight, PRI ground modes)

Displays the barometric minimums selected on the EFIS control panel.

5 Minimums Reference/Altitude (PRI in flight, PRI ground modes)

Displays approach minimum reference and altitude set by the MINS selector on the EFIS control panel.

6 Current Altitude (PRI in flight, PRI ground modes)

Displays current altitude in increments of thousands, hundreds and twenty feet.

For positive values of altitude below 10,000 feet, an “X” symbol is displayed.

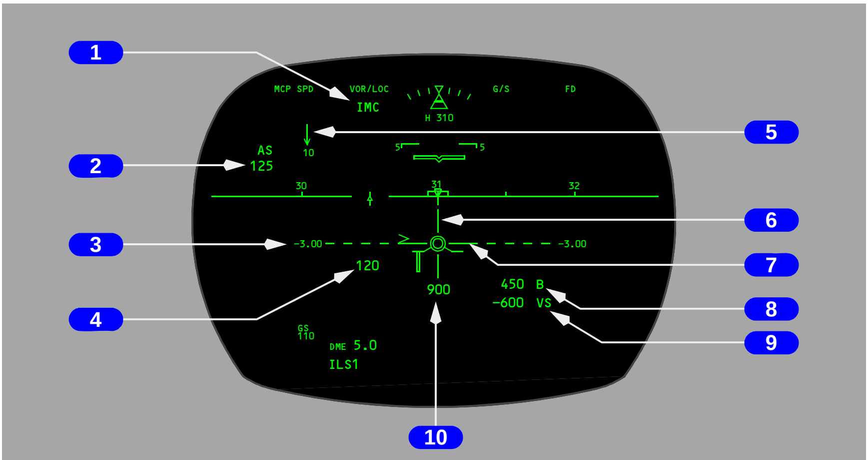
7 Barometric Setting (PRI in flight, PRI ground modes)

Displays the barometric setting in either inches of mercury (IN) or hectopascals (HPA) as selected on the EFIS control panel.

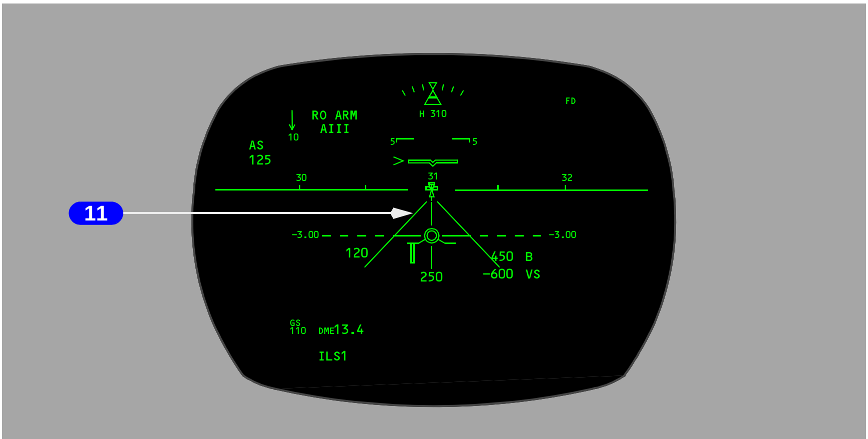
Note: In other than the PRI mode, the altitude scale and associated symbols are replaced with a digital readout. The readout is positioned relative to the flight path vector. If the flight path vector is not displayed, the readout is positioned relative to the airplane reference symbol.

Approach Mode Displays

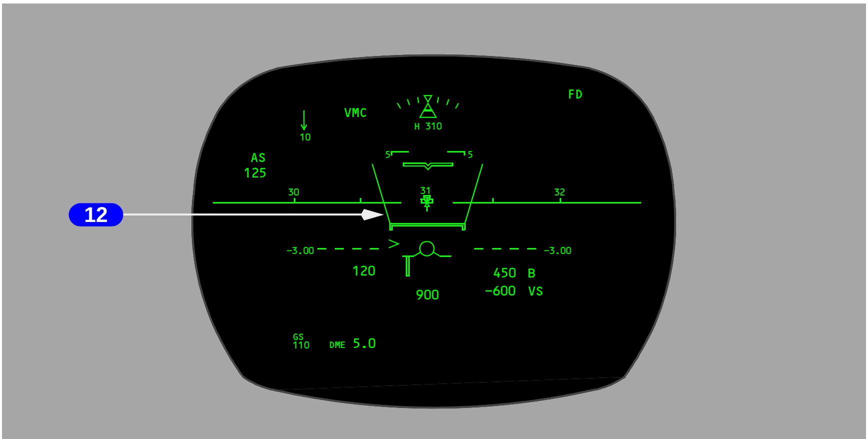
Refer to section 42 for symbology descriptions.



IMC MODE



AIII MODE



VMC MODE

1 **Mode/Status**

2 **Digital Selected Airspeed**

3 **Glideslope Reference Line**

4 **Digital Airspeed**

5 **Wind Indications**

6 **Lateral Deviation Line**

7 **Glideslope Deviation Line**

8 **Digital Barometric Altitude**

9 **Digital Vertical Speed**

10 **Radio Altitude**

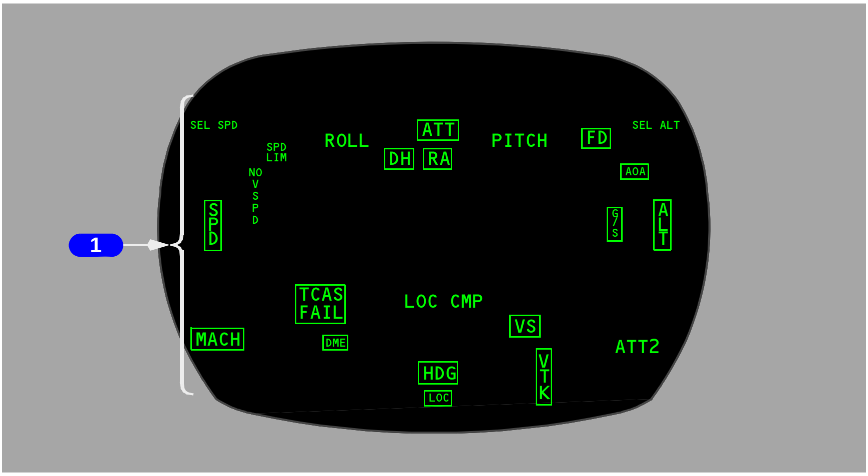
11 **Runway Edge Lines**

12 **TCAS Resolution Advisory**

Failure Indications and Flags

Dashes replace numbers if there is no computed information. Failure flags replace symbols or failure messages are displayed, as appropriate.

Data source flags are provided in a few cases to annunciate the source of displayed data when other than normal.

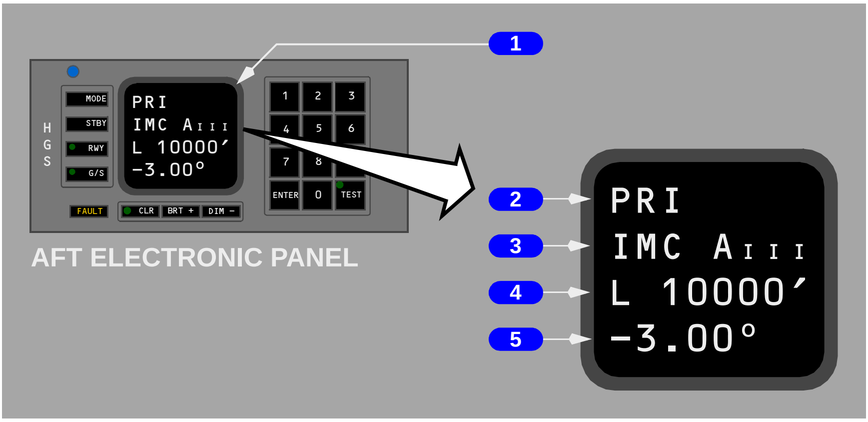


1 HUD System Failure Indications and Flags

See section 42 for detailed information on the HUD system failure indications and flags.

Control Panel Display

YK622 - YK625



1 Control Panel Display Window

Displays selected modes, entered values, system test and system status.

2 Mode Display Line

Displays current mode:

- PRI - primary flight mode
- AIII - Cat III approach mode
- IMC - instrument meteorological conditions approach mode
- VMC - visual meteorological conditions approach mode
- NO AIII - AIII capability lost
- CLR - combiner display cleared.

3 Standby Mode Display Line

Displays standby mode:

- PRI - primary flight mode
- AIII - Cat III approach mode
- IMC - instrument meteorological conditions approach
- VMC - visual meteorological conditions approach.

Automatic AIII arming is indicated by “AIII ARM” displayed as the standby mode. Once all requirements are satisfied for an AIII mode approach, AIII mode is automatically activated. Refer to Section 10-22, Head-Up Display System Description, for AIII mode arming requirements.

4 Runway Length/Elevation Line

Displays runway length or elevation:

- L XXXXX - valid entry is 0 to 99999 feet, however, entries between 7500 and 13500 feet are required to display ground roll guidance for low visibility takeoff operations
- E XXXXX - valid entry is –9999 to 99999 feet.

5 Reference Glideslope Line

Displays runway glideslope:

- valid entry is 0.00° to –9.99°
- entered values are required to be between –2.51° and –3.00° for AIII approach operations.

Intentionally
Blank

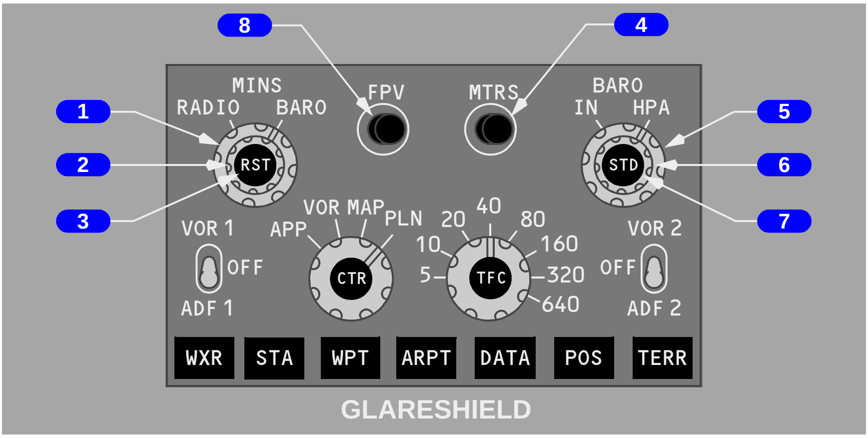
Flight Instruments, Displays Chapter 10

PFD/ND – Controls and Indicators Section 16

EFIS Control Panel (PFD/ND Display)

The left EFIS control panel controls the Captain outboard and inboard display units. The right EFIS control panel controls the First Officer outboard and inboard display units.

EFIS Control Panel Controls – Flight Instrument Displays



1 Minimums (MINS) Reference Selector (outer) (two position)

RADIO – selects radio altitude as the minimums reference.

BARO – selects barometric altitude as the minimums reference.

2 Minimums (MINS) Selector (middle) (slew)

ROTATE – adjusts the radio or baro minimums altitude.

3 Radio Minimums (MINS) Reset (RST) Switch (inner) (momentary action)

PUSH –

- resets the alert minimums annunciation
- blanks minimums display if alert is not active.

4 Meters (MTRS) Switch (momentary action)

PUSH – displays altitude indications in meters.

5 Barometric (BARO) Reference Selector (outer) (two position)

IN – selects inches of mercury as the barometric altitude reference.

HPA – selects hectopascals as the barometric altitude reference.

6 Barometric (BARO) Selector (middle) (slew)

ROTATE –

- adjusts the barometric altitude setting on the altitude tape
- if STD displayed, adjusts the preselected BARO reference.

7 Barometric (BARO) Standard (STD) Switch (inner) (momentary action)

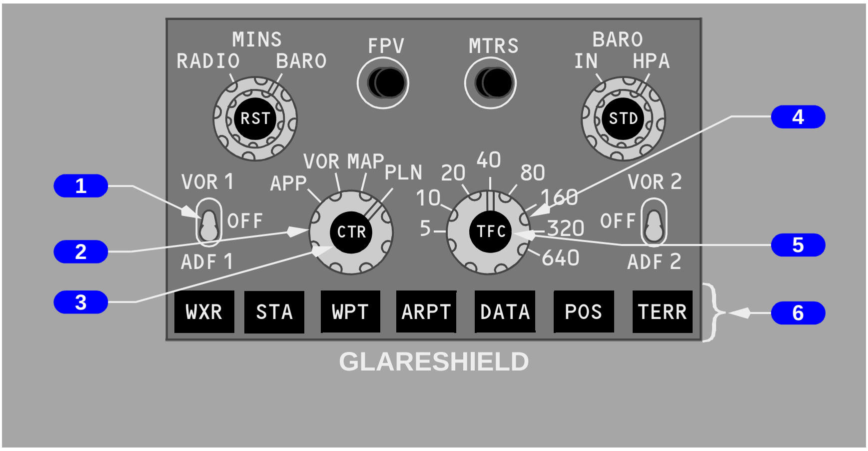
PUSH –

- selects the standard barometric setting (29.92 inches Hg/1013 HPA) for barometric altitude reference
- if STD is displayed, selects the preselected barometric reference
- if no preselected barometric is displayed, displays the last value before STD was selected.

8 Flight Path Vector (FPV) Switch (momentary action)

PUSH – displays flight path vector on the attitude indicator.

EFIS Control Panel Controls – Navigation Displays



1 VOR/ADF Switch (three position)

Displays VOR or ADF information on all navigation modes except PLAN.

VOR – displays the selected VOR bearing pointer, frequency or identification and DME.

OFF – removes the VOR or ADF displays.

ADF – displays the selected ADF pointer and ADF frequency or identification.

2 Mode Selector (outer)

Selects the desired display.

APP –

- displays localizer and glideslope information in heading–up format.
- displays reference ILS receiver, ILS frequency or identification, course and DME.

YV751 - YV754

- displays reference GLS receiver, GLS channel/course and GLS distance
- weather radar and TCAS are not displayed in center APP mode.

VOR –

- displays VOR navigation information in heading–up format
- displays reference VOR receiver, VOR frequency or identification, course, DME and TO/FROM information
- weather radar and TCAS are not displayed in center VOR mode.

MAP –

- displays FMC generated route and MAP information, airplane position, heading and track, in a track–up format
- displays waypoints, including the active waypoint, within the selected range
- displays VNAV path deviation.

PLN –

- displays a non–moving, true north up, route depiction
- the airplane symbol represents actual airplane position and orientation
- allows route step–through using the CDU LEGS page
- weather radar and TCAS are not displayed.

3 Center (CTR) Switch (inner)

PUSH –

- displays the full compass rose (center) for APP, VOR and MAP modes

YA701 - YA710, YK622, YK623, YK961 - YK965, YM482 - YM484

- subsequent pushes alternate between expanded and center displays.

YF048 - YF928, YK624 - YK630, YK966 - YL551, YN531 - YV754

- in MAP mode subsequent pushes alternate between center with VSD, expanded and center without VSD; in VOR or APP modes subsequent pushes alternate between expanded and center displays.

4 Range Selector (outer)

Selects desired display range in nautical miles for APP, VOR, MAP or PLN mode.

5 Traffic (TFC) Switch (inner)

PUSH – displays TCAS information on the navigation display (refer to Chapter 15, Warning Systems).

6 MAP Switches (momentary action)

The MAP switches:

- add background data/symbols to MAP and center MAP modes
- displays can be selected simultaneously
- second push removes the information.

WXR (weather radar) – energizes weather radar transmitter and displays weather radar returns in MAP, center MAP, expanded VOR, and expanded APP modes. When the 640 nm range is selected, weather radar returns are limited to 320 nm (refer to Chapter 11, Flight Management, Navigation).

YV751 - YV754

Note: WXR switch is automatically selected "OFF" in the event of an EFIS CP failure in flight.

STA (station) –

- displays all FMC data base navigation aids if on map scales 5, 10, 20 or 40 nm
- displays FMC data base high altitude navigation aids on map scales 80, 160, 320 or 640 nm.

WPT (waypoint) – displays the waypoints in the FMC data base which are not in the flight plan route if the selected range is 40 nm or less.

ARPT (airport) – displays all airports which are stored in the FMC data base and which are within the viewable map area.

YA701 - YA710, YK622, YK623, YK961 - YK965, YM482 - YM484

DATA – displays altitude constraint if applicable, and estimated time of arrival for each active route waypoint.

YF048 - YF928, YK624 - YK630, YK966 - YL551, YN531 - YT513, YV604, YV605

DATA – displays altitude constraint if applicable, and estimated time of arrival for each active route waypoint.

Route Data can be displayed on the lateral map area of the Vertical Situation Display (VSD) when in the VSD mode format. Displayed Route Data can be cycled on or off with the route “DATA” pushbutton.

YT514 - YT521, YV741 - YV754

DATA – displays altitude constraint if applicable, estimated time of arrival and down track RNP for each active route waypoint.

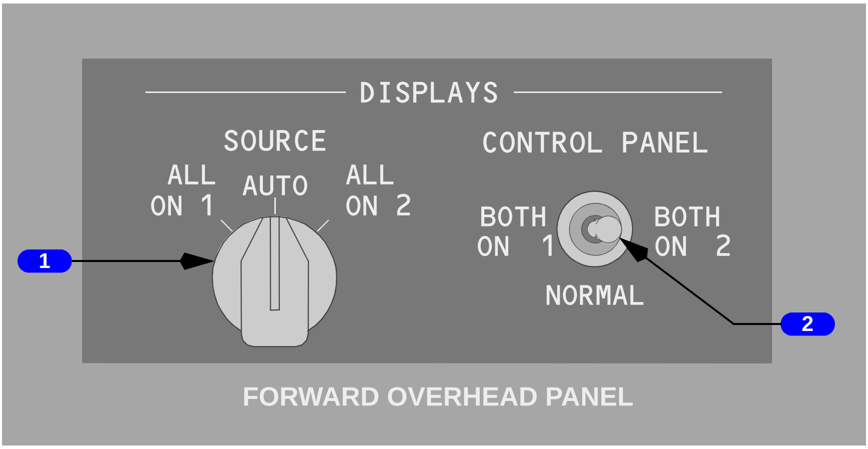
Route Data can be displayed on the lateral map area of the Vertical Situation Display (VSD) when in the VSD mode format. Displayed Route Data can be cycled on or off with the route “DATA” pushbutton.

POS (position) – displays IRS positions, GPS positions and VOR bearing vectors extended from the nose of the airplane symbol to the stations.

TERR (terrain) – displays GPWS generated terrain data in MAP, center MAP, VOR, and APP modes (refer to Chapter 15, Warning Systems).

Displays Source Control Panel

Both a display source Display Electronics Unit (DEU) selector and an EFIS control switch are located above the Captain on the forward overhead (P5) panel.



1 Displays Source Selector – DEU

Both DEUs or only one DEU can drive all six Captain and First Officer displays. There is a SOURCE selector on the overhead panel. The selector is normally set to the AUTO mode:

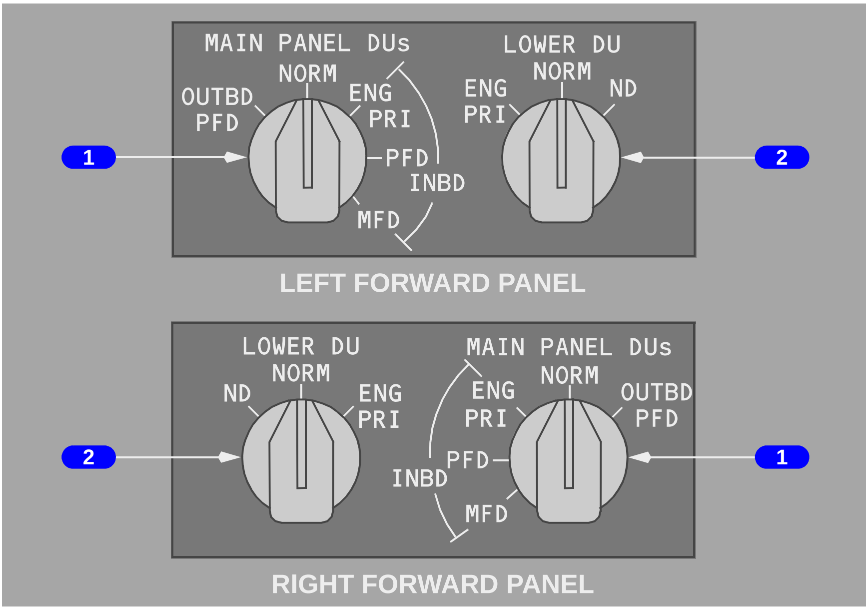
- ALL ON 1 – selects the Captain’s DEU to drive all six Captain and First Officer displays
- AUTO – allows DEU 1 to drive the Captain outboard, Captain inboard, and upper display units while DEU 2 drives the First Officer outboard, First Officer inboard, and lower display units. Provides automatic switching from both DEUs to one in case of single DEU failure
- ALL ON 2 – selects the First Officer’s DEU to drive all six Captain and First Officer displays.

Note: These source selectors and switches are normally used while the aircraft is on the ground for maintenance purposes.

2 Displays Control Panel Switch – EFIS

- BOTH ON 1 – both pilots’ displays are set to the Captain’s EFIS control panel
- NORMAL – the left EFIS control panel controls the Captain’s displays and the right EFIS control panel controls the First Officer’s displays
- BOTH ON 2 – both pilots’ displays are set to the First Officer’s EFIS control panel.

Display Select Panels



1 Main Panel Display Units (MAIN PANEL DUs) Selector

Selects what is displayed on the respective outboard and inboard display units:

- Outboard Primary Flight Display (OUTBD PFD) – displays the PFD on the outboard display unit and blanks the inboard display unit
- Normal (NORM) – displays PFD on the outboard display unit and ND on the inboard display unit
- Inboard Engine Primary (INBD ENG PRI) – displays the primary engine instruments on the inboard display unit and the PFD on the outboard display unit
- Inboard Primary Flight Display (INBD PFD) – displays the PFD on the inboard display unit and blanks the outboard display unit

YA701 - YA710, YK622 - YK625, YK961 - YK971, YL076, YL077, YM482 - YM484

- Inboard Multifunction Display (INBD MFD) – displays PFD on the outboard display unit and blanks the inboard display unit. The inboard display unit stays blank until system format (SYS) or secondary engine format (ENG) is selected with MFD switches on the engine display control panel.

YF048 - YF928, YK626 - YK630, YK973 - YK980, YL541 - YL551, YN531 - YV754

- Inboard Multifunction Display (INBD MFD) – displays PFD on the outboard display unit and blanks the inboard display unit. The inboard display unit stays blank until system format (SYS) or secondary engine format (ENG) is selected with MFD switches on the engine display control panel or video surveillance (DSPL) is selected on the flight deck entry video panel. In the normal display configuration, video surveillance is available only on the lower display unit.

2 Lower Display Unit (LOWER DU) Selector

Selects what is displayed on the lower display unit:

- Engine Primary (ENG PRI) – displays the primary engine instruments on the lower display unit and blanks the upper display unit

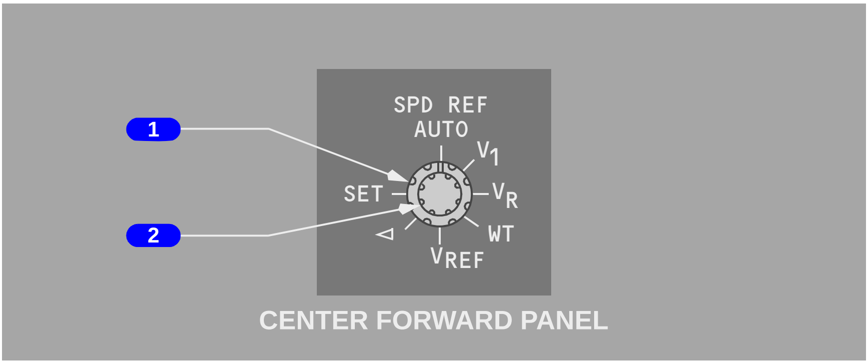
YA701 - YA710, YK622 - YK625, YK961 - YK971, YL076, YL077, YM482 - YM484

- Normal (NORM) – display unit is normally blank or displays MFD format selected on the engine display control panel

YF048 - YF928, YK626 - YK630, YK973 - YK980, YL541 - YL551, YN531 - YV754

- Normal (NORM) – display unit is normally blank or displays MFD format selected on the engine display control panel or video surveillance (DSPL) selected on the flight deck entry video panel
- Navigation Display (ND) – displays the navigation display on the lower unit.

Speed Reference Selector



1 **Speed Reference Selector (outer)**

Sets the reference airspeed bugs on the airspeed indication:

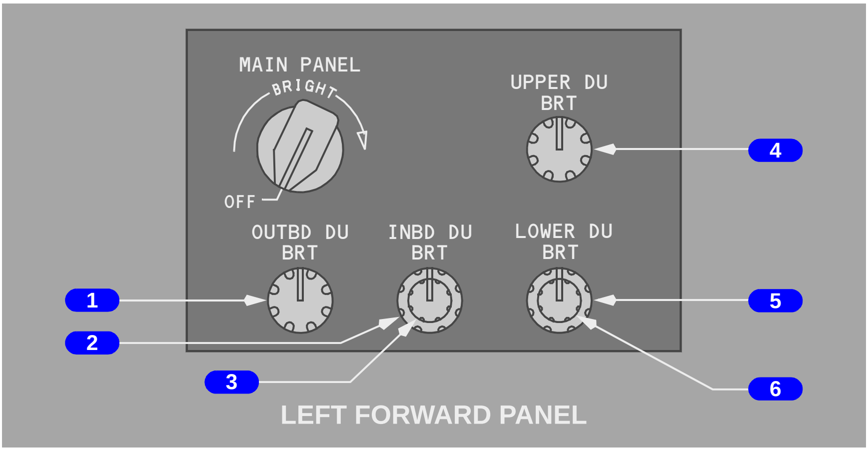
- AUTO – the reference airspeeds and gross weight are provided automatically through the FMC
- V1 – used to manually set decision speed on the ground; in flight, displays “INVALID ENTRY”
- VR – used to manually set rotation speed on the ground; in flight, displays “INVALID ENTRY”
- WT – allows manual entry of reference gross weight
- VREF – used to manually set the landing reference speed in flight; on the ground, displays “INVALID ENTRY”
- Bug 5 – used to manually set the white bug 5 to the desired value
- SET – removes the speed reference display.

2 **Speed Reference Selector (inner) (two speed slew)**

ROTATE –

- manually sets the appropriate reference airspeed or gross weight
- the digital display appears below the airspeed indication.

Display Brightness Controls
Captain Brightness Controls



1 **Outboard Display Unit Brightness (OUTBD DU BRT) Control (rotary)**

ROTATE – adjusts the brightness of the Captain outboard display unit.

2 **Inboard Display Unit Brightness (INBD DU BRT) Control (outer) (rotary)**

ROTATE – adjusts the brightness of the Captain inboard display unit.

YA701 - YA710, YK622 - YK625, YK961 - YK971, YL076, YL077, YM482 - YM484

3 **Inboard Display Unit Radar Brightness (INBD DU BRT) Control (inner) (rotary)**

ROTATE – adjusts weather radar and terrain display brightness on the Captain inboard display unit.

YF048 - YF928, YK626 - YK630, YK973 - YK980, YL541 - YL551, YN531 - YV754

3 **Inboard Display Unit Brightness/Contrast (INBD DU BRT) Control (inner) (rotary)**

ROTATE – adjusts weather radar and terrain display brightness on the Captain inboard display unit, adjusts display contrast when MFD is in the video surveillance mode.

4 **Upper Display Unit Brightness (UPPER DU BRT) Control (rotary)**

ROTATE – adjusts the brightness of the upper display unit.

5 **Lower Display Unit Brightness (LOWER DU BRT) Control (outer) (rotary)**

ROTATE – adjusts the brightness of the lower display unit.

YA701 - YA710, YK622 - YK625, YK961 - YK971, YL076, YL077, YM482 - YM484

6 **Lower Display Unit Brightness (LOWER DU BRT) Control (inner) (rotary)**

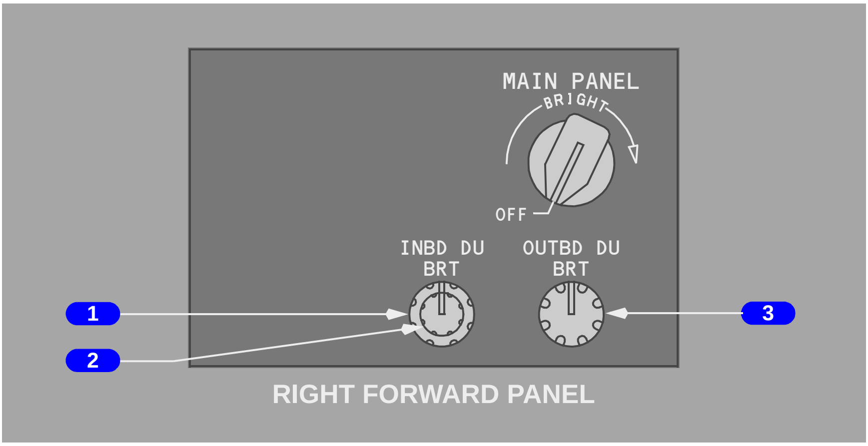
ROTATE – adjusts weather radar and terrain display brightness on the lower display unit.

YF048 - YF928, YK626 - YK630, YK973 - YK980, YL541 - YL551, YN531 - YV754

6 **Lower Display Unit Brightness/Contrast (LOWER DU BRT) Control (inner) (rotary)**

ROTATE – adjusts weather radar and terrain display brightness on the lower display unit, adjusts display contrast when MFD is in the video surveillance mode.

First Officer Brightness Controls



1 Inboard Display Unit Brightness (INBD DU BRT) Control (outer) (rotary)

ROTATE – adjusts the brightness of the First Officer inboard display unit.

YA701 - YA710, YK622 - YK625, YK961 - YK971, YL076, YL077, YM482 - YM484

2 Inboard Display Unit Radar Brightness (INBD DU BRT) Control (inner) (rotary)

ROTATE – adjusts weather radar and terrain display brightness on the First Officer inboard display unit.

YF048 - YF928, YK626 - YK630, YK973 - YK980, YL541 - YL551, YN531 - YV754

2 Inboard Display Unit Brightness/Contrast (INBD DU BRT) Control (inner) (rotary)

ROTATE – adjusts weather radar and terrain display brightness on the First Officer inboard display unit, adjusts display contrast when MFD is in the video surveillance mode.

3 Outboard Display Unit Brightness (OUTBD DU BRT) Control (rotary)

ROTATE – adjusts the brightness of the First Officer outboard display unit.

Standby Flight Instruments

The standby flight instruments include the:

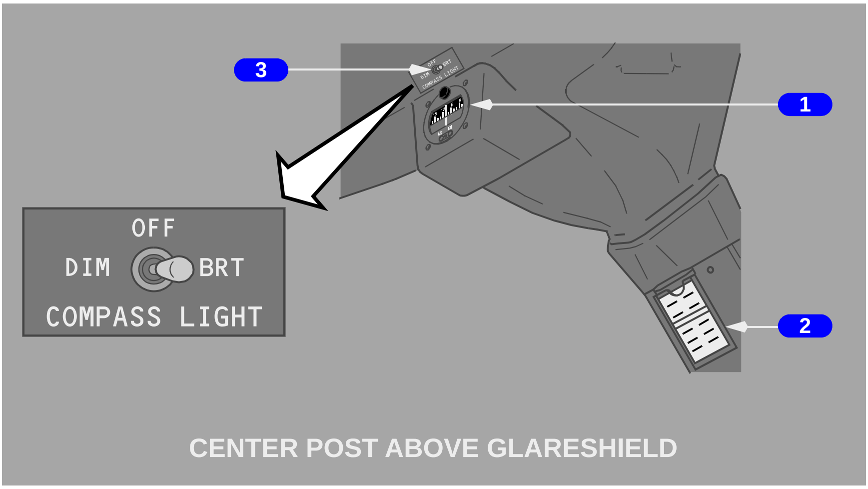
- standby magnetic compass

YA701 - YA706
- standby attitude indicator

YA701 - YA706
- standby altimeter/airspeed indicator

YA707 - YV754
- integrated standby flight display
- standby radio magnetic indicator

Standby Magnetic Compass



1 Standby Magnetic Compass

Displays magnetic heading.

2 Standby Magnetic Compass Correction Card

Provides appropriate heading corrections.

3 Compass Light Switch

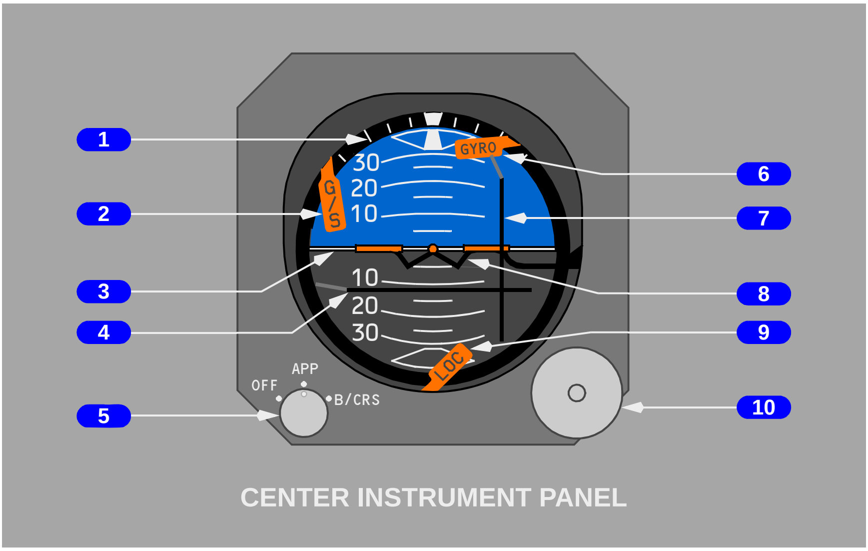
OFF – compass light is extinguished.

BRT – sets compass light to full brightness.

DIM – sets compass light to low brightness.

Standby Attitude Indicator

YA701 - YA706



1 **Bank Indicator and Scale**

Scale marks are at 0, 10, 20, 30, 45 and 60 degrees.

2 **Glideslope Flag**

- glideslope receiver has failed
- glideslope pointer is removed.

3 **Horizon Line and Pitch Angle Scale**

Pitch scale is in 5 degree increments.

4 **Glideslope Pointer and Deviation Scale**

- pointer indicates glideslope position
- pointer is not displayed when
  - approach selector is off or in B/CRS
  - no computed data exists
  - glideslope receiver has failed
- scale indicates deviation.

5 **Approach Mode Selector**

OFF – glideslope and localizer pointers retracted from view.

APP – glideslope and localizer pointers in view; ILS signals provided by the No. 1 ILS receiver.

B/CRS – reverses sensing for localizer pointer during back course approaches; glideslope pointer not displayed.

6 GYRO Flag

Attitude is unreliable.

7 Localizer Pointer and Deviation Scale

- pointer indicates localizer position
- pointer is not displayed when
  - approach selector is off
  - no computed data exists
  - localizer receiver has failed
- scale indicates deviation.

8 Airplane Symbol

9 Localizer Flag

- localizer receiver has failed
- localizer pointer is removed.

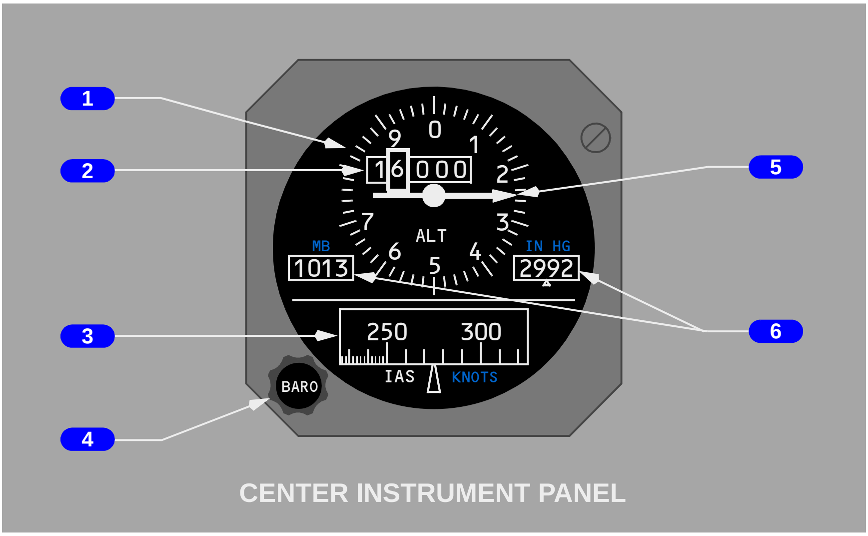
10 Caging Control

PULL – aligns horizon line with the airplane symbol

RELEASE – the control contracts.

Standby Altimeter/Airspeed Indicator

YA701 - YA706



1 **Standby Altimeter**

Receives static pressure from the alternate static ports.

2 **Digital Counter**

- indicates thousand foot increments of current altitude
- a green flag appears in the left side of the window when altitude is less than 10,000 feet
- a striped flag appears in the left side of the window when altitude is less than zero feet.

3 **Standby Airspeed Indicator**

Receives ram air pressure from the auxiliary pitot probe and static pressure from the alternate static ports.

4 **Barometric Setting Control**

ROTATE – adjusts the barometric correction in both barometric windows.

5 **Altitude Pointer**

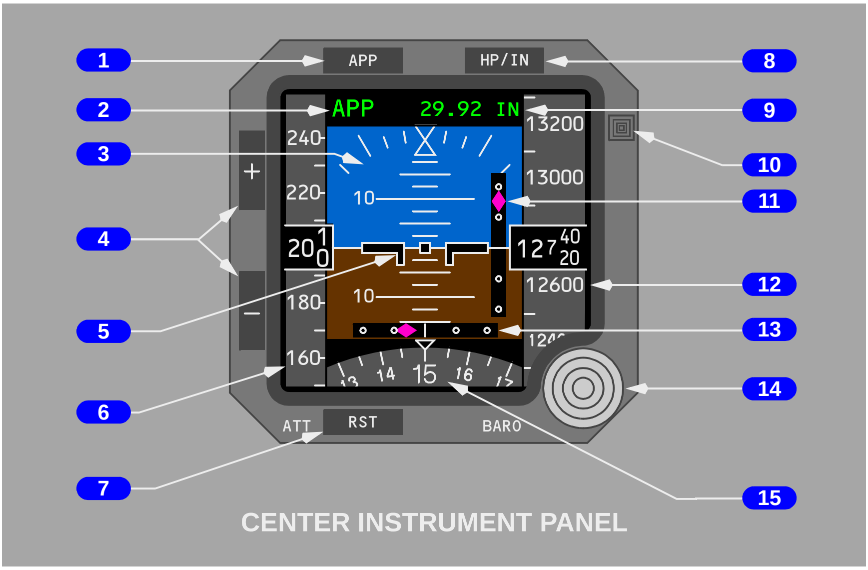
Indicates hundred foot increments of current altitude.

6 Barometric Setting Windows

Indicates barometric correction in millibars and inches of mercury as set by the barometric setting control.

Integrated Standby Flight Display

YA707 - YV754



1 Approach (APP) Switch

Push –

- when blank, selects APP
- when APP displayed, selects BCRS
- when BCRS displayed, blanks.

2 Approach Mode Annunciation

Indicates approach mode selected.

- Blank – no approach deviation data displayed
- APP – ILS localizer and glideslope deviation data displayed
- BCRS (Back course) – reverses sensing for localizer pointer during back course approaches.

3 Attitude Display

Displays airplane attitude.

- Indicates bank in reference to the bank scale
- Indicates the horizon relative to the airplane symbol
- Beyond 30 degrees pitch, large red arrowheads (V-shaped) indicate the attitude has become excessive, and the direction to the horizon line.

4 Display Brightness Switches

Push –

- + increases display brightness
- – decreases display brightness.

5 Airplane Symbol

Indicates airplane attitude with reference to the horizon.

6 Airspeed Indications

Indicates current airspeed when above 30 knots.

7 Attitude Reset (RST) Switch

Push and hold at least two seconds

- aligns horizon with the airplane symbol
- reset takes approximately ten seconds
- starts new initialization sequence if previous attempt failed (ground only).

8 Hectopascal/Inch (HP/IN) Switch

Push – changes the units of the barometric reference.

9 Barometric Setting

Indicates the barometric setting selected with the barometric selector.

STD is displayed when selected with the barometric selector.

10 Ambient Light Sensor

Automatically adjusts display intensity for ambient lighting condition.

11 Glideslope Pointer and Deviation Scale

The glideslope pointer indicates glideslope position relative to the airplane.

- the pointer is in view when the glideslope signal is received
- the scale is in view when the APP mode is selected.
- the pointer and scale are removed when the BCRS mode is selected

12 Current Altitude

13 Localizer Pointer and Deviation Scale

The localizer pointer indicates localizer position relative to the airplane.

- the pointer is in view when the localizer signal is received
- the scale is in view when either the APP or BCRS mode is selected

14 Barometric (BARO) Selector

Rotate – changes barometric setting

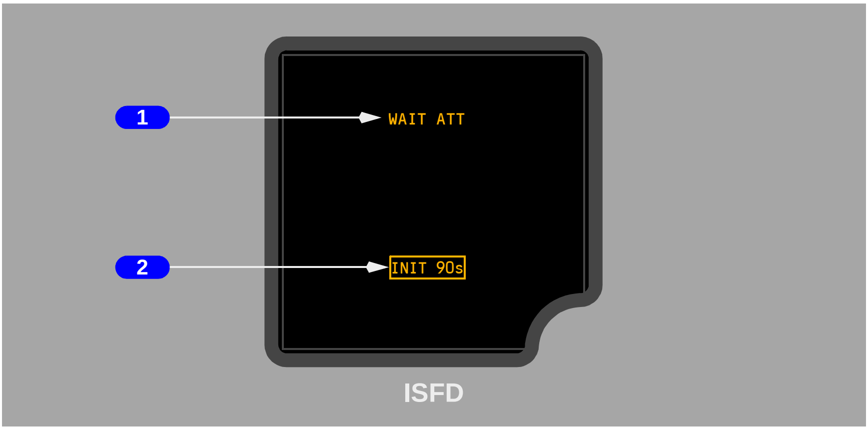
Push –

- selects standard barometric setting (29.92 inches Hg/1013 HPA)
- if STD is displayed, selects the preselected barometric setting.

15 Heading Indication

Displays airplane heading.

ISFD Messages



1 Attitude Messages

Indicates attitude display status.

- ATT:RST (amber) – attitude must be reset using the attitude reset switch
- ATT 10s (amber) – 10 second attitude realignment in progress
- WAIT ATT (amber) – indicates temporary self-correcting loss of attitude.

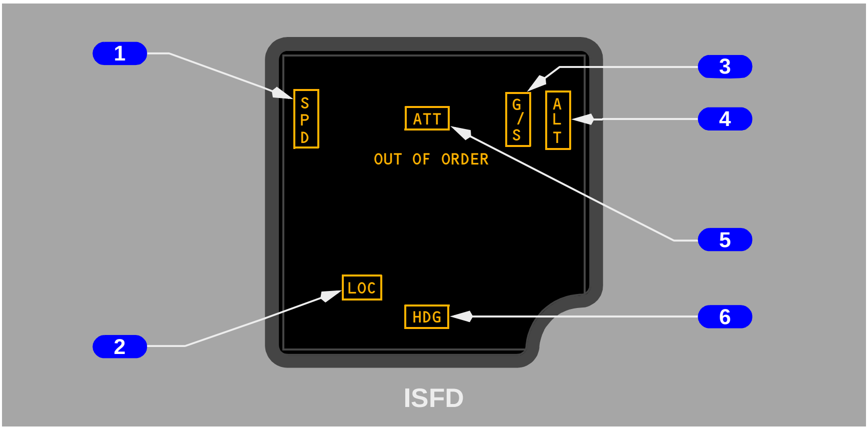
2 Initialization Message

INIT 90s (amber) – 90 second initialization countdown.

- countdown stops if excessive motion is detected
- countdown resumes when motion stops
- ATT:RST displays if initialization is not complete within six minutes.

ISFD Failure Flags

The OUT OF ORDER annunciation replaces the display when a total ISFD system failure occurs.



1 Airspeed flag

Airspeed information has failed.

2 ILS localizer failure flag

ILS localizer has failed.

3 ILS glideslope failure flag

ILS glideslope has failed.

4 Altitude flag

Altitude information has failed.

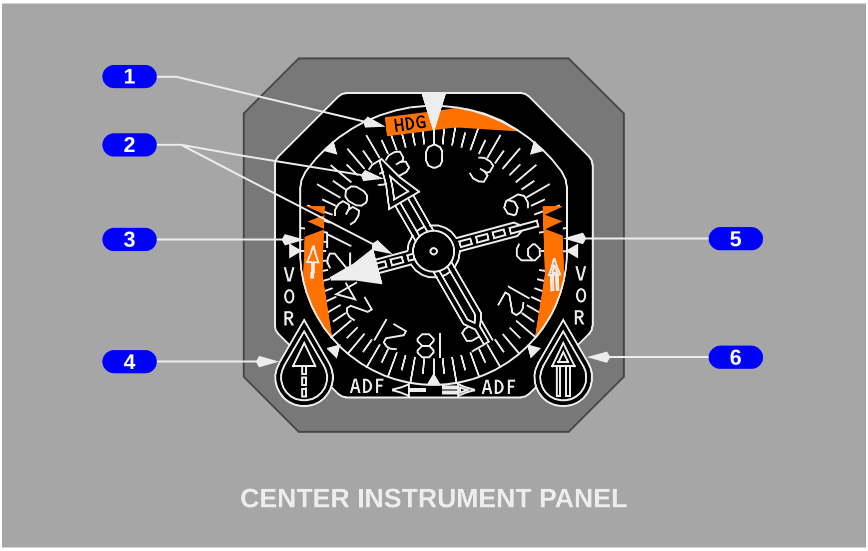
5 Attitude flag

Attitude information has failed.

6 Heading flag

Heading data has failed.

Standby Radio Magnetic Indicator



1 Heading Warning Flag

The compass signal from the air data inertial reference system is lost.

2 Bearing Pointers

- narrow pointer uses signals from the VHF NAV receiver No. 1 or ADF receiver No. 1
- wide pointer uses signals from the VHF NAV receiver No. 2 or ADF receiver No. 2.

3 Bearing Pointer No. 1 Warning Flag

VOR mode:

- RMI power failure
- VHF NAV signal unreliable.

ADF mode:

- RMI power failure
- ADF failure or signal unreliable.

4 VOR/ADF Bearing Pointer No. 1 Switch

ROTATE – selects VOR or ADF for the bearing pointer.

5 Bearing Pointer No. 2 Warning Flag

VOR mode:

- RMI power failure
- VHF NAV signal unreliable.

ADF mode:

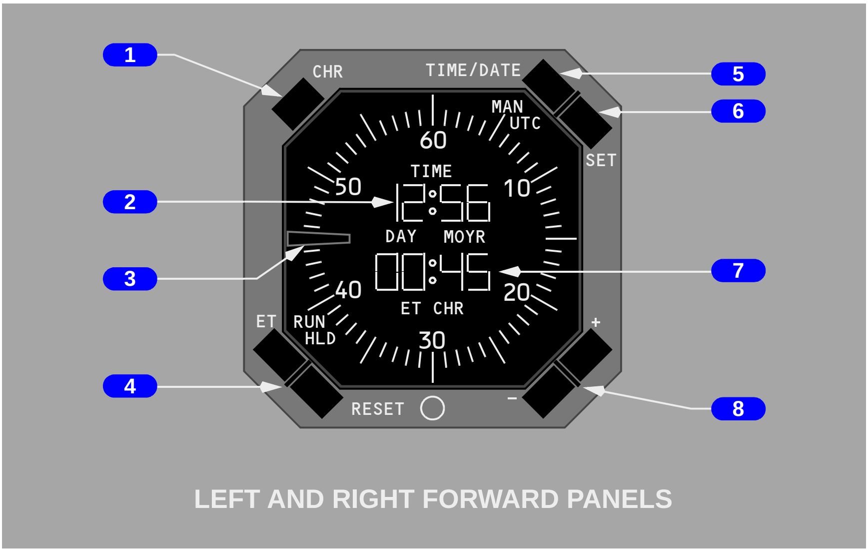
- RMI power failure
- ADF failure or signal unreliable.

6 VOR/ADF Bearing Pointer No. 2 Switch

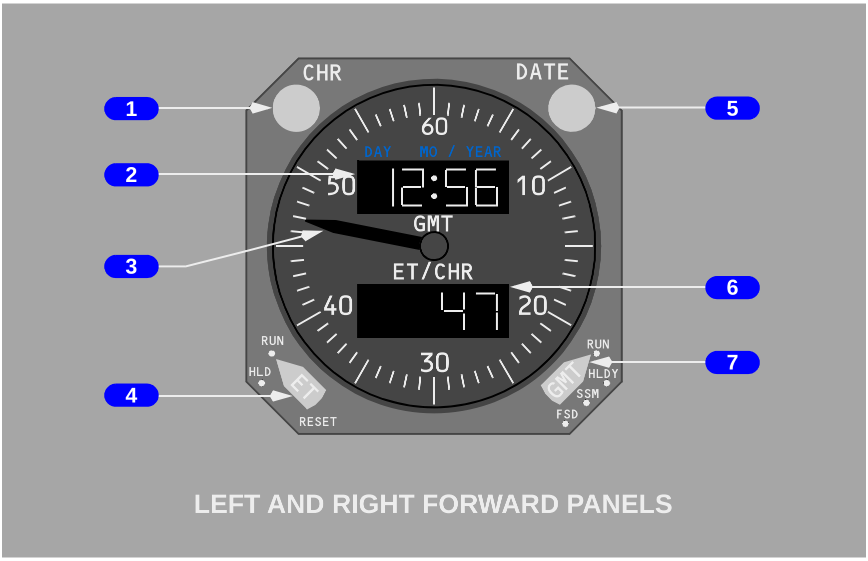
ROTATE – selects VOR or ADF for the bearing pointer.

Clock

YA704 - YA710



YA701 - YA703



YF048 - YV754

1 Chronograph (CHR) Control

PUSH –

- controls the start, stop and reset functions of the CHR display and second hand with successive pushing
- overrides any existing ET display.

YA704 - YV754

2 Time/Date Indicator

- displays UTC or manual time (hours, minutes) when time is selected with the time/date pushbutton
- alternately displays day–month and year when date is selected with the time/date pushbutton.

YA701 - YA703

2 Time/Date Window

- displays time (hours, minutes) when time is selected with the date control
- alternately displays day–month and year when date is selected with the date control.

3 Chronograph Second Hand

- indicates chronograph seconds
- controlled by the CHR control.

YA704 - YA710

4 Elapsed Time (ET) and RESET Pushbutton

Controls the elapsed time function:

- select the ET pushbutton once to run the elapsed time
- select the ET pushbutton again to hold the elapsed time
- select the RESET pushbutton to set the elapsed time to 0.

The RUN or HLD symbol is displayed on the lower left part of the LCD display.

YF048 - YV754

4 Elapsed Time (ET) Pushbutton

Controls the elapsed time function:

- select the ET pushbutton once to run the elapsed time
- select the ET pushbutton again to hold the elapsed time
- select the ET pushbutton again to continue the elapsed time
- select the ET pushbutton for 2 seconds to set the elapsed time to 0 and clear the display.

The ET and RUN or HLD symbols are displayed below the elapsed time.

YA701 - YA703

4 Elapsed Time (ET) Selector (three position, rotary)

Controls the elapsed time function:

RESET – returns ET display to zero (spring loaded to HLD).

HLD (hold) – stops the elapsed time display.

RUN – starts the elapsed time display.

YA704 - YV754

5 TIME/DATE Pushbutton

Controls the time/date function:

- select the TIME/DATE pushbutton once to see UTC time
- select the TIME/DATE pushbutton again to see UTC date
- select the TIME/DATE pushbutton again to see manual time
- select the TIME/DATE pushbutton again to see manual date.

The UTC or MAN symbol is displayed on the upper right part of the LCD display.

In MAN mode, clock time and date come from the clock. In UTC mode, clock time and date come from the global positioning system.

YA701 - YA703

5 Date Control

Controls the date display:

PUSH – displays date (day, month) alternating with year.

PUSH – returns display to time.

YA704 - YA710

6 SET Pushbutton

Controls the setting of manual time and date:

With manual time displayed:

- select the SET pushbutton once and the hours flash, use the plus or minus pushbutton to adjust the hours
- select the SET pushbutton again and the minutes flash, use the plus or minus pushbutton to adjust the minutes
- select the SET pushbutton again to run the time.

With manual date displayed:

- select the SET pushbutton once and the day flashes, use the plus or minus pushbutton to adjust the day
- select the SET pushbutton again and the month flashes, use the plus or minus pushbutton to adjust the month

- select the SET pushbutton again and the year flashes, use the plus or minus pushbutton to adjust the year
- select the SET pushbutton again to run the date.

Note: A delay greater than one minute while setting the time or date results in the clock reverting to the previous time/date setting.

YA701 - YA703

6 Elapsed Time (ET)/Chronograph Window

- displays elapsed time (hours, minutes) or chronograph minutes
- the chronograph display replaces the elapsed time display
- elapsed time continues to run in the background and displays after the chronograph is reset.

YF048 - YV754

6 Elapsed Time (ET)/Chronograph Indicator

- displays elapsed time (hours, minutes) or chronograph minutes
- the chronograph display replaces the elapsed time display
- elapsed time continues to run in the background and displays after the chronograph is reset.

YA704 - YA710

7 Elapsed Time (ET)/Chronograph Indicator

- displays elapsed time (hours, minutes) or chronograph minutes
- the chronograph display replaces the elapsed time display
- elapsed time continues to run in the background and displays after the chronograph is reset.

YA701 - YA703

7 Time Control (four position, rotary)

Sets the time and date when the time or date is selected with the date control.

FS D (fast slew, day) –

- advances hours when time is selected with the date control
- advances days when date is selected with the date control.

SS M (slow slew, month) –

- advances minutes when time is selected with the date control
- advances months when date is selected with the date control.

HLD Y (hold, year) –

- stops the time indicator and sets the seconds to zero when time is selected with the date control
- advances years when date is selected with the date control.

RUN – starts the time indicator.

YF048 - YV754

7 SET Control

Controls the setting of manual time and date:

With manual time displayed:

- select the SET control once and the hours flash, rotate the control to adjust the hours
- select the SET control again and the minutes flash, rotate the control to adjust the minutes
- select the SET control again to run the time.

With manual date displayed:

- select the SET control once and the day flashes, rotate the control to adjust the day
- select the SET control again and the month flashes, rotate the control to adjust the month
- select the SET control again and the year flashes, rotate the control to adjust the year
- select the SET control again to run the date.

Note: A delay greater than one minute while setting the time or date results in the clock reverting to the previous time/date setting.

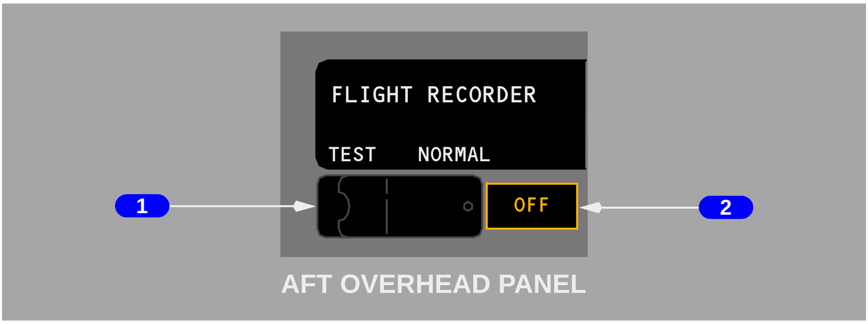
YA704 - YA710

8 Plus (+) and Minus (-) Pushbuttons

Used to set the manual time and date:

- select the + pushbutton to increase the value
- select the - pushbutton to decrease the value.

Flight Recorder



1 Flight Recorder Test Switch

NORMAL (guarded position) –

- in flight – the recorder operates anytime electrical power is available
- on the ground – either engine must also be operating.

TEST – powers the flight recorder on the ground.

2 OFF Light (amber)

ILLUMINATED –

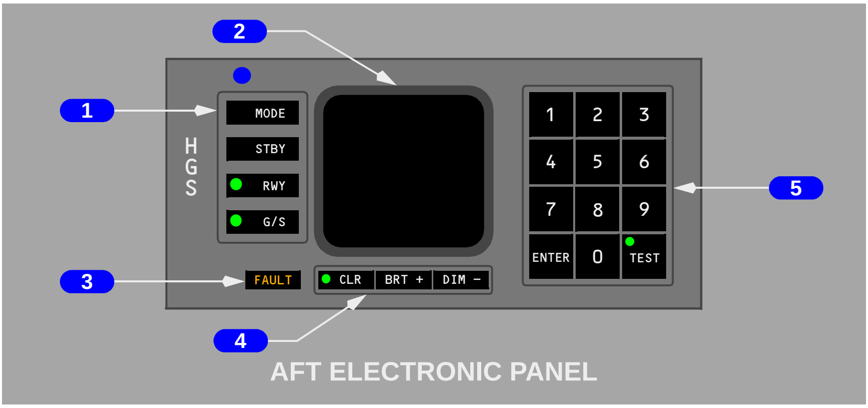
- indicates the recorder is not operating or the test is invalid
- may indicate power failure, loss of input data, or electronic malfunction.

This Section Applies to YK622 - YK625, YS179 - YS190

HGS Control Panel

YK622 - YK625

The HUD control panel controls modes of operation, display values, and system test and status information.



1 Mode/Function Keys

Push - selects mode or allows data entry:

- MODE – selects desired mode from available modes on the standby display line
- STBY – selects standby mode
- RWY – used to enter runway length and elevation or to toggle between entered values. Select once to enter runway length, select again to enter runway elevation. Use the DIM - (minus) key to enter negative values
- G/S – used to enter the glideslope angle for the landing runway.

Note: Values entered using the mode/function keys are stored in the HUD computer. If a power interruption should occur, the last mode and value will be displayed once power is restored.

2 Control Panel Display

Displays information entered using the mode/function keys. Refer to Section 12, Head–Up Display System – Displays.

3 FAULT Light

Illuminated (amber) – HUD BITE fault.

4 Clear and Brightness Keys

CLR – used to clear all symbology from the combiner display. Symbology can be re-displayed by selecting CLR again, changing modes, or entering TEST. CLR can also be used as a backspace key during data entry and TEST operations.

BRT + (plus) – used to manually increase control panel display intensity.

DIM – (minus) – used to manually decrease control panel display intensity.

Note: Display brightness is adjusted automatically based on ambient light measured by a sensor located in the upper left corner of the control panel.

5 Numeric Keys

Push -

- 0 through 9 – puts selected number in display
- ENTER – used to enter selected values
- TEST – used by maintenance for system tests and troubleshooting.

Multi-purpose Display and Control Unit (MCDU)

YS179 - YS190

The HUD uses the Multipurpose Display and Control Unit (MCDU) as a control panel to control modes of operation, display values, and system test and status information. For complete information on the MCDU refer to Chapter 11, Flight Management, Navigation.

MCDU Displays

YS179 - YS190

Either Captain’s or First Officer’s MCDU can be used to operate the Head-Up Guidance System. HGS operation is accessible by pushing the "MENU" function key at any time to go immediately to the Menu page. On the Menu page, push the "HGS" line select key to open the "HGS DATA" page.

Both pilots can set HGS modes and make data entries to the HGS Computer. The FMC automatically transfers runway data (length, elevation, and glideslope angle) to the HGS when a pilot enters a flight plan with planned departure and arrival runways.

When the arrival runway has not been planned, pilots can set HGS modes and make manual data entries for touchdown zone elevation, runway length, and reference glideslope angle. When manually inputting data, push the MCDU "CLR" key to erase existing values. Use the numeric keypad to record the new data. When the new data shows correctly on the screen, push the corresponding line select key to enter the data into the MCDU.

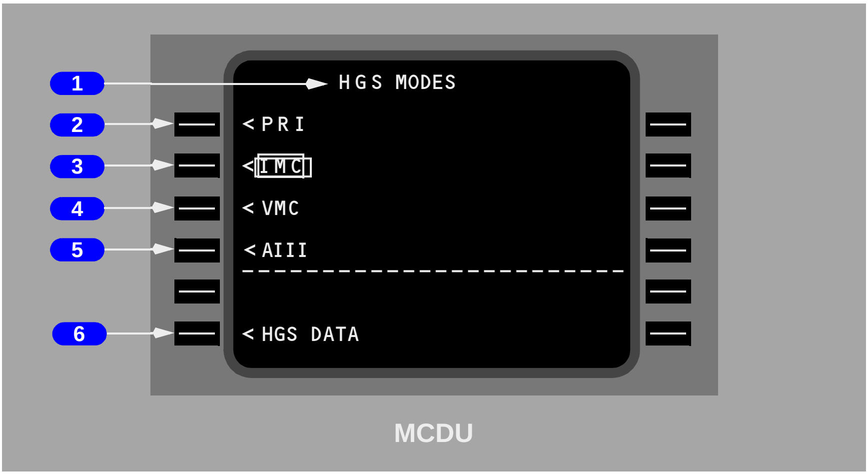
Pilots can also push the "<CLR HGS" line select key on the MCDU HGS Data page to remove all symbology from the Combiner display.

HGS Modes of Operation

The HGS has four modes of operation, summarized in the following table.

Mode	Flight Operation	Guidance Source
Primary	Takeoff, climb, enroute, descent, approach & landing	DFCS (Digital Flight Control System)
IMC approach	Autopilot/Flight Director approaches approach and landing	DFCS
VMC approach	Visual approaches	NONE
AIII approach	ILS approach and landing	HGS

HGS Modes Select



1 HGS MODES - MCDU Control Panel Display Window

Displays selected modes, entered values, system test and system status. To access the "HGS MODES" page, push "HGS MODES" (line select key 6L). Use the line select keys on the HGS Modes page to change the HGS modes. To change modes on the HGS Modes page, push the line select key next to the name of the mode.

2 Primary (PRI) Mode

- Push "HGS MODES" < PRI line select key.
- This selects primary mode and the mode indicated on the MCDU "HGS MODES" page will change to Primary.

The low visibility takeoff display incorporates a ground roll reference symbol, ground roll guidance cue, and a ground localizer line (if an ILS frequency is tuned on both nav receivers). The HGS derived ground roll guidance cue provides lateral guidance relative to the ground roll reference symbol to track the localizer

When Primary mode is selected on the MCDU panel, PRI is highlighted and the caret ("<") next to PRI is removed.

The primary mode may be used during all phases of flight from takeoff to landing. This can include low visibility takeoff operations utilizing ground roll guidance, all enroute operations and either non-precision or precision approaches to CAT I or CAT II minimums utilizing flight director guidance and/or raw data.

Attitude information is displayed as a horizontal line and pitch scales positioned relative to an airplane reference symbol.

Airspeed and altitude are displayed in tapes along the left and right edges of the display. A sectored HSI is displayed in flight in the lower center of the display. On the ground, the HSI, flight path and guidance cues are not displayed. These symbols are automatically displayed once the aircraft is in flight.

During takeoff, a TO/GA (Takeoff/Go Around) pitch target line and a guidance cue are displayed. The TO/GA pitch target line is displayed as a horizontal dash line initially positioned at the top of the display. As the pitch attitude increases during rotation, its vertical position relative to the airplane reference symbol is adjusted to display the pitch command from the pilot's flight director. Initially, the flight director guidance cue is displayed when the airplane reference is within 2 ° of the TO/GA pitch target or when climbing through 50 feet radar altitude, whichever occurs first. The TO/GA pitch target line remains until the TO/GA mode is exited. The flight director guidance cue is displayed throughout flight when the pilot's flight director is selected ON and both pitch and roll commands remain valid.

A full time slip-skid symbol is displayed as part of the roll scale. During any takeoff (after rotation) or go-around (below 1000 feet), additional slip-skid symbols are displayed to enhance lateral control in the event of an engine failure. These two additional symbols are displayed relative to the airplane reference and the flight path symbols and are removed above 1500 feet.

AFDS engaged modes, auto throttle modes, and autopilot status is indicated across the top of the display similar to the flight mode annunciator display. Navigation information is displayed dependent on the selected navigation source and active AFDS mode. During LNAV operations, vertical and lateral deviations are similarly displayed based on FMC data. During ILS/VOR operations, course deviation is displayed within the HSI. Glideslope data is presented on a glideslope deviation scale adjacent to the altitude tape.

If the HGS is in a mode other than primary, depressing a TO/GA switch activates the primary mode independent of the mode selected on the MCDU.

Primary Mode - Low Visibility Takeoff

The primary mode includes special symbology used for a low visibility takeoff. The display supports visual runway centerline tracking and enhances situational awareness.

Primary Mode - Approach and Landing

When the primary mode is used for an approach and landing, flight director guidance and navigation raw data is displayed. Once on the ground, the ground localizer line and ground localizer scale is displayed (if an ILS frequency is tuned on both nav receivers) to enhance centerline tracking.

3 Instrument Meteorological Conditions (IMC) Mode

The IMC mode is an alternate approach mode primarily intended for autopilot approaches. Like the PRI mode, the IMC mode guidance cue utilizes AFDS derived guidance. The guidance cue is displayed when the pilot’s flight director is active and both pitch and roll commands are valid.

Altitude and airspeed data is displayed as digital values and navigation raw data is displayed in close proximity to the flight path vector.

4 Visual Meteorological Conditions (VMC) Mode

The VMC mode is intended for visual approach operations. No flight director or HUD guidance is displayed. The flight path vector is used to control the approach to the runway.

Approach symbology format for the VMC mode is similar to the IMC mode. However, navigation data is not displayed.

5 AIII Approach Mode

The HGS AIII mode is specifically designed for manual ILS approach and landing operations to CAT IIIa minimums. In the AIII mode, the guidance cue gives flight path guidance derived from HGS internal approach and landing guidance algorithms.

Note: CAT IIIa operations are not standard operating procedures. Consult applicable directives and obtain approval from command operational authorities before initiating or conducting CAT IIIa HGS low visibility approaches to landing.

The AIII mode can be set manually or automatically, but it starts operating only after ILS capture. In manual selection, "AIII" flashes in the upper left of the Combiner display, at which time the pilot can select the AIII mode on the MCDU any time while the aircraft is above 500 feet AGL. In automatic selection, the pilot needs to arm AIII mode on the MCDU. The message "AIII ARM" shows on the upper left of the Combiner display, and "AIII" flashes for 5 seconds before the HGS automatically changes to AIII mode.

In AIII mode, the HGS removes the altitude and airspeed tape displays and replaces them with numeric representations. The HGS also replaces the HSI, displaying instead ILS raw data in proximity to the flight path group near the center of the display.

When available, AIII capability status is displayed adjacent to the standby mode. “Aiii” changes to “AIII” and moves to the standby mode once all conditions have been met to conduct an AIII mode approach. Pressing the mode key then activates the AIII mode.

Automatic AIII arming is indicated by “AIII ARM” displayed as the standby mode. Once all requirements are satisfied for an AIII mode approach, AIII mode is automatically activated. Refer to Section 10-22, Head–Up Display System Description, for AIII mode arming requirements.

Even if the HGS is capable of providing AIII guidance, AIII mode cannot be activated until the following Approach On Course (AOC) conditions are satisfied:

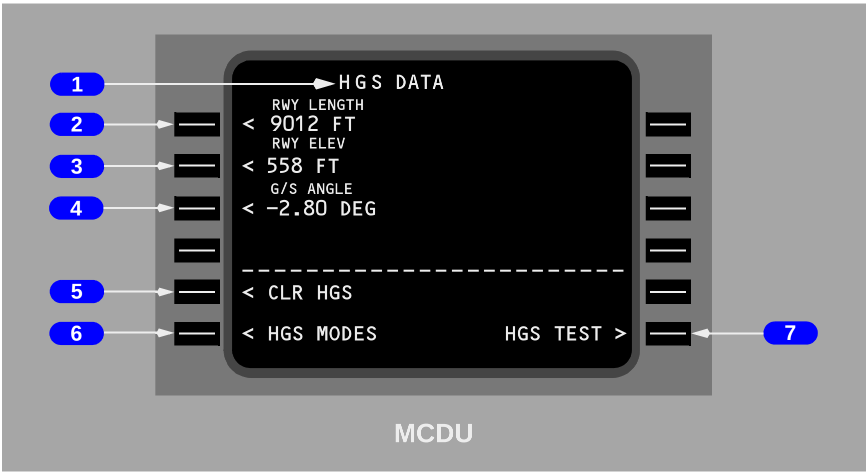
- Both VHF Navigation Receivers are tuned to an ILS frequency
- The difference between the aircraft’s magnetic track and the pilot’s selected course is less than 15 degrees
- Radio altitude is greater than 500 feet
- VHF Nav #1 or VHF Nav #2 localizer deviation is less than approximately ¼ dot and glideslope deviation is less than approximately 1 ¼ dots for at least five seconds.

6 HGS DATA

The HGS Data line select key (LSK 6L) gives access to guidance derived from HGS internal approach and landing guidance algorithms.

- Runway Data
- CLR HGS
- HGS MODES
- HGS TEST

If not automatically flight planned, runway data can manually be input at any time by selecting the HGS DATA page.



1 MCDU HGS DATA PAGE

Push the "MENU" function key at any time to go immediately to the Menu page. On the Menu page, push the "HGS" line select key to open the HGS DATA page.

The HGS data page gives access to runway length, runway elevation, glideslope, clear headings, and HGS TEST.

2 Runway Length

Displays current runway length in feet or meters as indicated on the display screen. To change the value of runway length, use the MCDU numeric keypad to erase and record the new runway length. The HGS accepts runway lengths from 0 to 99,999 feet or the equivalent in meters. When the new value shows correctly on the scratch pad line, push the line select key. If a value does not agree with acceptable limits, "*INVALID LENGTH*" shows on the MCDU scratch pad line and the operation of roll out guidance or low visibility takeoff modes is prevented. Push the "CLR" key to remove the invalid length and re-enter the correct length.

- L XXXXX - valid entry is 0 to 99,999 feet, however, entries between 7,500 and 13,500 feet are required to display ground roll guidance for low visibility takeoff operations.

Note: When a flight plan is entered into the FMC, runway data (length, elevation, and glideslope angle) is automatically entered into the HGS for the departure and arrival runways. The runway data shows on the display in small characters. The Captain or First Officer verifies the correct data is displayed on the MCDU. Once determination is made and verified that the runway data is correct, the pilot then pushes the applicable line select keys two times each to change the small characters to large characters. Once the large characters appear on the display and are correct, the data is transmitted to the HUD and applicable approach displays.

3 Runway Elevation Line

Use the MCDU numeric keypad to record the runway elevation. For negative elevations, first push the "+/–" function key and then record the new runway elevation. When the new value shows correctly on the scratch pad line, push the line select key to enter it into the HGS.

The HGS accepts runway elevations from –9,999 to 99,999 feet (feet only) and refer to Mean Sea Level (MSL). If a value does not agree with these limits, "*INVALID ELEVATION*" shows on the MCDU scratch pad line. Push the MCDU "CLR" key to remove "INVALID ELEVATION" message from the MCDU scratch pad.

- E XXXXX - valid entry is – 9,999 to 99,999 feet.

4 Glideslope Angle

Use the MCDU keypad if necessary to change or record the value of the glideslope angle. To remove the displayed value, push the MCDU "CLR" key. Key in the new value using the numeric keypad. When the new value shows correctly on the scratch pad line, push the corresponding line select key 3 left. The new glideslope angle then shows on the display and the previous value is erased.

The HGS accepts glideslope angles from –0.00° to –9.99°. The minus sign ("–") and trailing zeroes do not have to be entered as part of the value. If a value does not agree with these limits, "*INVALID G/S*" shows on the MCDU scratch pad line. Push the MCDU "CLR" key to remove "*INVALID G/S*" message from the MCDU scratch pad and re-enter the correct value.

For an AIII approach, the HGS accepts glideslope angles from –2.50° to –3.00°. The minus sign ("–") and trailing zeroes do not have to be entered as part of the value. If a value does not agree with these AIII limits, the operation of AIII mode is prevented.

5 Clear HGS

Line select key 5 left clears images from HUD:

- Removes all symbology from the Combiner display
- The letters "CLR HGS" are highlighted on the MCDU display.

6 HGS Modes

Line select key 6 left accesses the "HGS Modes" page

- To change modes, push the line select key next to the name of the mode.

7 HGS Test

Pushing line select key 6 right initiates the TEST

- All legends come on and stay on
- To end the test, push the "EXIT>" line select key on the MCDU.

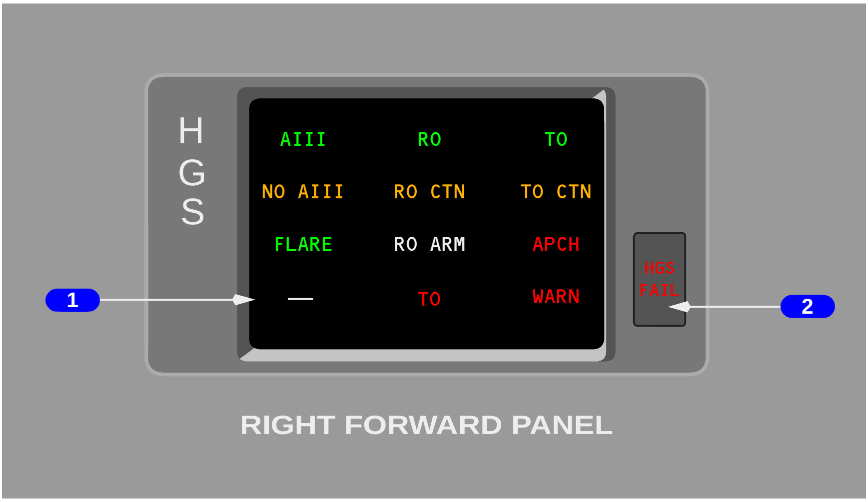
HGS Annunciator Panel

YS179 - YS190

The HGS Annunciator Panel is installed in the First Officer’s instrument panel and provides HGS status and warning annunciations to the First Officer during CATIII approach, landing, and rollout operations.

In order to provide the high degree of safety necessary for manual CATIII low visibility operations, the First Officer acts as an independent monitor and is required to assess the approach to the runway and the performance of the HGS and associated systems.

To test the HGS Annunciator Panel, set the master BRT/DIM/TEST switch to TEST. When the BRT/DIM/TEST switch is in the TEST position, all legends on the Annunciator Panel come on and stay on.



1 HGS Status Annunciations

- AIII (green) – AIII mode is active and all required systems and equipment are valid. It is displayed concurrently with the AIII mode annunciation on the Combiner
- NO AIII (amber) – loss of AIII capability above 500 feet AGL. "NO AIII" shows concurrently on the Combiner
- APCH WARN (Approach Warning) (red) – system or approach conditions out of tolerance
- FLARE (green) – system derived flare guidance is active. It is displayed when the flare guidance symbol ("+") is displayed on the Combiner. If AIII mode is lost, the “FLARE” annunciation will not illuminate

- RO ARM (Rollout Guidance Armed) (white) – system capable of providing ground roll guidance during rollout. Displayed prior to touchdown during an AIII approach
- RO CTN (Rollout Guidance Caution) (amber) – loss of rollout guidance below 500 feet AGL
- RO (Rollout Guidance) (green) – rollout guidance is active
- TO (Takeoff) (green) – not used, displayed only during maintenance test
- TO CTN (Takeoff Caution) (amber) – not used, displayed only during maintenance test
- TO WARN (Takeoff Warning) (red) – not used, displayed only during maintenance test.

2 HGS FAIL Light (red)

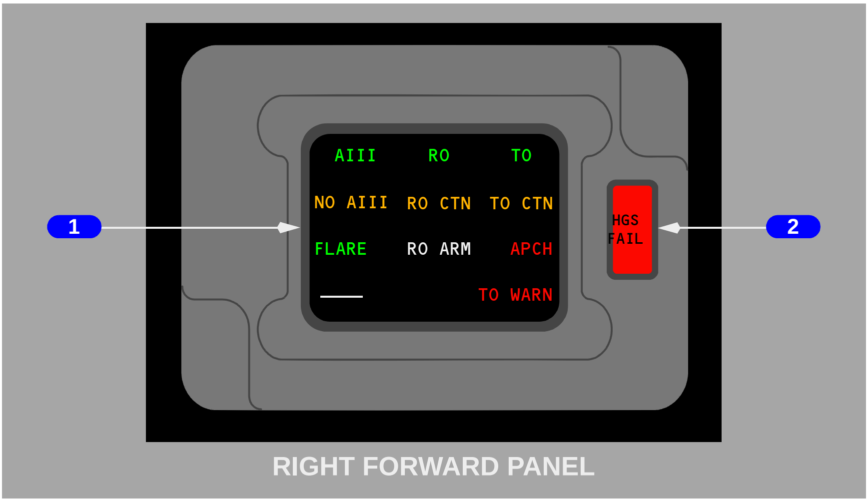
Illuminated (red) – indicates HGS failure below 500 ft AGL.

Push –

- extinguishes the HGS Fail Light
- will not illuminate again until failure is cleared and another failure occurs
- resets system for another failure.

HGS Annunciator Panel

YK622 - YK625



1 HGS Status Annunciations

- AIII (green) – AIII mode is active and all required systems and equipment are valid
- NO AIII (amber) – loss of AIII capability above 500 feet AGL.
- APCH WARN (Approach Warning) (red) – system or approach conditions out of tolerance
- FLARE (green) – system derived flare guidance is active
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- RO (Rollout Guidance) (green) – rollout guidance is active
- TO (green) – not used, displayed only during maintenance test.
- TO CTN (Takeoff Caution) (amber) – not used, displayed only during maintenance test
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- extinguishes the HGS Fail Light
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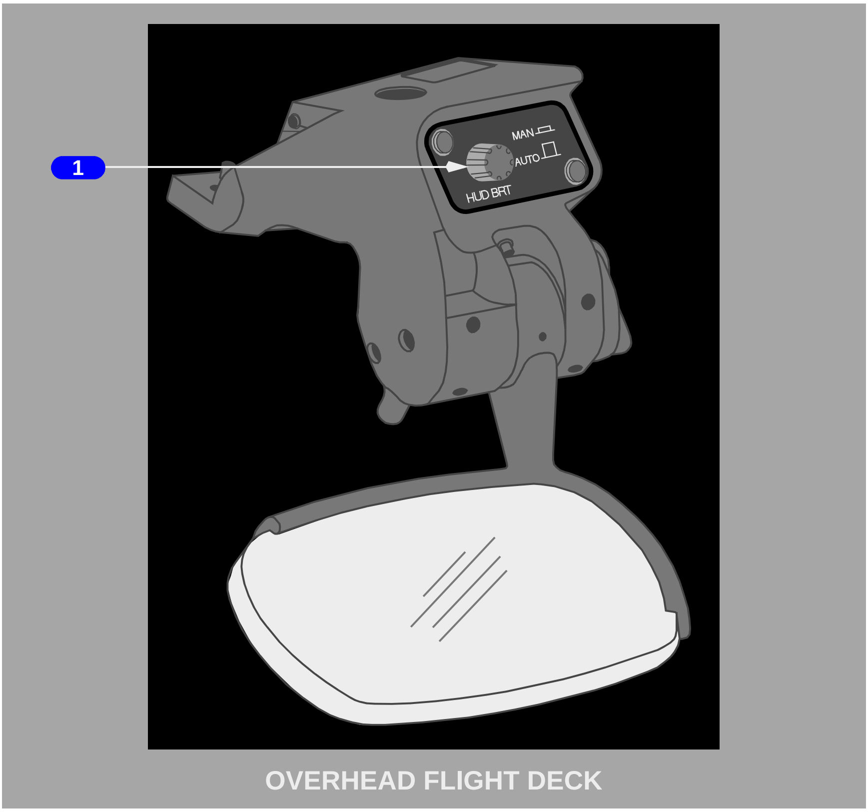
- resets system for another failure.

Combiner Controls

Brightness and Stow Controls



1 Brightness Control Knob

MAN – push knob in for manual brightness adjustment.

AUTO – pull knob out for automatic brightness adjustment. Display intensity varies based on ambient light detected by a sensor on the combiner.

HUD BRT – rotate knob clockwise to increase display intensity. Rotate knob counter-clockwise to decrease display intensity.

2 Stow Lever

There are three positions for the combiner:

- Stow – AFT/UP
- Normal operating detent – DOWN
- Breakaway – FWD

Pull lower portion of the stow lever toward the pilot and rotate the glass down and forward to the normal operating detent. To stow the combiner glass, grasp and rotate toward the pilot, aft and up, until it locks in the stowed position.

The forward breakaway position allows the combiner glass to be displaced forward from its normal operating position. The combiner glass can be returned from the breakaway position by rotating the stow lever away from the pilot and rotating the glass aft to the normal operating detent.

Note: If the combiner glass is not in the normal operating position (detent) the ALIGN HUD message will display when in IMC and VMC modes. If the ALIGN HUD message can not be extinguished by grasping and moving the combiner glass forward or aft, then back into its normal operating detent, IMC and VMC modes should not be used.

The ALIGN HUD restriction does not apply to use of the HUD in PRI mode.

Flight Instruments, Displays Chapter 10

PFD/ND – System Description Section 21

Introduction

The Common Display System (CDS) supplies information to the flight crew on six flat panel liquid crystal display units (DUs). The outboard and inboard display units present all primary flight and navigation information. Primary engine indications are normally displayed on the upper DU. Secondary engine indications or system data are normally displayed on the lower DU.

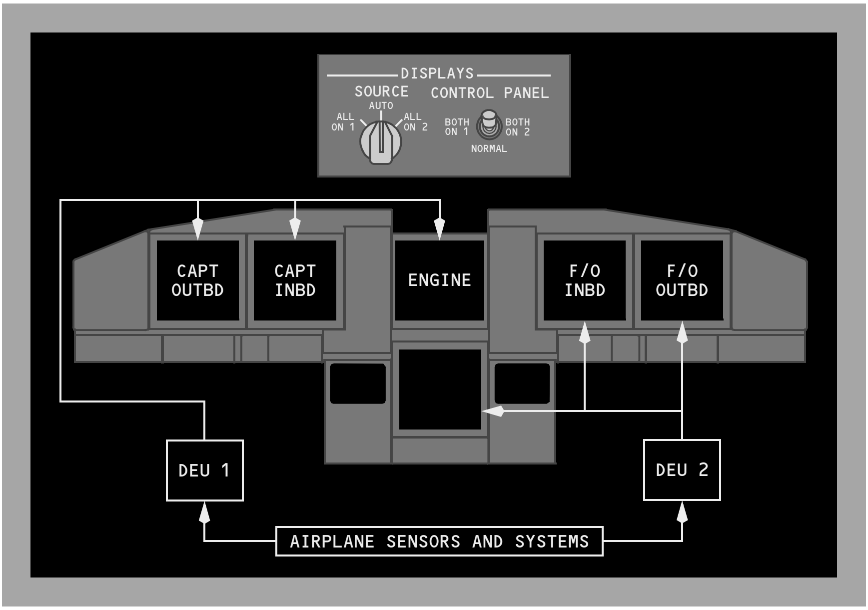
Detailed information on the following subjects is found in other sections of this chapter:

- Primary Flight Display (PFD)– Section 31
- Navigation display (ND)– Section 41.

Display Brightness Control

Adjustment of the brightness of each DU is controlled by a combination of light sensors and brightness controls. Two remote light sensors, located left and right on the top of the glareshield, compensate for the amount of ambient light entering through the flight deck windows and adjust the brightness of the related DUs. Each DU also has an integral light sensor which provides automatic control of brightness as a function of ambient light striking the face of the DU. Brightness controls are used by the pilot to further adjust the intensity of each display unit.

DISPLAYS SOURCE Panel



The DISPLAYS source panel, located on the forward overhead panel, contains source controls for the display electronic units (DEUs) and EFIS control panels.

Two DEUs receive data from sensors and airplane systems and supply data to the DUs. During normal operation, with the display SOURCE selector switch in the AUTO position, DEU 1 supplies data to the Captain outboard, Captain inboard and upper DUs while DEU 2 supplies data to the First Officer outboard, First Officer inboard and lower DUs. If a DEU fails, the remaining DEU automatically supplies data to all six displays. A single DEU failure will continue to supply each pilot with flight instrument information from independent sources. Each DEU receives data from both ADIRUs.

The display SOURCE selector, used on the ground for maintenance purposes, allows manual selection of either DEU 1 or DEU 2 for all six display units. If the displays are automatically or manually switched to a single DEU source, a "DSPLY SOURCE" annunciation illuminates on the primary flight displays.

The CONTROL PANEL select switch determines which EFIS control panel controls the pilots' display functions. This switch should remain in NORMAL. With the switch positioned to either BOTH ON 1 or BOTH ON 2, the selected EFIS control panel provides inputs for both sets of pilot displays.

EFIS Control Panels

Two EFIS control panels, located on the glare shield of the center main panel, control display options, mode, and range for the related pilot's displays.

If one EFIS control panel fails, the displays can be controlled by the remaining control panel. Refer to the PFD and ND sections of this chapter for more information.

Display Select Panel

The display select panel, located on the left and right forward panels, controls the displays on the inboard, outboard and lower DUs. Normal operation is all selectors in the NORMAL position. The pilots' outboard and inboard DUs display primary flight and navigation data and the upper DU displays primary engine data and fuel quantity.

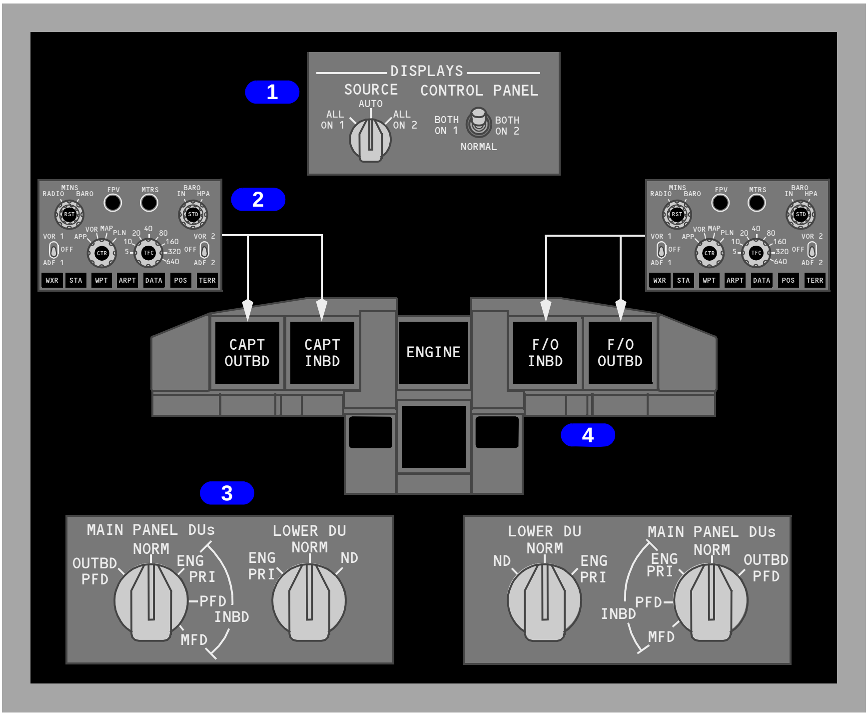
If a DU fails, automatic display switching ensures critical information remains available to the pilots at all times. If the system detects an operational failure on an outboard DU, the primary flight display automatically moves to the inboard DU and the failed outboard DU blanks. The OUTBD/INDB selector no longer has control over that display unit. If the upper DU fails, the engine display automatically moves to the lower DU.

Manual control of display formats is provided for undetected failures. The outboard rotary switch on the display select panel controls the formats displayed on either the outboard or inboard DUs. The inboard rotary switch controls the display format shown on the lower DU.

Display Selection and Control Examples

The following examples show display selections.

Normal Display Configuration



1 DISPLAYS Source Panel

The display SOURCE select switch is in AUTO and the CONTROL PANEL select switch is in NORMAL.

2 EFIS Control Panel

The left EFIS control panel controls the Captain outboard and inboard display units. The right EFIS control panel controls the First Officer outboard and inboard display units.

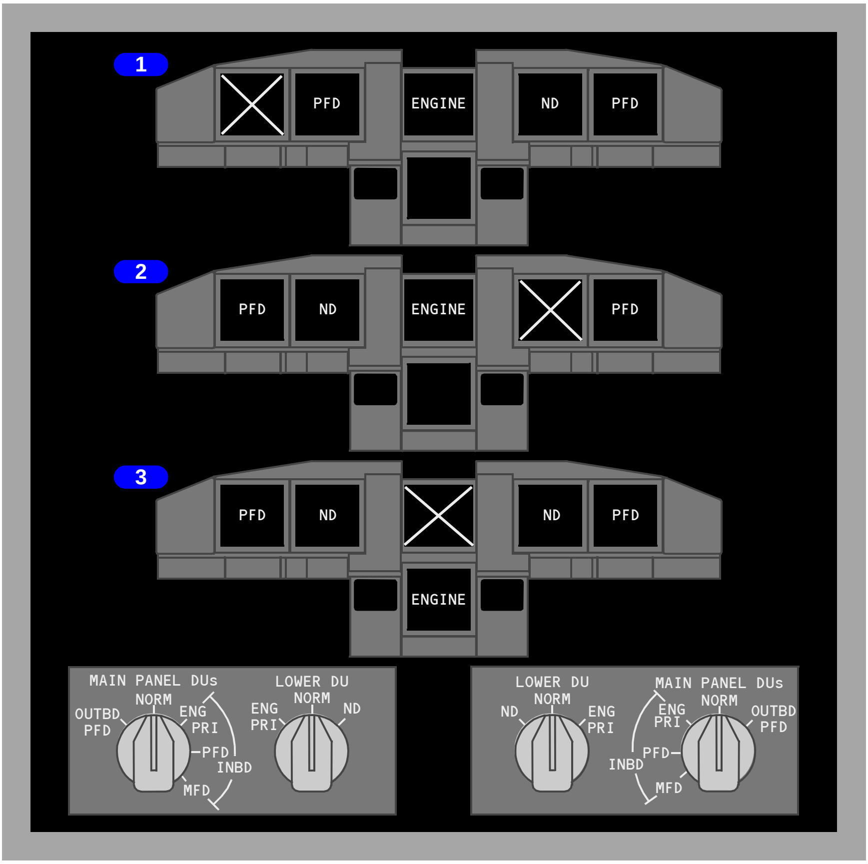
3 Display Select Panel

All selectors are in NORMAL.

4 Display Units

The pilots’ outboard and inboard DUs show the normal PFD/ND displays.

Display Unit Failure Automatic Switching



1 Outboard Display Unit Fails

If an outboard display unit fails, the PFD is automatically displayed on the inboard display unit and the outboard display unit blanks.

2 Inboard Display Unit Fails

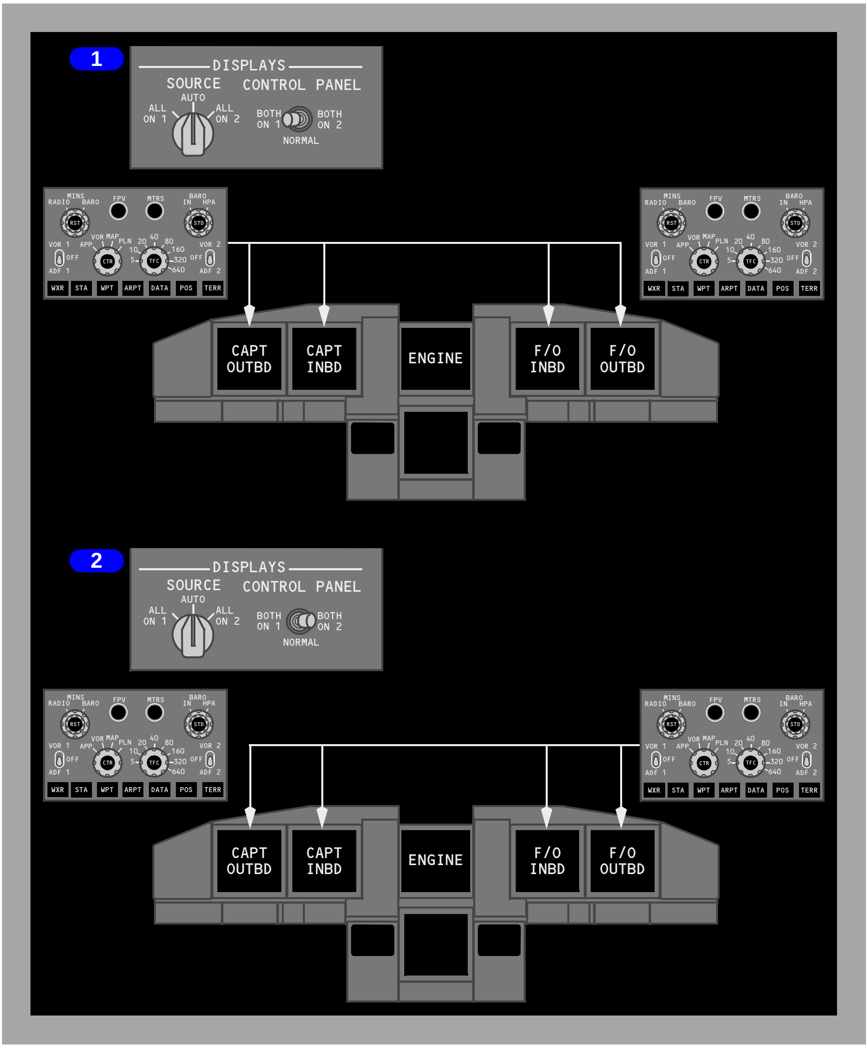
If an inboard display unit fails, the PFD format remains displayed on the outboard display unit and the inboard display unit blanks.

3 Upper Display Unit Fails

If the upper display unit fails, the primary engine display automatically moves to the lower display unit and the upper display unit blanks. If the secondary engine display is already on the lower display unit, a compact engine display is then displayed.

Note: There is no automatic switching for a lower DU failure.

EFIS Control Panel



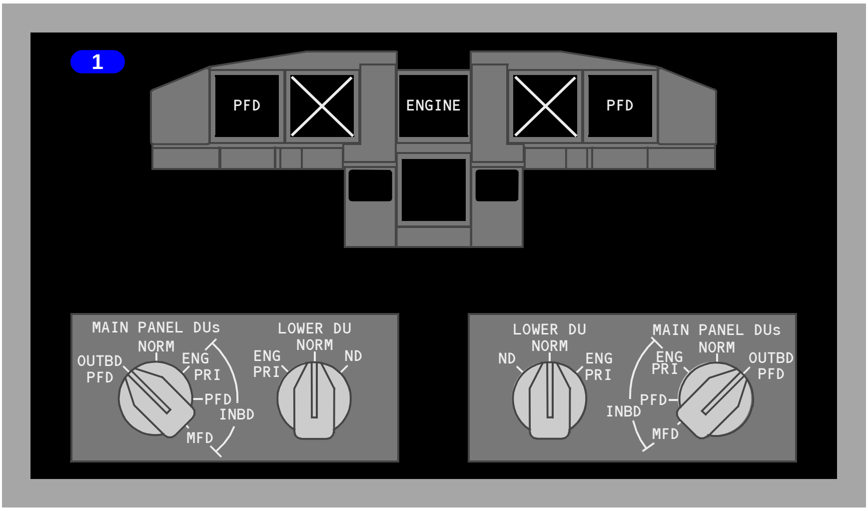
1 CONTROL PANEL Select Switch BOTH ON 1

The left EFIS control panel controls both pilots’ outboard and inboard display units.

2 CONTROL PANEL Select Switch BOTH ON 2

The right EFIS control panel controls both pilots’ outboard and inboard display units.

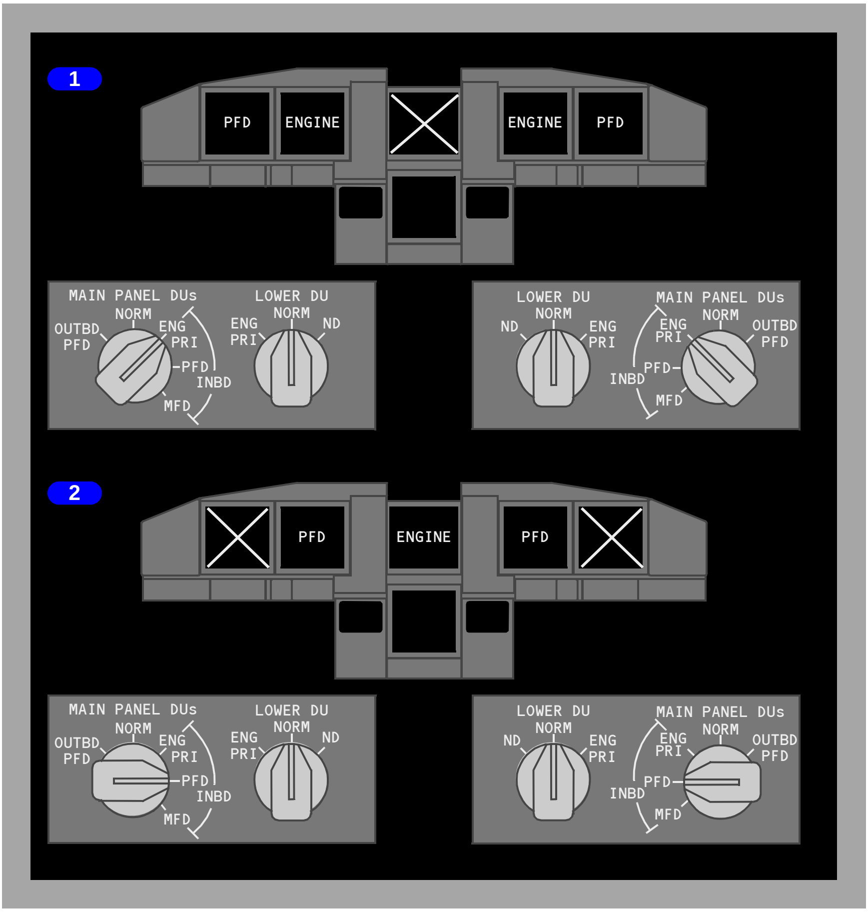
Outboard Display Switching

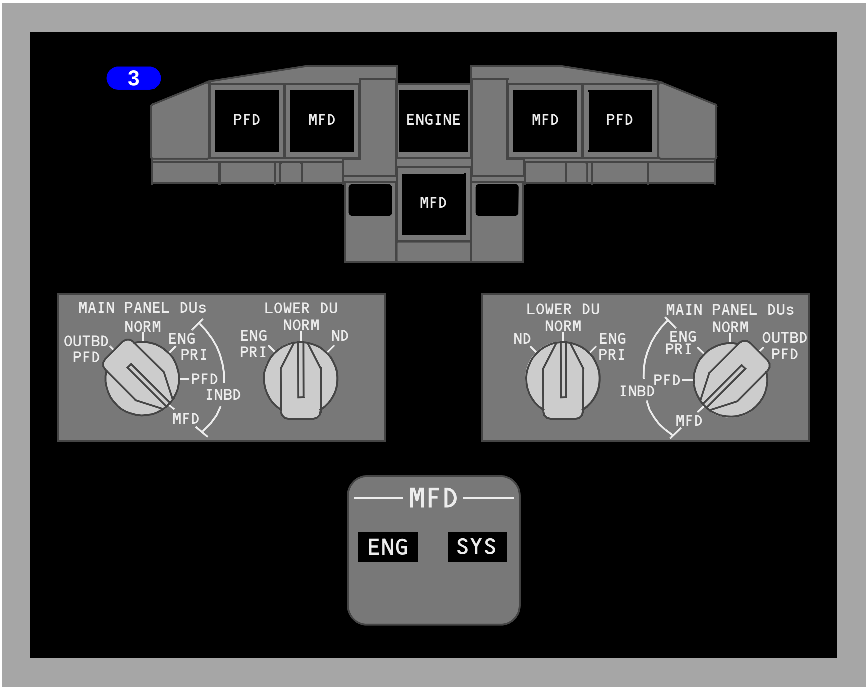


1 MAIN PANEL DUs Switch to OUTBD PFD

If the MAIN PANEL DUs switch is turned to Outboard Primary Flight Display (OUTBD PFD), the PFD format is displayed on the outboard display unit and the inboard display unit blanks.

Inboard Display Switching





1 MAIN PANEL DUs Switch to INBD ENG PRI

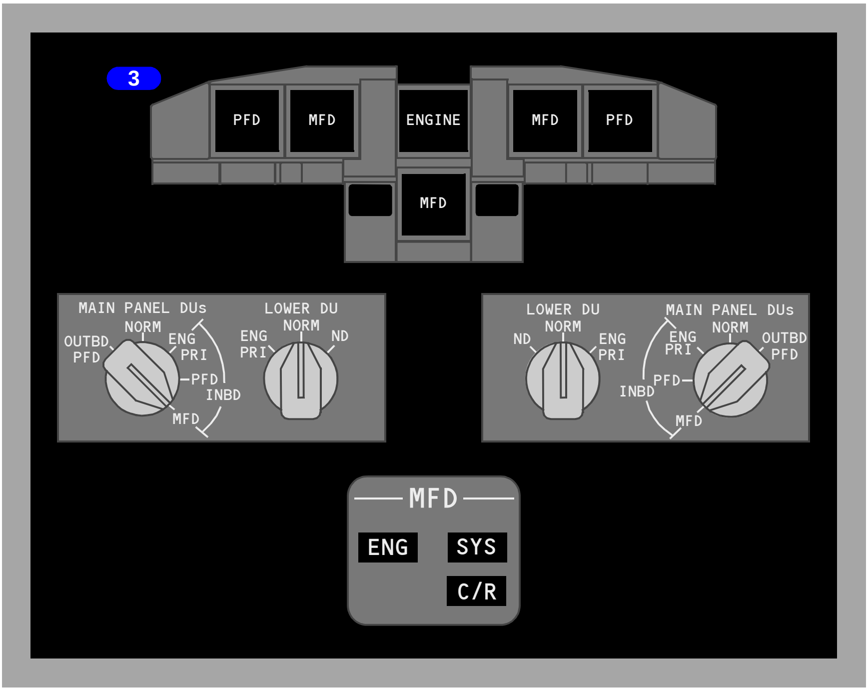
If the MAIN PANEL DUs switch is turned to INBD ENG PRI, the primary engine display moves to the inboard DU, the PFD format is displayed on the outboard DU and the upper DU blanks.

2 MAIN PANEL DUs Switch to INBD PFD

If the MAIN PANEL DUs switch is turned to INBD PFD, the PFD format is displayed on the inboard DU and the outboard DU blanks.

3 MAIN PANEL DUs Switch to MFD

If the MAIN PANEL DUs switch is turned to INBD MFD, the PFD continues to be displayed on the outboard display unit and the inboard display is blank. The system format (SYS) or secondary engine format (ENG) can then be selected to the inboard display unit and lower display unit with the MFD switches on the engine display control unit.



1 MAIN PANEL DUs Switch to INBD ENG PRI

If the MAIN PANEL DUs switch is turned to INBD ENG PRI, the primary engine display moves to the inboard DU, the PFD format is displayed on the outboard DU and the upper DU blanks.

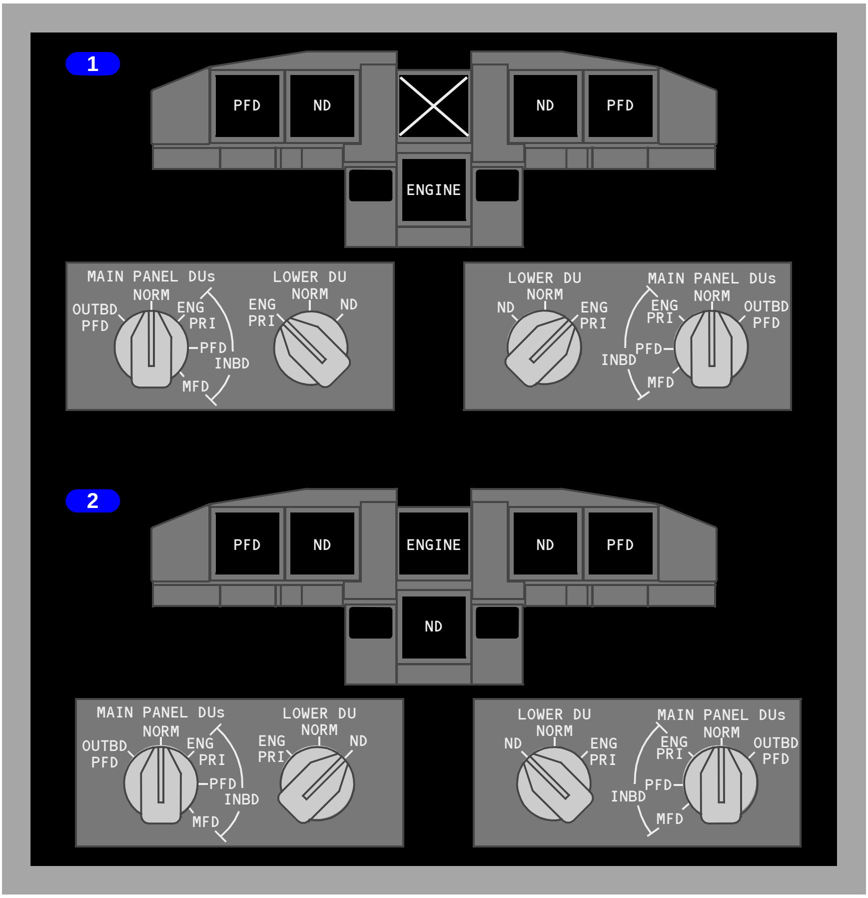
2 MAIN PANEL DUs Switch to INBD PFD

If the MAIN PANEL DUs switch is turned to INBD PFD, the PFD format is displayed on the inboard DU and the outboard DU blanks.

3 MAIN PANEL DUs Switch to MFD

If the MAIN PANEL DUs switch is turned to INBD MFD, the PFD continues to be displayed on the outboard display unit and the inboard display is blank. The system format (SYS) or secondary engine format (ENG) can then be selected to the inboard display unit and lower display unit with the MFD switches on the engine display control unit. The C/R switch cancels or recalls autoland status on the display.

Lower Display Switching



1 LOWER DU Switch to ENG PRI

If the LOWER DU switch is turned to ENG PRI, the engine display moves to the lower DU and the upper DU blanks.

2 LOWER DU Switch to ND

If the LOWER DU switch is turned to ND, the engine display is shown on the upper DU and the navigation display is shown on the lower DU. When the MFD ENG switch is selected, the compact engine display is shown on the upper DU.

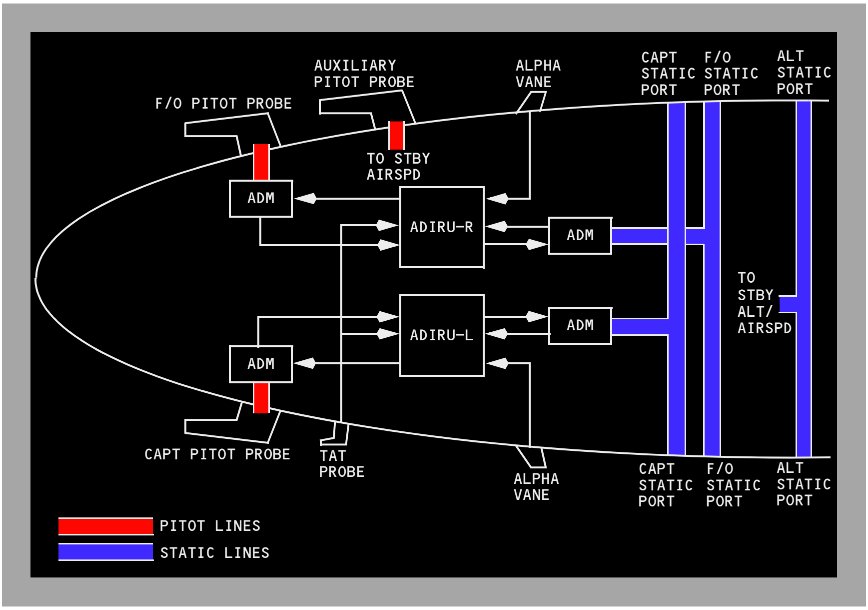
Display System Information Sources

Air Data Inertial Reference System (ADIRS)

The ADIRS produces flight data such as position, speed, altitude and attitude for the flight displays, flight management computers, flight controls, engine controls and all other systems requiring inertial and air data.

The major components of the ADIRS are:

- two air data inertial reference units (ADIRUs)
- four air data modules (ADMs)
- one inertial system display unit (ISDU)
- one dual mode select unit (MSU)
- six static ports
- three pitot probes
- two alpha vanes
- one total air temperature probe



Air Data Inertial Reference Unit (ADIRU)

The ADIRUs provide inertial position and track data to the FMC as well as attitude, altitude and airspeed data to the displays. The ADIRUs process information measured by internal gyros and accelerometers, and from air data module inputs, the alpha vanes and other systems.

The ADIRUs are described in Chapter 11, Flight Management, Navigation.

Air Data

The pitot static system is comprised of three separate pitot probes and six flush static ports. Two pitot probes and four static ports interface with the air data modules. The remaining auxiliary pitot probe and alternate static ports provide pitot and static pressure to the standby instruments. The auxiliary pitot probe is located on the first officer's side of the airplane.

The air data modules convert pneumatic pressure to electrical signals and send these data to the ADIRUs. Each pitot air data module is connected to its on–side pitot probe; there is no cross connection. The air data module connected to the Captain's pitot probe sends information to the left ADIRU, while the air data module connected to the First Officer's pitot probe sends information to the right ADIRU. The remaining air data modules are located at the balance centers of the Captain's and First Officer's static ports. The air data module connected to the Captain's static ports sends information to the left ADIRU, while the air data module connected to the First Officer's static ports sends information to the right ADIRU.

Angle–of–Attack

There are two alpha vanes, one located on each side of the forward fuselage. The vanes measure airplane angle–of–attack relative to the air mass.

Total Air Temperature (TAT)

A total air temperature probe is mounted outside the airplane to sense air mass temperature. The temperature sensed by the probe is used by the ADIRUs to compute total air temperature.

Note: For manual CDU input of OAT on the ground, TAT indication is approximate and should not be used in lieu of ambient OAT for takeoff performance.

Static Air Temperature (SAT)

Static air temperature, displayed on the CDU PROGRESS page, comes from the ADIRUs, using total air temperature probe information.

Standby Flight Instruments

The standby flight instruments include:

- standby magnetic compass

YA701 - YA706

- standby attitude indicator

YA701 - YA706

- standby altimeter/airspeed indicator

YA707 - YV754

- integrated standby flight display
- standby radio magnetic indicator

Standby Magnetic Compass

A standard liquid–damped magnetic standby compass is provided. A card located near the compass provides correction factors.

Standby Attitude Indicator

YA701 - YA706

The standby attitude indicator provides attitude information that is independent of the primary attitude displays. The indicator is powered by the battery bus and remains powered after the loss of all normal AC power as long as battery power is available. The gyro reaches operational speed approximately 60 seconds after power is applied. The indicator requires three minutes to achieve accuracy requirements.

Integrated Standby Flight Display (ISFD)

YA707 - YV754

YA707 - YV750

The ISFD displays attitude, airspeed, altitude, localizer/glideslope deviation and magnetic heading information. Attitude information is computed from data provided by internal inertial sensors. Airspeed and altitude are computed from pneumatic pressure data provided by direct connections to the auxiliary pitot and alternate static sources. Localizer/Glideslope deviation is provided by the #1 MMR. Magnetic heading is provided by the #1 ADIRU. Magnetic heading is not available in polar regions. (Later versions of the ISFD will automatically switch to True Heading when Magnetic Heading becomes unusable in polar regions).

YV751 - YV754

The ISFD displays attitude, airspeed, altitude, localizer/glideslope deviation and magnetic heading information. Attitude information is computed from data provided by internal inertial sensors. Airspeed and altitude are computed from pneumatic pressure data provided by direct connections to the auxiliary pitot and alternate static sources. Localizer/Glideslope deviation is provided by the #1 MMR (The MMR can provide Localizer and Glideslope deviation from ILS or GLS sources). Magnetic heading is provided by the #1 ADIRU. Magnetic heading is not available in polar regions. (Later versions of the ISFD will automatically switch to True Heading when Magnetic Heading becomes unusable in polar regions).

Note: The standby magnetic compass must be used to validate information.

The battery bus powers the ISFD. Selecting the battery switch ON activates the ISFD. After 10 seconds, an initialization sequence begins that requires 90 seconds to complete. ATT and INIT 90s messages are displayed during initialization. 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 is displayed.

Detection of a momentary out-of-limit ISFD condition may cause the attitude display to blank and the WAIT ATT or ATT:RST message to display. Operation of the attitude reset switch is required in response to the ATT:RST message. This will reset the horizon line with the airplane symbol.

On the ground, operation of the attitude reset switch must be performed with the airplane stationary. In flight, operation of the attitude reset switch must be performed with the airplane in wings level, non-accelerated flight. During the process, the ATT 10s message displays. Failure to maintain straight and level flight for 10 seconds may result in an ATT:RST message. If the reset attempt is unsuccessful, the ATT:RST message remains displayed and the ISFD does not enter normal operation.

Standby Altimeter/Airspeed Indicator

YA701 - YA706

Standby altitude and airspeed are displayed on a single indicator.

The standby altimeter receives static pressure from the alternate static ports. Current altitude is displayed digitally. A pointer indicates altitude in hundreds of feet. Barometric setting windows display the barometric setting in both millibars and inches of mercury as set by the barometric setting control. The altimeter has a range of –1000 to 50,000 feet.

The standby airspeed indicator receives ram air pressure from the auxiliary pitot probe and static pressure from the alternate static ports. It provides current airspeed in knots.

Standby Radio Magnetic Indicator

The standby Radio Magnetic Indicator (RMI) displays magnetic and VOR/ADF bearing to the station. The RMI is powered by the AC standby bus and remains powered after the loss of all normal AC power as long as battery power is available.

Clocks

YA704 - YV754

Two electronic clocks are installed in the flight deck, each clock has 2 digital displays with time or date set on the upper display, and elapsed or the chronograph (ET/CHR) on the lower display. Separate controls are provided for each display.

This clock is a GPS compatible electronic clock and can be initialized using Coordinated Universal Time (UTC) or Manual Time Mode. Standby 28V DC power is used when the main 28V DC power is not available. The clock reverts to standby power when the airplane is powered down. The standby power keeps the time base but does not provide power for the display, buttons, or output of clock data. When the airplane is powered up and a valid Global Position System (GPS) signal is restored, the clock will initialize to UTC time.

YF048 - YV754

If a UTC signal is not valid during initialization and then drops into manual initialization, but then becomes valid before manual function is started, the clock will revert back to UTC mode. If a UTC signal becomes valid after manual function is started or completed, UTC time can be selected by using the TIME/DATE button.

YA704 - YA710

If no signal is valid, the clock will revert to intialization in manual mode. If a UTC signal becomes valid after manual function is started or completed, UTC time can be selected by using the TIME/DATE button.

Clocks

YA701 - YA703

Two electronic clocks are installed, with two digital displays on each clock. Either Greenwich Mean Time (GMT) or local time may be set on the upper time display. The lower ET/CHR display is used for either elapsed time or the chronograph. Separate controls are provided for each display.

Flight Recorder (DFDR)

The Digital Flight Data Recorder (DFDR) provides a permanent record of operational and systems information including time, heading, altitude, airspeed, acceleration, attitude, engine thrust, and flight control surface position.

The recorder is a solid state device and complies with Federal Aviation Administration and European Aviation Safety Agency requirements for data sampling rates and number/type of parameters sampled.

Operational and systems information are automatically recorded whenever the flight recorder is powered.

The DFDR has the following features:

- Continuously records the most recent flight data, saving the most current data for the last 25 hours of operation
- The DFDR is housed in a sealed container located behind an access door in the far aft cabin ceiling
- Corrosion, fire and impact resistant, survives deep sea pressure to 13,451 feet (4,100 m)
- Locator beacon operable for 30 days
- Receptacle for downloading and copying data for analysis.

Aircraft Condition Monitoring System (ACMS)

YA701 - YF927, YK622 - YL547, YL549 - YV754

The Aircraft Condition Monitoring System (ACMS) contains software that provides the operator useful reports on the condition of the airframe, engines, trends monitoring, and maintenance.

The ACMS consists of:

- ACMS software containing applicable maintenance and operations algorithms for each phase of flight
- Digital Flight Data Acquisition Unit (DFDAU). The DFDAU receives signals representing certain flight condition and airplane systems operating performance and converts them to a digital form for recording on the DFDR
- Printer (PTR)
- Aircraft Communication Addressing and Reporting System (ACARS).
- ACARS air/ground message functionality continuing to expand with additional message formats.

YL545 - YL547, YL549 - YL551, YN531 - YV754

- Quick Access Recorder (QAR). The QAR provides approximately 25 hours of recorded airplane systems and flight information. The DFDR and QAR record the same information. The QAR is located in the electronics equipment bay and provides aircraft maintainers with quick access to stored data.

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Flight Instruments, Displays Chapter 10

Head-Up Display System Description Section 22

This Section Applies to YK622 - YK625, YS179 - YS190

Introduction

The Head-Up Display (HUD) system uses electronics and optics to calculate and display flight information. The flight information is displayed as flight symbols which project on to a transparent glass screen in front of the pilot. The flight symbols overlay and combine with the outside view through window No. 1.

The HUD system can be used during manual flight operations, or with the AFDS engaged during automatic flight operations. When used manually, internal HUD guidance is used to control flight symbology and is independent of any AFDS derived or displayed flight director guidance.

HUD system components, combined with other airplane systems, produce flight symbology displayed in four distinct modes of operation. Each mode of operation has unique characteristics, and is intended to be used during a particular phase of flight based on system capability and meteorological conditions. TCAS resolution advisories and system failure flags are also displayed when active. Detailed information on display symbology is found in Section 42 of this chapter.

The HUD system consists of the following components:

- HUD computer
- Overhead unit (OHU)
- Combiner
- Control panel
- Annunciator panel

HUD Computer

The HUD computer receives input signals from aircraft sensors and equipment and converts this data to symbology for display on the combiner. The computer also evaluates system and approach performance through extensive Built-In Test Equipment (BITE), input validation, and approach monitor processing. If an out of tolerance condition exists, the applicable annunciation appears on the combiner and/or annunciator panel. Internal components control the following functions:

- Guidance control
- Shape and position of flight symbols
- Airplane sensor status
- HUD system status
- HUD system mode.

Overhead Unit (OHU)

The OHU contains the CRT and projection optics to display flight symbology on the combiner. Electronic circuitry within the OHU controls display intensity and system monitoring.

Combiner

The combiner optically combines flight symbology from the OHU, with the pilot's view through window No.1. It acts as a wavelength selective mirror, reflecting only the flight symbology color (green) and lets other colors pass through.

The combiner alignment detector monitors the angular position of the combiner. The HUD computer uses the detector to verify correct combiner position for normal viewing. If the combiner is not in the correct position, and the HUD is in the IMC or VMC modes, the ALIGN HUD message appears on the combiner.

The combiner glass element has a break away safety feature which allows the element to rotate forward from the normal position, in case of abnormal deceleration.

Control Panel

The HUD control panel is used to select and display modes of operation and enter data. Display intensity is controlled by panel switches or by an ambient light sensor located on the upper left corner of the panel.

Annunciator Panel

The annunciator panel consists of lights to indicate HUD system status annunciations during AIII mode approach and landing operations.

Modes of Operation

The HUD system provides a mode–selectable display on the combiner. The modes are:

- PRI (Primary) - used for most HUD operations
- AIII - primarily used for manually flown CAT II or CAT IIIa ILS approach and landing operations
- IMC - used for AFDS autopilot/flight director approaches
- VMC - used for visual approaches.

Primary (PRI) Mode

The primary mode may be used during all phases of flight from takeoff to landing. This can include low visibility takeoff operations utilizing ground roll guidance, all enroute operations and either non-precision or precision approaches to CAT I or II minimums utilizing flight director guidance and/or raw data.

Attitude information is displayed in the form of a horizon line and pitch scales positioned relative to an airplane reference symbol. Airspeed and altitude are displayed in tapes along the left and right edges of the display. A sectored HSI is displayed in flight in the lower center of the display. On the ground, the HSI, flight path and guidance cue are not displayed. These symbols are automatically displayed once the aircraft is in flight.

During takeoff, a TOGA pitch target line and a guidance cue are displayed. The TOGA pitch target line is displayed as a horizontal dash line initially positioned at the top of the display. As the pitch attitude increases during rotation, its vertical position relative to the airplane reference symbol is adjusted to display the pitch command from the Captain’s flight director. Initially, the flight director guidance cue is displayed when the airplane reference is within 2 degrees of the TOGA pitch target line or when climbing through 50 feet radar altitude, whichever occurs first. The TOGA pitch target line remains until the TO/GA mode is exited. The flight director guidance cue is displayed throughout flight when the Captain’s flight director is selected on and both pitch and roll commands remain valid.

A full time slip-skid symbol is displayed as part of the roll scale. During any takeoff (after rotation) or go-around (below 1000 feet), additional slip-skid symbols are displayed to enhance lateral control in the event of an engine failure. These two additional symbols are displayed relative to the airplane reference and the flight path symbols and are removed above 1500 feet.

AFDS engaged modes, autothrottle modes and autopilot status is indicated across the top of the display similar to the flight mode annunciator display. Navigation information is displayed dependent on the selected navigation source and active AFDS mode. During LNAV operations, vertical and lateral deviations are similarly displayed based on FMC data. During ILS/VOR operations, course deviation is displayed within the HSI. Glideslope data is presented on a glideslope deviation scale adjacent to the altitude tape.

If the HUD is in a mode other than primary, depressing a TO/GA switch activates the primary mode independent of the standby mode indicated on the HUD control panel.

Primary Mode - Low Visibility Takeoff

The primary mode includes special symbology used for a low visibility takeoff. The display supports visual runway centerline tracking and enhances situational awareness.

Note: Approval must be obtained from the appropriate regulatory authority prior to conducting HUD low visibility takeoff operations.

The low visibility takeoff display incorporates a ground roll reference symbol, ground roll guidance cue and a ground localizer line (if an ILS frequency is tuned on both nav receivers). The HUD derived ground roll guidance cue provides lateral guidance relative to the ground roll reference symbol to track the localizer. The ground localizer line provides raw localizer information any time the aircraft is on the ground and the Captain's navigation receiver is tuned to a localizer frequency. The localizer deviation is presented relative to the selected course mark on the horizon.

A ground localizer scale and pointer indicates localizer deviation relative to the Captain's nav receiver localizer bearing.

Primary Mode - Approach and Landing

If the primary mode is used for an approach and landing, flight director guidance and navigation raw data is displayed. Once on the ground, the ground localizer line and ground localizer scale is displayed (if an ILS frequency is tuned on both nav receivers) to enhance centerline tracking.

AIII Approach Mode

The HUD AIII mode is specifically designed for manual ILS approach and landing operations to CAT II or CAT IIIa minimums. Altitude and airspeed tape displays are replaced with digital values. The HSI is also replaced with ILS raw data displayed in proximity to the flight path group around the center of the display. In the AIII mode, flight path guidance is provided by the guidance cue which is derived from internal approach and landing guidance algorithms, and is independent of any AFDS derived or displayed flight director guidance.

Note: Approval must be obtained from the appropriate regulatory authority prior to conducting HUD Cat II or CAT IIIa operations.

AIII mode is dependent on the availability of all required systems and ILS approach criteria. Because of these requirements, the AIII mode is not identified as a selectable standby mode until these requirements are met. AIII capability is displayed on the control panel at any time, and on the combiner after LOC and G/S capture in the PRI mode.

ILS approach criteria requirements are satisfied when:

- Both VHF navigation receivers tuned to an ILS frequency, and
- VHF #1 or VHF #2 localizer deviation is less than approximately ¼ dot and glideslope deviation is less than approximately 1 and ¼ dots for at least five seconds, and
- The difference between the airplane's magnetic track and the captain's selected course is less than 15 degrees, and
- Radio altitude is greater than 500 feet.

Note: Once these criteria have been satisfied, subsequent deviations outside the criteria prior to AIII mode selection, will result in a loss of ability to select the AIII mode.

Automatic AIII mode arming requirements are satisfied when:

- PRI or IMC mode selected, and
- all required systems operating normally (AIII capable), and
- ILS frequency tuned on VHF NAV receiver No. 1 or No. 2, and
- radio altitude is greater than 500 feet, and
- TOGA mode not active.

To activate AIII ARM, push the STBY function key on the HUD control panel. When armed, "AIII ARM" is displayed on the standby mode display line and "AIII ARM" is displayed on the combiner. Approximately five seconds after the requirements for ILS approach criteria are satisfied, the AIII mode is automatically activated.

Once the AIII mode is active, the AIII mode symbology and related annunciations are displayed on the combiner, the control panel display, and the HUD annunciator panel.

Any sensor or equipment condition that results in a loss of AIII capability will cause a NO AIII annunciation displayed on the combiner and on the control panel display. The first officer's AIII annunciation is also extinguished. The annunciation will remain until another mode is selected or AIII capability is regained.

Below 500 feet radar altitude, with a loss of AIII capability or if the approach or flare performance does not ensure a safe touchdown within the required touchdown zone, an APCH WARN annunciation will be displayed on the combiner and on the HUD annunciator panel.

IMC Mode

The IMC mode is an alternate approach mode primarily intended for autopoilot approaches. Like the PRI mode, the IMC mode guidance cue utilizes AFDS derived guidance. The guidance cue is displayed when the Captain's flight director is active and both pitch and roll commands are valid.

Approach symbology format for the IMC mode is similar to the AIII approach mode. Altitude and airspeed data is displayed as digital values and navigation raw data is displayed in close proximity to the flight path vector.

VMC Mode

The VMC mode is intended for visual approach operations. No flight director or HUD guidance is displayed. The flight path vector is used to control the approach to the runway.

Approach symbology format for the VMC mode is similar to the AIII and IMC modes. However, navigation data is not displayed.

The proper mechanical alignment of the combiner is critical during visual operations. Combiner position is monitored by the combiner alignment detector, to determine if the combiner is within allowable position tolerances while in the IMC or VMC mode. If its position is out of tolerance, an ALIGN HUD message is displayed on the combiner. Elimination of the message is accomplished by gently pushing the combiner in the breakaway direction and releasing. This allows the combiner to reposition itself. If the message cannot be removed, the IMC or VMC mode should not be used.

TCAS Resolution Advisory

TCAS resolution advisories are displayed as preventive and corrective symbols, and are similar to the pitch commands displayed on the attitude indicator.

Preventive advisories do not require any crew action, but indicate an unsafe zone, displayed as a double lined bracket. On the unsafe side of the bracket, two angled lines are extended from the corners. The position of the bracket is determined by TCAS, and represents the vertical flight path position that is safe.

Corrective advisories require positive action by the crew and are indicated by a double lined box. The position of the box is determined by the vertical speed requirements from TCAS, and represents the vertical flight path position that is safe.

For additional information on TCAS, refer to Chapter 15, Warning Systems.

Failure Flags and Data Source Annunciations

Failure flags are displayed for invalid sensor status and miscompares between similar parameters. These flags are generally indicated by boxed annunciations for the affected parameters, and in the case of failure, the removal of all symbols related to the fault. In some cases, symbols are removed as a result of other symbols being removed due to a fault.

Flags associated with a miscompare of similar data result in the display of a flag without the removal of the related symbols. The flag indicates the applicable data should be verified by cross-checks with other flight deck displays.

Data source annunciations are provided in a few cases to annunciate the source of displayed data when other than normal.

Dashes replace numbers if there is no computed data.

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Flight Instruments, Displays Chapter 10

PFD/ND – Primary Flight Display Section 31

Introduction

The Primary Flight Displays (PFDs) present a dynamic color display of all the parameters necessary for flight path control. The displays provide the following information:

- flight mode annunciation
- airspeed
- altitude
- vertical speed
- attitude
- steering information
- radio altitude
- instrument landing system display
- approach minimums
- heading/track indications
- TCAS indications
- GPWS annunciations

Failure flags are displayed for airplane system failures. Displayed information is blanked or replaced by dashes if no valid information is available to the display system (because of out–of–range or malfunctioning navigation aids). Failure flags are displayed when aircraft systems cannot generate a reliable display.

Flight mode annunciations are described in Chapter 4, Automatic Flight.

Airspeed

YA701 - YA710, YM482 - YM484
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.

YF048 - YL551, YN531 - YV754
Airspeed is displayed on a tape and in a digital window on the left side of the PFD. The current Mach number is digitally displayed below the airspeed tape when the current Mach number is 0.40 Mach or above. Ground speed is displayed when airspeed decreases below 0.40 Mach. An airspeed trend vector indicates predicted airspeed in 10 seconds. Selected airspeed is displayed above the airspeed tape.

Takeoff and landing reference speeds and flap maneuvering speeds are shown along the right edge of the airspeed tape. Maximum and minimum airspeeds are also displayed along the right edge of the airspeed tape.

YF048 - YL551, YN531 - YV754
Once the crew has set Flap/VREF in the MCDU APPROACH REF page, a green “REF” and numerical landing Flap/VREF appears on the PFD. The REF symbol will move vertically adjacent to the reference airspeed, and the numerical display will remain fixed at the base and to the right of the speed tape. In addition to the green VREF, a white VREF bug provides a ready target airspeed which allows sufficient tail clearance margin during a one engine inoperative flaps 15° landing.

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.

YA701 - YA706
A pitch limit indication is displayed at all times when the flaps are not up.

YA707 - YV754
A pitch limit indication is displayed at all times when the flaps are not up, or when flaps are up and airspeed approaches stick shaker activation for existing flight conditions.

Steering Indications

The flight director is displayed when the related flight director switch is on. Pitch and roll commands are combined on a single display.

The Flight Path Vector (FPV) symbol represents airplane flight path angle vertically and drift angle laterally. The flight path vector is displayed on the PFD when the EFIS control panel FPV switch is selected on. The FPV shows the Flight Path Angle (FPA) above or below the horizon line and drift angle left or right of the pitch scale's center. The FPA uses inertial and barometric altitude inputs. The vertical FPA is unreliable with unreliable primary altitude displays.

The FPV symbol is displayed in two brightness levels. The FPV symbol is displayed dim when either the flight director or a TCAS resolution advisory is displayed. The FPV symbol is displayed bright when the flight director is off and there is no TCAS resolution advisory displayed.

Instrument Landing System Indications

ILS glideslope and localizer deviation, frequency/identification, DME, course, and marker beacon indications are provided.

The approach reference information appears above and to the left of the attitude display. The ILS station identification or frequency, course, and (if available) DME are displayed.

The marker beacon indication (OM – outer marker, IM – inner marker, or MM – middle marker) is displayed in the upper right corner of the attitude display area.

The glideslope pointer and scale appear on the right side of the attitude indication when a valid signal is received. At low radio altitudes with autopilot engaged the scale turns amber and the pointer flashes to indicate an excessive glideslope deviation. The pointer is not displayed when the glideslope signal is unusable or when the track and the front course on the mode control panel differ by more than 90 degrees (backcourse).

The localizer pointer and scale appear at the bottom of the attitude indication when a valid signal is received. When the course deviation is slightly more than ½ dot, the localizer mode is engaged and track is within 5 degrees of the MCP selected course, the scale automatically expands. At low radio altitudes with autopilot engaged the scale turns amber and the pointer flashes to indicate excessive deviation. Below 1,000 feet AGL with LNAV engaged and LOC armed, the localizer scale turns amber and the pointer flashes if the localizer is not captured.

Each pilot's deviation alerting system self-tests upon becoming armed at 1500 feet radio altitude. This self-test generates a two second LOC and G/S deviation alerting display on each attitude indicator.

YF048 - YL551, YN531 - YV754
Below 2500 feet radio altitude with the localizer pointer in view, a rising runway symbol comes into view. The symbol provides lateral guidance. At 200 feet radio altitude, the symbol rises toward the airplane symbol.

Approach Minimums

The selected radio altitude or barometric approach minimums are set on the EFIS control panel. They are displayed near the bottom left of the altitude display.

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. The display turns amber when the radio altitude is below the radio altitude minimums.

Altitude

Altitude is displayed on an altitude tape along the right side of the PFD. It is also shown digitally in a window in the middle of the tape. When meters is selected on the EFIS control panel:

- current altitude in meters is also shown above the altitude window
- selected altitude in meters is displayed above the altitude tape.

Selected altitude is displayed above the altitude tape and is boxed when approaching the selected altitude. Selected altitude is also depicted with a bug on the altitude tape.

The selected barometric approach minimum is indicated on the altitude tape with a triangular pointer and a line when BARO minimums are selected. When RADIO minimums are selected, the pointer is still set at BARO minimums but there is no line.

YF048 - YL551, YN531 - YV754

A landing altitude reference bar is displayed along the inner edge of the altitude indication. The reference bar indicates the height above touchdown. A white bar is displayed from 1000 to 500 feet above landing altitude. An amber bar is displayed from 500 feet to the landing altitude.

A landing altitude indication is displayed as a crosshatched area and indicates:

- the FMC landing altitude for destination runway or airport, or
- the landing altitude for departure runway or airport until 400 NM from departure or one–half the distance to destination, whichever occurs first.

The current barometric reference is displayed below the altitude tape in either inches of mercury or hectopascals as selected on the EFIS control panel. A preselected barometric reference can be displayed when STD is displayed.

Altitude reference is selectable between QNH and QFE. QNH is the normal operating mode. A description of QFE operation is contained in the CDU Approach Reference Page description in Chapter 11, Flight Management, Navigation.

Vertical Speed

Vertical speed is displayed to the right of the altitude tape with a tape and pointer. Vertical speed is digitally displayed above or below the vertical speed display when vertical speed is greater than 400 feet per minute. It is displayed above with positive vertical speed and below with negative vertical speed. The selected vertical speed bug shows the selected vertical speed when in the AFDS vertical speed (V/S) pitch mode.

Heading/Track Indications

Heading/track information is displayed in the bottom section of the PFD on a section of the compass rose. Current heading is displayed under a pointer at the top of the compass rose. The MCP selected heading is displayed as a bug on the outside of the compass rose and digitally in the left half of the compass rose.

The current heading/track reference (MAG/TRU) is shown in the right half of the compass rose. A line drawn perpendicular to the edge of the compass rose from the invisible center depicts the current airplane track.

Traffic Alert and Collision Avoidance (TCAS) Indications

TCAS resolution advisories are displayed in the attitude indication area.

Refer to Chapter 15, Warning Systems.

GPWS Warnings

GPWS warnings are displayed in large capital letters between the attitude display and the heading/track compass rose. Refer to Chapter 15, Warning Systems.

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Flight Instruments, Displays Chapter 10

PFD/ND – Navigation Displays Section 41

Introduction

The NDs provide a mode–selectable color flight progress display. The modes are:

- MAP
- VOR
- APP (approach)
- PLN (plan)

The MAP, VOR, and APP modes can be switched between an expanded mode with a partial compass rose and a centered mode with a full compass rose.

Map Mode

The MAP mode is recommended for most phases of flight. This mode shows airplane position relative to the route of flight against a moving map background.

Displayed information can include:

- current track
- selected and current heading
- position trend vector
- range to selected altitude
- map range scale
- ground speed
- true airspeed
- wind direction and speed
- next waypoint distance
- waypoint estimated time of arrival
- selected navigation data points

Navigation Data Points

Additional navigation facility (STA), waypoint (WPT), airport (ARPT), route progress (DATA) and position (POS) data are available for display on the ND in both the expanded and center map modes.

VOR and Approach Modes

The VOR and APP modes are presented heading up. The VOR and APP modes display track, heading, and wind speed and direction with VOR navigation or approach information.

Plan Mode

The PLN mode is presented true north up. The active route may be viewed using the STEP prompt on the CDU LEGS pages.

ND Information

Heading

Heading is supplied by the FMC or air data inertial reference system (ADIRS). The ND compass rose can be referenced to magnetic north or true north.

Track

Track is supplied by the FMC during normal operation.

Traffic

Traffic information from the TCAS can be displayed on the ND. TCAS is described in Chapter 15, Warning Systems.

Weather Radar

Weather radar information can be displayed on the ND. The weather radar system is described in Chapter 11, Flight Management, Navigation.

Failure Flags and Messages

Failure flags are displayed for system failures or invalid information. Indications are blanked or replaced by dashes when source system information is not available.

The message EXCESS DATA is displayed if the amount of information sent to the ND exceeds the display capability. When this occurs, the system removes some information from the display. The message can be removed by:

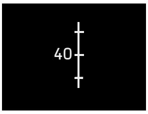
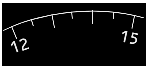
- reducing the amount of map information
- reducing range, or
- deselecting one or more of the EFIS control panel map switches (STA, WPT, ARPT, DATA, POS).

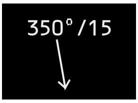
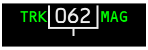
ND Symbology

The following symbols can be displayed on each ND, depending on EFIS control panel switch selections. Colors indicate the following:

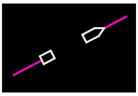
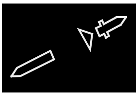
- W (white) – present status, range scales
- G (green) – dynamic conditions
- M (magenta) – command information, pointers, symbols, fly–to condition
- C (cyan) – nonactive or background information
- A (amber) – cautions, faults, flags
- R (red) – warnings
- B (black) – blank area, off condition.

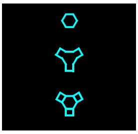
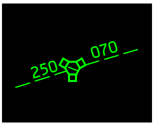
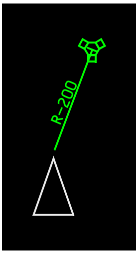
Heading, Track, and Speed

SYMBOL	NAME	MODE	REMARKS
	Selected heading bug (M)	All except PLN	Displays the MCP–selected heading. A dashed reference line (M) extends from the marker to the airplane symbol (VOR CTR and APP CTR do not display dashed line). In the MAP mode with LNAV or VORLOC engaged, the dashed line is removed 10 seconds after the selected heading bug is moved.
	Current heading pointer (W)	All except PLN	Points to current heading on the compass rose.
	Track line and range scale (W)	All except PLN	Indicates current track. Number indicates range (VOR CTR and APP CTR do not display range).
	Expanded compass (W)	MAP, VOR, APP	Displays 90 degrees of compass rose.
GS310	Groundspeed (W)	All	Displays current groundspeed.

SYMBOL	NAME	MODE	REMARKS
	True airspeed (W)	All	Displays current true airspeed above 100 knots.
	Wind direction/ speed and wind arrow (W)	All	Indicates wind speed and direction, with respect to display orientation and heading/track reference. Displayed if wind magnitude is greater than 6 knots and blanked if wind magnitude becomes less than 4 knots. Blank until TAS is greater than 101 knots. PLN mode displays direction/speed without the arrow.
	Track orientation (G), current track (W), track reference (G)	MAP, MAP CTR	Displays TRK as the orientation, the current track, and MAG or TRU as the reference, and points to the heading on the compass rose.
	Heading orientation (G), current heading (W), heading reference (G), heading pointer (W)	VOR, VOR CTR, APP, APP CTR	Displays HDG as the display orientation, current heading, MAG or TRU as the heading reference, and points to the heading on the compass rose.

Radio Navigation

SYMBOL	NAME	MODE	REMARKS
116.80 OR SEA	ILS /VOR Reference receiver frequency or identifier display (W)	VOR, VOR CTR, APP, APP CTR	Located upper right corner. Frequency displayed before the identifier is decoded. The decoded identifier replaces the frequency. Medium size characters for VOR, small size characters for DME only.
CRS 135	Reference ILS or VOR course (W)	VOR, VOR CTR, APP, APP CTR	Located upper right corner. Indicates the VOR course or ILS localizer course.
DME 24.6	Reference VOR or ILS DME (W)	VOR, VOR CTR, APP, APP CTR	Located upper right corner. Indicates DME distance to the reference navaid.
DME 24.6	DME distance (G)	All except PLN	Located lower left or right corner. Indicates DME distance to navaid.
	Selected course pointer (W) and line (M)	VOR, APP	Displays selected course as set by the related MCP course selector.
	Selected course pointer (W) TO/FROM pointer (W)	APP CTR, VOR CTR	Displays selected course as set by the related MCP course selector. TO/FROM pointer is displayed when VOR navigation is being used.
TO FROM	To/from indication (W)	VOR, VOR CTR	Displays VOR to/from indication.

SYMBOL	NAME	MODE	REMARKS
	VOR (C, G), DME/TACAN (C, G), VORTAC (C, G)	MAP, MAP CTR, PLN	When the EFIS control panel STA map switch is selected on, appropriate navaids are displayed. All navaids contained in the FMC data base and within the MAP area are displayed when the selected range is 5, 10, 20 or 40 nm. Only high altitude navaids are displayed when the selected range is 80, 160, 320 or 640 nm. Nav aids not being used are displayed in cyan. Manually tuned VHF navaids are displayed in green, regardless of STA map switch selection.
	Manually tuned VOR radials (G)	MAP, MAP CTR, PLN	When a navaid is manually tuned, the selected course and reciprocal are displayed.
	VOR/DME raw data radial and distance (G)	MAP, MAP CTR	When the POS map switch is selected on, the station radial extends to the airplane.

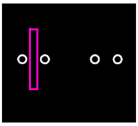
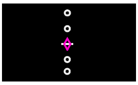
YA701 - YV750

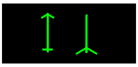
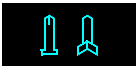
	System source annunciation (G)	VOR, VOR CTR, APP, APP CTR	Indicates the selected receiver as the display reference.

SYMBOL	NAME	MODE	REMARKS

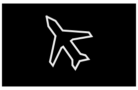
YV751 - YV754

	System source annunciation (G)	VOR, VOR CTR, APP, APP CTR	Indicates the selected receiver as the display reference.

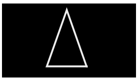
	ILS localizer or VOR course deviation indication (M) and scale (W)	VOR, VOR CTR, APP, APP CTR	Displays LOC or VOR course deviation. Deviation indicator points in direction of VOR or ILS selected course. For ILS deviation, indicator fills (M) when less than 2 ½ dots from center.
	Glideslope pointer (M) and scale (W)	APP, APP CTR	Displays glideslope position and deviation.
	VOR frequency or identifier (G), ADF frequency or identifier (C)	All except PLN	Located lower left or right corner. Frequency is displayed before identifier is decoded. Decoded identifier replaces the frequency. For VORs, small size characters indicate only DME information is being received.

SYMBOL	NAME	MODE	REMARKS
	VOR (G) or ADF (C) selection	All except PLN	Located lower left or right corner. Represents positions of the EFIS control panel VOR/ADF switches.
	VOR 1 (G) or ADF 1 (C) pointer head and tail	All except PLN	Indicates bearing to (head) or from (tail) the tuned station, if selected on the respective EFIS control panel.
	VOR 2 (G) or ADF 2 (C) pointer head and tail	All except PLN	Indicates bearing to (head) or from (tail) the tuned station, if selected on the respective EFIS control panel.

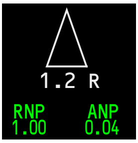
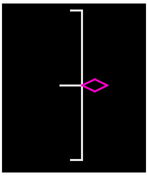
Map

SYMBOL	NAME	MODE	REMARKS
	Airplane symbol (W)	VOR CTR, APP CTR	Current airplane position is at the center of the symbol.
	Airplane symbol (W)	PLN	Indicates actual position and track along the flight plan route. Inhibited north of 82N latitude and south of 82S latitude.

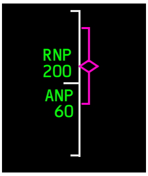
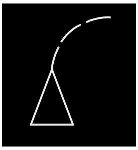
YA701 - YL544, YM482 - YM484

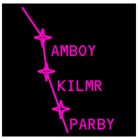
	Airplane symbol (W)	MAP, MAP CTR, VOR, APP	Current airplane position is at the apex of the triangle.

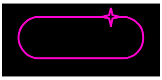
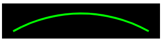
YL545 - YL551, YN531 - YV754

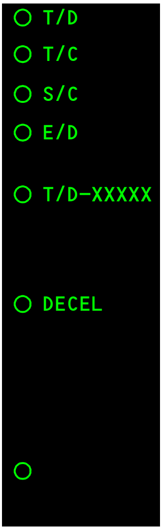
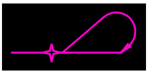
	Airplane symbol (W), Lateral ANP/RNP values (G)	MAP, MAP CTR, VOR, APP	Current airplane position is at the apex of the triangle. Displays lateral path deviation distance in MAP and MAP CTR mode only. Whenever ANP exceeds RNP, the ANP/RNP labels and values are displayed in amber.
	VNAV path pointer (M) and deviation scale (W)	MAP, MAP CTR	Displays vertical deviation from selected VNAV PATH during descent only. Scale indicates ± 400 feet deviation. Digital display is provided when the pointer deviates more than ± 30 feet from center.

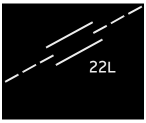
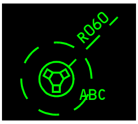
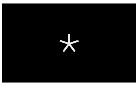
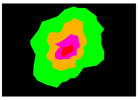
YL545 - YL551, YN531 - YV754

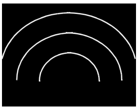
SYMBOL	NAME	MODE	REMARKS
	Path deviation band (M), Vertical ANP/RNP values (G)	MAP, MAP CTR	Path deviation band is symmetric about the pointer and represents vertical RNP. Whenever ANP exceeds RNP, the ANP/RNP labels and values are displayed in amber.
	Position trend vector (W) (dashed line)	MAP, MAP CTR	Predicts position at the end of 30, 60, and 90 second intervals. Each segment represents 30 seconds. Based on bank angle and ground speed. Selected range determines the number of segments displayed. For range: • > 20 NM, 3 segments • = 20 NM, 2 segments • < = 10 NM, 1 segment.
	Active waypoint identifier (M)	MAP, MAP CTR, PLN	Indicates the active flight plan waypoint, the next waypoint on the route of flight.
	Active waypoint distance (W)	MAP, MAP CTR, PLN	Distance to the active waypoint.
	Active waypoint ETA (W)	MAP, MAP CTR, PLN	Indicates FMS–calculated ETA at the active waypoint.

SYMBOL	NAME	MODE	REMARKS
	Waypoint: active (M), modified (W), inactive (C)	MAP, MAP CTR, PLN	Active– represents the waypoint the airplane is currently navigating to. Modified – represents the waypoints on the active route that are being modified. Inactive – represents the waypoints on the active route.
	Off route waypoint (C)	MAP, MAP CTR, PLN	When the EFIS control panel WPT map switch is selected on, waypoints not on the selected route are displayed, for ranges of 5, 10, 20, or 40 NM.
	Flight plan route: active (M), modified (W), inactive (C), offset (M)	MAP, MAP CTR, PLN	The active route is displayed with a continuous line (M) between waypoints. Active route modifications are displayed with short dashes (W) between waypoints. Inactive routes are displayed with long dashes between waypoints. An offset route, selected through the FMC, is displayed with a dot–dash line (M) parallel to the active route.
	Route data: active (M), inactive (W)	MAP, MAP CTR, PLN	When the EFIS control panel DATA switch is selected on, entered or procedural altitude and ETAs for route waypoints are displayed.

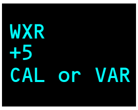
SYMBOL	NAME	MODE	REMARKS
	Holding pattern: active (M), modified (W), inactive (C)	MAP, MAP CTR, PLN	A holding pattern appears when in the flight plan. The holding pattern appears as a fixed size if the selected range is greater than 80 NM. A scaled representation of the holding pattern is displayed when the selected range is 80 NM or less and the airplane is within 3 minutes of the holding fix.
	Altitude range arc (G)	MAP, MAP CTR	Based on vertical speed and groundspeed, indicates the approximate map position where the MCP altitude will be reached.
	Conditional waypoint: active (M), inactive (W)	MAP, MAP CTR, PLN	Active - represents the conditional waypoint event the airplane is currently navigating to. Inactive - represents the conditional waypoints on the route. Data within parentheses for conditional waypoints indicates type of conditional waypoint (ALTITUDE, COURSE INTERCEPT, etc.).

SYMBOL	NAME	MODE	REMARKS
	Altitude profile point and identifier (G)	MAP, MAP CTR, PLN	Indicates the approximate map position of the FMC–calculated T/C (top–of–climb), T/D (top– of–descent), S/C (step climb), and E/D (end of descent) points. Indicates intermediate T/D points for level flight path segments during descent. Level flight path segment altitude is displayed. Indicates the beginning of a deceleration segment resulting from deceleration to a holding pattern, a waypoint speed restriction or flaps up maneuvering speed. Indicates airport speed restriction deceleration point (no identifier).
	Procedure turn: active (M), modified (W), inactive (C)	MAP, MAP CTR, PLN	A procedure turn appears when in the flight plan. The procedure turn appears as a fixed size if the selected range is greater than 80 NM. A scaled representation of the procedure turn is displayed when the selected range is 80 NM or less and the airplane is within 3 minutes of the procedure turn.
	Airport and runway (W)	MAP, MAP CTR, PLN	Displayed when selected as the origin or destination and selected range is 80, 160, 320, or 640 NM.

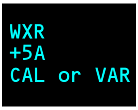
SYMBOL	NAME	MODE	REMARKS
	Airport (C)	MAP, MAP CTR, PLN	Displayed if the EFIS control panel ARPT map switch is selected on. Origin and destination airports are always displayed, regardless of map switch selection.
	Airport and runway (W)	MAP, MAP CTR, PLN	Displayed when selected as the origin or destination and selected range is 5, 10, 20, or 40 NM. Dashed runway centerlines extend 14.2 NM.
	Selected reference point and bearing distance information (G)	MAP, MAP CTR, PLN	Displays the reference point selected on the CDU FIX page. Bearing and/or distance from the fix are displayed with dashes (G).
	GPS position (W)	MAP, MAP CTR	When the EFIS POS map switch is selected on, indicates GPS position relative to FMC position.
	ADIRU position (W)	MAP, MAP CTR	When the EFIS control panel POS map switch is selected on, the star indicates ADIRU position relative to FMC position.
	Weather radar returns (R, A, G, M)	MAP, MAP CTR, VOR, APP	The most intense areas are displayed in red, lesser intensity in amber, and lowest intensity green. Turbulence is displayed in magenta.
	Selected map options (C)	MAP, MAP CTR, PLN	Displays EFIS control panel selected map options.

SYMBOL	NAME	MODE	REMARKS
 FMC L FMC R	MAP source annunciation (G)	MAP, MAP CTR, PLN	Displays source of FMC data used by CDS for data presentation.
	Range arcs (W)	MAP, VOR, APP	Displayed in MAP, APP and VOR modes when the WXR map, TERR map or TCAS TFC switches are selected.

YA701 - YA710, YM482 - YM484

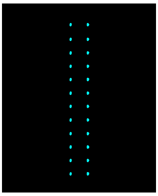
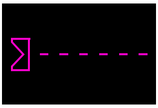
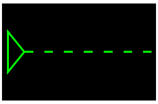
 WXR +5 CAL or VAR	Weather radar annunciations: Mode (C), Tilt (C), Gain (C)	MAP, MAP CTR, VOR, APP	Annunciations vary with option selected.

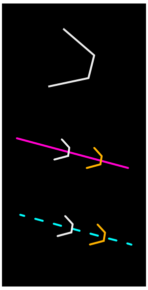
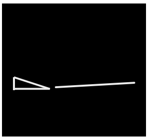
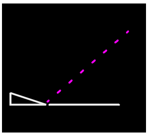
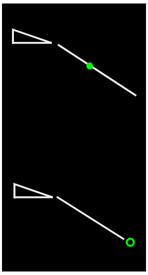
YF048 - YL551, YN531 - YV754

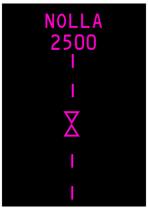
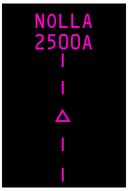
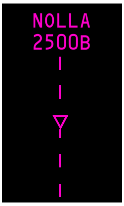
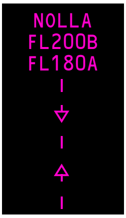
 WXR +5A CAL or VAR	Weather radar annunciations: Mode (C), Tilt (C), Tilt Mode (C), Gain (C)	MAP, MAP CTR, VOR, APP	Annunciations vary with option selected.

Vertical Situation Display (VSD)

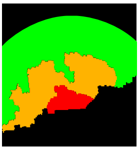
YF048 - YF928, YK624 - YK630, YK966 - YL551, YN531 - YV754

SYMBOL	NAME	REMARKS
	Airplane symbol (W)	Current airplane altitude is the bottom of the triangle. Current airplane lateral position relative to terrain is the point of the triangle.
	Enroute swath (C) (dashed line)	Indicates area of the map that is shown on the VSD. Display is inhibited both on takeoff and approach when the airplane is within 6 NM of the runway and less than 3000 feet above field elevation. During turns, the swath edge leading the turn opens in the direction of the turn.
	Selected altitude bug and line (M)	Bug indicates the altitude set in the MCP altitude window. When the selected altitude is off scale, the bug is parked at the top or bottom, with only one half the bug visible. Dashed line extends from bug to background display boundary. Line does not park.
	BARO minimums pointer and line (G)	Pointer indicates the barometric minimums selected on the EFIS control panel. Dashed line extends from pointer to background display boundary. Pointer and line turn amber when airplane descends below selected minimum altitude. Reset with the RST switch on the EFIS control panel. After the pointer is set with the BARO position, moving the Minimums Reference selector to RADIO displays only the pointer.

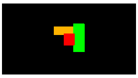
SYMBOL	NAME	REMARKS
	Decision gates (W, A)	Indicates suggested points where airplane should be path and speed stable on approach. Gates are placed on the 3 Degree Reference Line or FMC Approach Glide Path Angle Line: • at 1000 feet above field elevation (W). • at 500 feet above field elevation (A). Decision gates that are below the missed approach waypoint altitude will not be displayed.
	Flight path vector (W)	Fixed length line indicates current flight path angle and rotates about the point of the triangle. Angle of the line is dependent on the vertical speed and ground speed of the airplane.
	MCP selected vertical speed vector (M)	Dashed line indicates the selected vertical speed as a target angle when the MCP V/S mode is selected. Extends to the edge of the background display and rotates about the point of the triangle.
	Range to target speed dot (G)	Indicates where the airplane will achieve the FMC or MCP target speed. If the airplane is within 5 knots of the target speed the dot will be blanked. If the airplane increases 10 knots or more faster than the target speed the dot will reappear. Displayed at the end of the Flight Path Vector as an unfilled dot if the target speed will not be achieved within the vector length.

SYMBOL	NAME	REMARKS
	Waypoint altitude constraint: active (M), inactive (W)	At Altitude example.
	Waypoint altitude constraint: active (M), inactive (W)	At or Above Altitude example.
	Waypoint altitude constraint: active (M), inactive (W)	At or Below Altitude example.
	Waypoint altitude constraint: active (M), inactive (W)	Block Altitude example.

Look-Ahead Terrain

SYMBOL	NAME	MODE	REMARKS
	Terrain display (R, A, G, M)	MAP, MAP CTR, VOR, APP	Displays terrain data from the GPWS terrain data base. Color and density vary based on terrain height vs. airplane altitude. Refer to Chapter 15, Warning Systems.

YF048 - YF928, YK626 - YK630, YK973 - YK980, YL541 - YL551, YN531 - YV754

SYMBOL	NAME	MODE	REMARKS
	Terrain obstacle (R, A, G)	MAP, MAP CTR, VOR, APP	Obstacles are displayed from the GPWS data base and use the same display criteria as the terrain display.
OBSTACLE	Obstacle annunciation (R, A)	All	Obstacle caution alert active (A), obstacle warning alert active (R).

YF048 - YF928, YK626 - YK630, YK973 - YK980, YL541 - YL551, YN531 - YV754

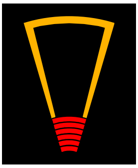
SYMBOL	NAME	MODE	REMARKS
TERR 060 030	Terrain mode annunciation (C) Terrain elevation (R,A,G)	MAP, MAP CTR, VOR, APP	Terrain display enabled (manual or automatic display). Terrain elevation displayed in hundreds of feet showing highest and lowest displayed terrain. Colors correspond to terrain display. Terrain elevation not displayed when terrain data unavailable.

YA701 - YA710, YK622 - YK625, YK961 - YK971, YL076, YL077, YM482 - YM484

SYMBOL	NAME	MODE	REMARKS
TERR	Terrain mode annunciation (C)	MAP, MAP CTR, VOR, APP	Terrain display enabled (manual or automatic display).

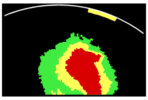
SYMBOL	NAME	MODE	REMARKS
TERR TEST	Terrain test mode annunciation (C)	All	GPWS operating in self-test mode.
TERRAIN	Terrain annunciation (R, A)	All	Look-ahead terrain caution alert active (A), look-ahead terrain warning alert active (R).
TERR FAIL	Terrain status annunciations (A)	All	Look-ahead terrain alerting and display have failed.
TERR POS	Terrain status annunciations (A)	All	Look-ahead terrain alerting and display unavailable due to position uncertainty.
TERR INHIBIT	Terrain status annunciations (A)	All	GPWS terrain inhibit switch in TERR INHIBIT position.
TERR RANGE DISAGREE	Terrain range status annunciations (A)	MAP, MAP CTR, VOR, APP	Terrain output range disagrees with selected EFIS control panel range.
MAP/TERR RANGE DISAGREE	Terrain range status annunciations (A)	MAP, MAP CTR	Terrain output range and map display output range disagree with selected EFIS control panel range.

Predictive Windshear

SYMBOL	NAME	MODE	REMARKS
	Predictive windshear symbol (R, B, A)	MAP, MAP CTR, VOR, APP	Displays windshear location and approximate geometric size (width and depth). Amber radials extend from predictive windshear symbol to help identify location of windshear event.
WINDSHEAR	Windshear annunciation (R, A)	All	Predictive windshear caution active (A). Predictive windshear warning active (R).
PWS FAIL	Predictive windshear status annunciation (A)	All	Predictive windshear alerting and display have failed.

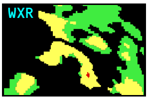
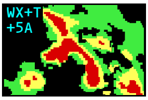
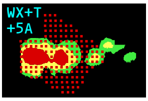
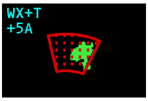
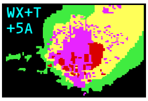
Path Attenuation Compensation (PAC)

YF048 - YL551, YN531 - YV754

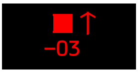
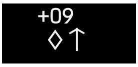
	Weather radar Path Attenuation Compensation (A)	MAP, MAP CTR, VOR, APP	Attenuated region behind rainfall (radar shadow) is indicated by amber arc on outer range ring.

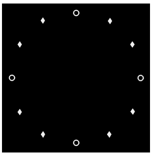
Threat Assessment

YS184 - YS190, YT501 - YV754

 	Core Threat Assessment (R, A, G, M)	MAP, MAP CTR, VOR, APP	Weather radar colors are adjusted to more accurately reflect the weather threat.
	Associated Threat Assessment (R)		Lightning or hail probability is indicated by red speckled pattern in black/green/amber areas above 25,000 ft, or green/amber areas below 25,000 ft.
	Predictive OverFlight (R)		Rapidly building cell below flight altitude is indicated by red speckled pattern with red outline. Indication is replaced by actual weather when cell reaches flight altitude.
	Two-level Turbulence (M)		Severe turbulence is displayed in solid magenta. Light-to-moderate turbulence is displayed in speckled magenta.

TCAS

SYMBOL	NAME	MODE	REMARKS
	TCAS resolution advisory (RA), relative altitude (R)	MAP, MAP CTR, VOR, APP	These symbols are displayed only when the EFIS control panel traffic (TFC) switch is selected on. Refer to Chapter 15, Warning Systems. The arrow indicates traffic climbing or descending at a rate >= 500 fpm. At rates < 500 fpm, the arrow is not displayed. The number and associated signs indicate altitude of traffic in hundreds of feet relative to the airplane. The number is below the traffic symbol when the traffic is below, and above the traffic symbol when the traffic is above the airplane. Absence of the number implies altitude unknown.
	TCAS traffic advisory (TA), relative altitude (A)		
	TCAS proximate traffic, relative altitude (W)		
	TCAS other traffic, relative altitude (W)		
RA 5.3 +03 ↑ TA 8.9 -12 ↑	TCAS no bearing message (RA–R, TA–A)	MAP, MAP CTR, VOR, APP	Message provides traffic type, range in NM, altitude and vertical direction. TFC must be selected on.
TRAFFIC	TCAS traffic alert message (RA–R, TA–A)	All	Displayed whenever a TCAS RA or TA is active. EFIS control panel TFC switch does not have to be selected on.
OFFSCALE	TCAS off scale message (RA–R, TA–A)	MAP, MAP CTR, VOR, APP	Displayed whenever RA or TA traffic is outside the traffic area covered by the ND range. Displayed only if the EFIS control panel TFC switch is selected on.

SYMBOL	NAME	MODE	REMARKS
TFC	TCAS mode (C)	MAP, MAP CTR, VOR, APP	Indicates the ND TCAS display is active; the EFIS control panel TFC switch is selected on.
TA ONLY	TCAS mode (C)	All	Indicates TCAS computer is not computing RAs. Displayed whether the EFIS control panel TFC switch is selected on or off.
TCAS TEST	TCAS mode (C)	All	Indicates TCAS is operating in the test mode. Displayed whether EFIS control panel TFC switch is selected on or off.
TCAS OFF	TCAS mode (A)	All	Displayed when the TCAS/ATC mode switch is not in TA ONLY or TA/RA. Not displayed if TCAS is failed.
TCAS FAIL	TCAS mode (A)	All	Indicates TCAS failure, if traffic is selected.
	Range Ring (W)	MAP, MAP CTR, VOR, APP	Displayed when TFC selected on EFIS Control Panel. Shows 3 NM range ring oriented to aircraft heading. Displayed at ranges of 80 NM or less.

Flight Instruments, Displays — Chapter 10

Head-Up Display System, Symbology — Section 42

This Section Applies to YK622 - YK625, YS179 - YS190

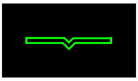
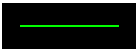
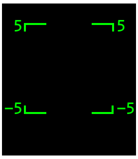
Introduction

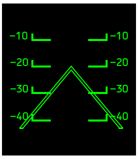
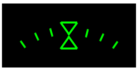
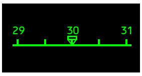
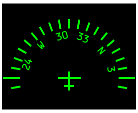
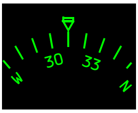
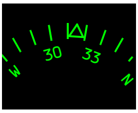
HUD symbology consists of green symbols projected on the combiner from the OHU. The PRI mode display symbols are similar to those on the CDS, and can be used for all phases of flight. The approach mode displays (AIII, IMC, VMC) are optimized to enhance aircraft control and situational awareness during final approach, flare, and touchdown.

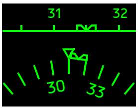
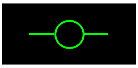
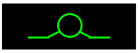
In addition to flight symbology, TCAS resolution advisories and HUD system failure flags and data source annunciations are displayed when active.

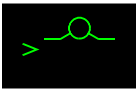
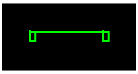
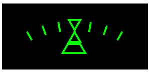
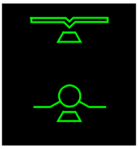
Head-Up Guidance Display Symbology

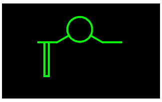
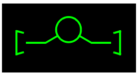
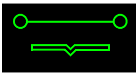
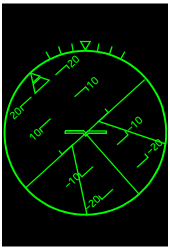
The following symbols can be displayed on the combiner, depending on HUD and EFIS control panel switch selections.

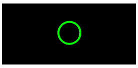
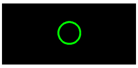
SYMBOL	NAME	MODE	REMARKS
	Airplane reference	All	Top center point of the symbol represents airplane projected centerline. The symbol is positioned at a fixed position 7 ° above the display's vertical center. Symbol is fixed at display center when the unusual attitude display is active.
	Horizon Line	All	Indicates the horizon relative to the airplane reference symbol. Position based on current airplane pitch and roll attitude.
	Pitch Scale	PRI in flight, AIII approach, IMC, VMC	Displays airplane pitch in five degree increments between -20 ° and +25 °.

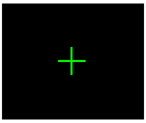
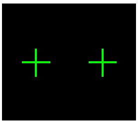
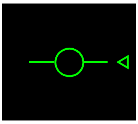
SYMBOL	NAME	MODE	REMARKS
	Compressed pitch scale	PRI in flight, AIII approach, IMC, VMC	Displays airplane pitch in ten degree increments between +/-30 ° and +/-90 °. A chevron appears on the pitch scale at -20 ° and +30 °.
	Bank Scale and Pointer	All	Displays the corresponding roll attitude in ten degree increments between 0 ° and +/-30 °. Tic marks at +/-45 ° and +/-60 ° are added when the airplane exceeds +/-35 ° and +/-50 ° respectively.
	Horizon heading scale	All	Magnetic heading is displayed in five degree increments (and labeled every 10 °) on the horizon line. A downward pointing triangle indicates current airplane magnetic heading.
	HSI heading scale	PRI in flight	Displays airplane magnetic heading in a 210 ° compass rose format.
	Heading pointer	PRI in flight	Indicates current heading.
	Drift angle pointer	PRI in flight	Indicates current drift angle or track.

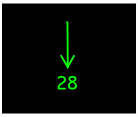
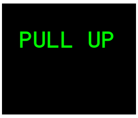
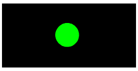
SYMBOL	NAME	MODE	REMARKS
	Selected heading bug	All	Displays selected heading on the horizon line and on the HSI (when in view). Not displayed if the selected heading is outside of the currently displayed heading scale.
	Digital selected heading	All	Displayed full time in PRI mode and for five seconds after selection in the IMC, VMC or AIII modes.
	Digital heading	All	Displays current magnetic heading directly below the roll scale pointer.
	Ground roll reference	PRI ground	Provides a reference for ground roll guidance during low visibility takeoff operations. Displayed on the horizon line until 3° of attitude is achieved.
	Flight path symbol	PRI in flight, AIII approach, IMC, VMC	Displays the actual flight path vector of the aircraft. Has display priority over all other symbols except the guidance cue and the FLARE command.

SYMBOL	NAME	MODE	REMARKS
	Flight path acceleration	All	Positioned left of the flight path vector; indicates sum of all forces affecting the airplane including thrust, drag, and wind. Positioned above flight path vector; airplane is accelerating. Positioned below flight path vector; airplane is decelerating. Removed from display when a decreasing performance low-level windshear is detected below 400 feet AGL.
	Pitch limit indication (also called angle of attack limit)	PRI in flight, AIII approach, IMC, VMC	Displayed whenever the airplane's angle of attack is within 5 ° of stick shaker, any time stick shaker is active, or whenever WINDSHEAR guidance cue is displayed.
	Slip/skid indicator	All	The bottom portion of the bank scale pointer moves laterally with respect to the top triangle portion of the pointer.
	Additional slip/skid indicators	PRI in flight, AIII approach, IMC, VMC	Positioned below the airplane reference and flight path symbols. Displayed during takeoff or low altitude go-around.

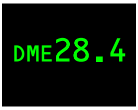
SYMBOL	NAME	MODE	REMARKS
	Speed error tape	PRI in flight, AIII approach, IMC, VMC	Displays the difference between indicated airspeed and the reference speed selected on the mode control panel. Tape length equal to the diameter of the flight path circle represents approximately 5 knots of error. Maximum tape length is limited to 15 knots of error.
	Bank warning	PRI in flight, AIII approach, IMC, VMC	Displayed if radio altitude is less than 100 feet and airplane roll angle exceeds 5 °. Symbol remains until roll angle is less than 3 ° or radio altitude greater than 100 feet.
	Tail strike pitch limit	PRI ground	Tail strike occurs if this symbol meets the aircraft reference symbol. Displayed if the airplane pitch angle approaches the tail strike angle or the pitch rate is too excessive during takeoff rotation, below 10 feet AGL.
	Unusual attitude	PRI in flight, AIII approach, IMC, VMC	Automatically displayed when pitch exceeds -20°/+35° or roll exceeds 55°.

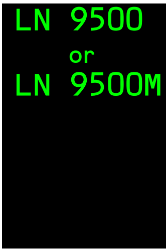
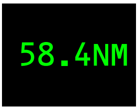
SYMBOL	NAME	MODE	REMARKS
	Flight director guidance cue	PRI in flight, IMC	Functions similar to the flight director, but is designed for control of flight path. Automatically displayed when within 2° of pitch command or radio altimeter indicates 50 feet. The objective is to capture the guidance cue inside the flight path vector circle.
	HUD guidance cue	PRI ground, AIII approach	Similar to flight director guidance cue, but driven by HUD computer. During low visibility takeoff, the cue provides localizer tracking. During AIII approach, the cue provides approach and flare commands. The objective is to capture the guidance cue inside the flight path vector or ground roll reference circle.
	TO/GA pitch target line	PRI in flight	Displayed when greater than 65 knots, AFDS TO/GA mode active and a valid pitch command input of greater than 10 ° is received. Symbol remains until TO/GA mode is exited. The objective is to place the airplane reference symbol on the target line.

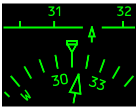
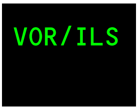
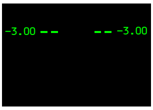
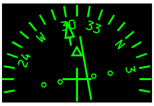
SYMBOL	NAME	MODE	REMARKS
	AIII flare command	AIII approach	Initially displayed 2-3 ° directly below the guidance cue at 105 feet above runway elevation. The symbol flashes for one second and rises toward the guidance cue at a rate proportional to the expected flare pitch rate. At an altitude between 45 and 55 feet, the flare command and guidance cue meet and continue rising to command the flare maneuver until touchdown.
	Flare cues	PRI in flight, IMC, VMC	Displayed on each side of the flight path symbol, indicating the flare maneuver must be accomplished. The cues flash continuously as the airplane descends through 55 feet radio altitude, until 10 feet radio altitude is reached.
	Rollout excessive deviation triangle	AIII rollout	Points in the direction of runway centerline during excessive deviation from the localizer on rollout.
	Ground deceleration scale	PRI ground, AIII rollout, IMC, VMC	Scale marks are labeled with autobrake settings. Displayed during all landings. Displayed during takeoff if deceleration is sensed when groundspeed above 50 knots. Removed when groundspeed below 25 knots, airplane is accelerating or after lift off.

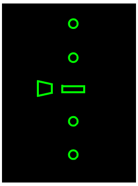
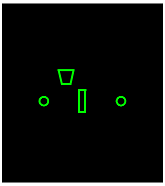
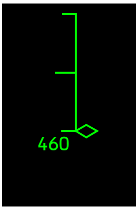
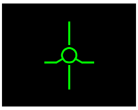
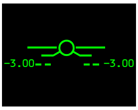
SYMBOL	NAME	MODE	REMARKS
	Wind speed and direction	PRI in flight, AIII approach, IMC,VMC	Indicates wind speed and direction, with respect to airplane magnetic heading. Displayed if wind magnitude is greater than 6 knots and blanked if wind magnitude becomes less than 4 knots.
	Windshear warning	PRI in flight, AIII approach, IMC,VMC	Displayed above the airplane reference symbol during a GPWS or PWS windshear warning.
	Ground proximity warning	PRI in flight, AIII approach, IMC,VMC	Displayed whenever the GPWS is activated.
	Windshear guidance cue	PRI in flight	During a windshear warning, and in TO/GA mode, the PRI mode is automatically selected and the guidance cue becomes a solid circle to provide guidance to exit windshear conditions.

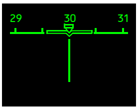
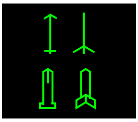
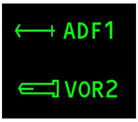
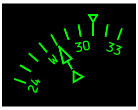
SYMBOL	NAME	MODE	REMARKS
250	Radio altitude	PRI in flight, AIII approach, IMC,VMC	Displayed below the flight path symbol, or relative to the airplane reference symbol if the flight path symbol is not displayed. The value is removed from the display at 1500 feet when ascending and again displayed at 1400 feet when descending. This value is displayed in ten foot increments between 50 and 1500 feet, five foot increments between 10 and 50 feet and one foot increments below 10 feet.
DH	Decision height	PRI in flight, AIII approach, IMC	Displayed left of radio altitude when selected decision height is reached. When decision height is reached, the message flashes for 3 seconds and then remains steady.
OM or MM or IM	Marker beacon	PRI in flight, AIII approach, IMC	Displayed below the airplane reference symbol for marker beacon passage.
210	Digital airspeed	AIII approach, AIII rollout, IMC, VMC	Displays airspeed next to the flight path symbol if it is displayed, and next to the airplane reference symbol if flight path is not displayed.
AS 210	Digital selected airspeed	All	Displays speed selected on the MCP.

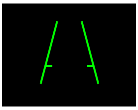
SYMBOL	NAME	MODE	REMARKS
	Digital ground speed	All	Displays digital ground speed.
	Digital mach	PRI in flight	Displays mach speed below airspeed scale when mach speed is above .400. Removed when below .380.
	Selected mach	All	Displays selected mach speed above airspeed scale (PFD/ND format only).
	Digital barometric altitude	AIII approach, AIII rollout, IMC, VMC	Displays barometric altitude relative to the flight path symbol if it is displayed, and relative to the airplane reference symbol if flight path is not displayed.
	Digital vertical speed	PRI in flight, AIII approach, IMC, VMC	In PRI mode, displayed in the lower right corner of the display. In all other modes, displayed to the right of the flight path symbol. Value displayed in 50 feet/minute increments.
	DME distance	PRI in flight, AIII approach, IMC, VMC	Indicates DME distance to the reference navaid.

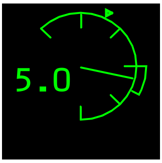
SYMBOL	NAME	MODE	REMARKS
	Digital runway elevation	AIII approach	Displays runway elevation entered on the HUD control panel for 5 seconds: • after AIII mode selected, or • runway elevation value changed during an AIII mode approach.
	Digital runway length in feet. Digital runway length in meters.	AIII approach, AIII rollout	Displays runway length entered on the HUD control panel for 5 seconds: • after AIII mode selected, or • runway length value changed during an AIII mode approach. When AIII mode active and above 500 feet AGL, display flashes when runway length entered is outside of rollout guidance capability.
	Digital runway remaining in feet Digital runway remaining in meters	PRI ground, AIII rollout	Displays the length of runway remaining between airplane and end of runway based on runway length entered on the HUD control panel.
	Distance to go	PRI in flight, IMC	Distance to next waypoint.
	Selected course (digital)	All	Displayed full time in PRI mode and for five seconds after selection in the IMC, VMC or AIII modes.

SYMBOL	NAME	MODE	REMARKS
	Selected course pointer	All	Displays MCP selected course below the horizon line and on the HSI (PRI mode only). The horizon line pointer is surrounded by a 3 ° gap in the horizon line.
 VOR 1,2 ILS 1,2	System source annunciation	PRI in flight, PRI ground, AIII approach, AIII rollout IMC	Indicates the selected receiver as the display source.
 VOR/ILS			Indicates source cannot be determined.
 FMC L, R	FMC source annunciation	All	Indicates the selected FMC as the system source.
 -3.00 -- -- -3.00	Glideslope reference line	AIII approach, IMC, VMC	Displays the glideslope value entered on the HUD control panel. Positioning the flight path symbol over the glideslope reference line results in a descent angle equal to the value entered.
	ILS localizer or VOR deviation indication and scale	PRI in flight	Displays LOC or VOR course deviation on the HSI. With excessive localizer deviation during an ILS approach, the symbol will flash until the excessive deviation is no longer present.

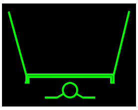
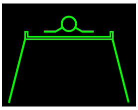
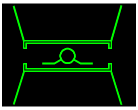
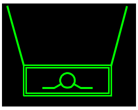
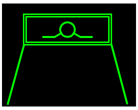
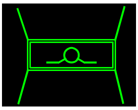
SYMBOL	NAME	MODE	REMARKS
	Glideslope pointer and deviation scale	PRI in flight	Displays glideslope position and deviation during ILS approach. With excessive glideslope deviation, the pointer will flash until the excessive deviation is no longer present.
	Ground localizer pointer and deviation scale	PRI ground, AIII rollout	Displays airplane lateral deviation relative to the runway centerline.
	Vertical deviation pointer and scale	PRI in flight, IMC	Full scale represents 400 feet of vertical deviation. When the deviation is off scale, the pointer is parked at the top or bottom of the tape, and the digital value is displayed at the appropriate end of the scale.
	Lateral deviation line	AIII approach, IMC	Displayed as vertical lines referenced to the selected course. In IMC mode, the line will flash during excessive localizer deviation.
	Glideslope deviation line	AIII approach, IMC	Displayed as horizontal lines referenced to the glideslope reference line. In IMC mode, the line will flash during excessive glideslope deviation. The line is removed below 70 feet radio altitude.

SYMBOL	NAME	MODE	REMARKS
	Ground localizer line	PRI ground, AIII rollout, IMC	Displays localizer deviation as a vertical line below the airplane reference symbol and is referenced to the selected course.
	VOR1/ADF 1 pointer head and tail VOR2/ADF 2 pointer head and tail	PRI in flight	Indicates bearing to (head) or from (tail) the tuned station.
	Bearing source annunciations	PRI in flight	Indicates pointer source.
	To/from pointer	PRI in flight, PRI ground	A triangle pointing in the same direction as the selected course indicates a “to” condition. Pointing away from the selected course indicates a “from” condition.
	TO/FROM annunciation	AIII approach, IMC	Displayed below the VOR system source annunciation. Indicates movement to or from a VOR station.
	Runway elevation	AIII approach	Indicates entered runway elevation for 5 seconds after AIII mode is selected or if elevation value is changed during AIII mode operation.

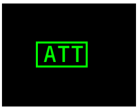
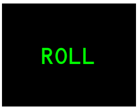
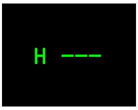
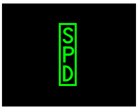
SYMBOL	NAME	MODE	REMARKS
	Runway edge lines	AIII approach	Displayed between 300 and 60 feet radio altitude. The lines are scaled to a width of 200 feet and a length of 8000 feet. Tic marks are displayed at the touchdown aimpoint representing 1050 feet from the runway threshold.
IDLE	IDLE message	AIII approach	Displayed below the radio altitude when flare guidance commands a thrust reduction to idle for touchdown. Message is displayed between 25 to 5 feet radio altitude, depending on airspeed.
ALIGN HUD	ALIGN HUD message	IMC, VMC	Indicates the combiner is not properly aligned with the OHU.
IMC or VMC or AIII	HUD system mode	AIII approach, AIII rollout, IMC, VMC	Indicates current HUD system mode. The PRI mode is not indicated as it is uniquely identifiable by the airspeed and altitude tapes.
AIII	AIII approach status	PRI in flight	A flashing “AIII” indicates availability of AIII approach mode.
AIII or NO AIII		AIII approach	Indicates AIII mode selection once all AIII approach requirements have been satisfied. If AIII capability is lost, the “NO AIII” status message is displayed.

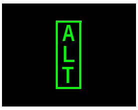
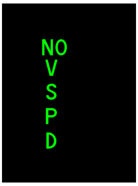
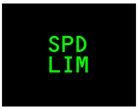
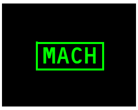
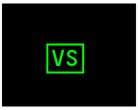
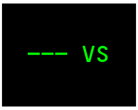
SYMBOL	NAME	MODE	REMARKS
APCH WARN	Approach warning	AIII approach	Displayed below 500 feet if approach monitoring tolerances are exceeded or AIII capability is lost.
TAILSTRIKE	Tail strike warning	PRI in flight, AIII approach, IMC, VMC	Displayed when a tail strike is likely during landing. Tail strike monitoring is active below 100 feet AGL.
	Angle of attack scale and indicator	PRI in flight, AIII approach, IMC, VMC	Displays current angle of attack, stick shaker trip point and approach reference band. Tic marks every 5°. Approach reference band is added after the first flap extension.

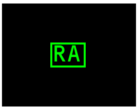
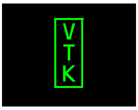
TCAS Resolution Advisory

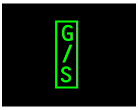
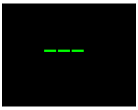
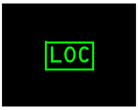
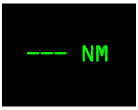
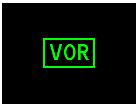
SYMBOL	NAME	MODE	REMARKS
	Down preventive	PRI in flight, AIII approach, IMC, VMC	Area(s) inside the lines indicate the pitch region(s) to avoid in order to resolve the traffic conflict. The flight path symbol should be positioned outside the pitch command area(s) to ensure traffic avoidance. A double-lined box indicates a corrective action is required, and represents TCAS maneuver guidance to maintain or increase separation from the traffic.
	Up preventive		
	Up and down preventive		
	Descend corrective		
	Climb corrective		
	Combined corrective		

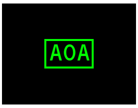
Failure Flags and Data Source Annunciations

SYMBOL	NAME	MODE	REMARKS
	IRS attitude flag	All	IRS pitch or roll attitude has failed.
	Pitch miscompare flag	All	Indicates a pitch miscompare of greater than 5 ° for more than 1.5 seconds.
	Roll miscompare flag	All	Indicates a roll miscompare of greater than 5 ° for more than 1.5 seconds.
	Heading flag	All	Heading data has failed.
	No heading	All	IRU heading has no computed data.
	Airspeed flag	All	Airspeed information has failed. In PRI mode, if airspeed has no computed data, airspeed data is removed and no failure flag is displayed. The boxed characters are positioned vertically in the PRI mode or horizontally in the AIII, IMC or VMC modes.

SYMBOL	NAME	MODE	REMARKS
	Altitude flag	All	Altitude information has failed. In PRI mode, if altitude has no computed data, altitude data is removed and no failure flag is displayed. The boxed characters are positioned vertically in the PRI mode or horizontally in the AIII, IMC or VMC modes.
	Decision speed flag	PRI ground	V1 decision speed or VR rotation speed has not been entered or is invalid.
	Speed limit flag	PRI in flight, PRI ground	Maximum operating speed data has failed.
	Mach flag	PRI in flight, PRI ground	MACH airspeed has failed.
	Vertical speed flag	All	Vertical speed has failed. In AIII, IMC or VMC modes, may also show for no computed data.
	Vertical speed	PRI in flight	Vertical speed has no computed data.
	Selected altitude flag	PRI in flight, PRI ground	Selected altitude has failed.

SYMBOL	NAME	MODE	REMARKS
	Selected airspeed flag	All	Selected speed has failed.
	Radio altitude flag	All	Radio altitude has failed.
	Localizer miscompare flag	PRI in flight PRI ground; AIII rollout	Localizer miscompare has occurred during low visibility takeoff or rollout.
	Vertical deviation flag	PRI in flight, IMC	FMC vertical track data is invalid. Vertical deviation pointer is removed if there is no computed data.
	DME flag	All	DME has failed.
	DME	All	DME has no computed data.
	Flight director flag	PRI in flight, PRI ground, IMC	Flight director has failed.
	TCAS fault	PRI in flight, AIII approach, IMC, VMC	TCAS has a fault.

SYMBOL	NAME	MODE	REMARKS
	Right (#2) IRS source	All	All IRS information used or displayed by the HUD is taken from the right (#2) IRS.
	Glideslope flag	PRI in flight, AIII approach, IMC	ILS has failed.
	Ground speed	All	Ground speed has no computed data.
	Lateral deviation fault	PRI in flight, PRI ground	ILS has failed.
	Distance to next waypoint	PRI in flight, AIII approach, IMC, VMC	Distance to next waypoint has no computed data.
	Decision height flag	PRI in flight, AIII approach, IMC	Decision height data has failed. Displayed below 1500 feet radio altitude.
	VOR failure flag	PRI in flight, AIII approach, IMC	VOR has failed.

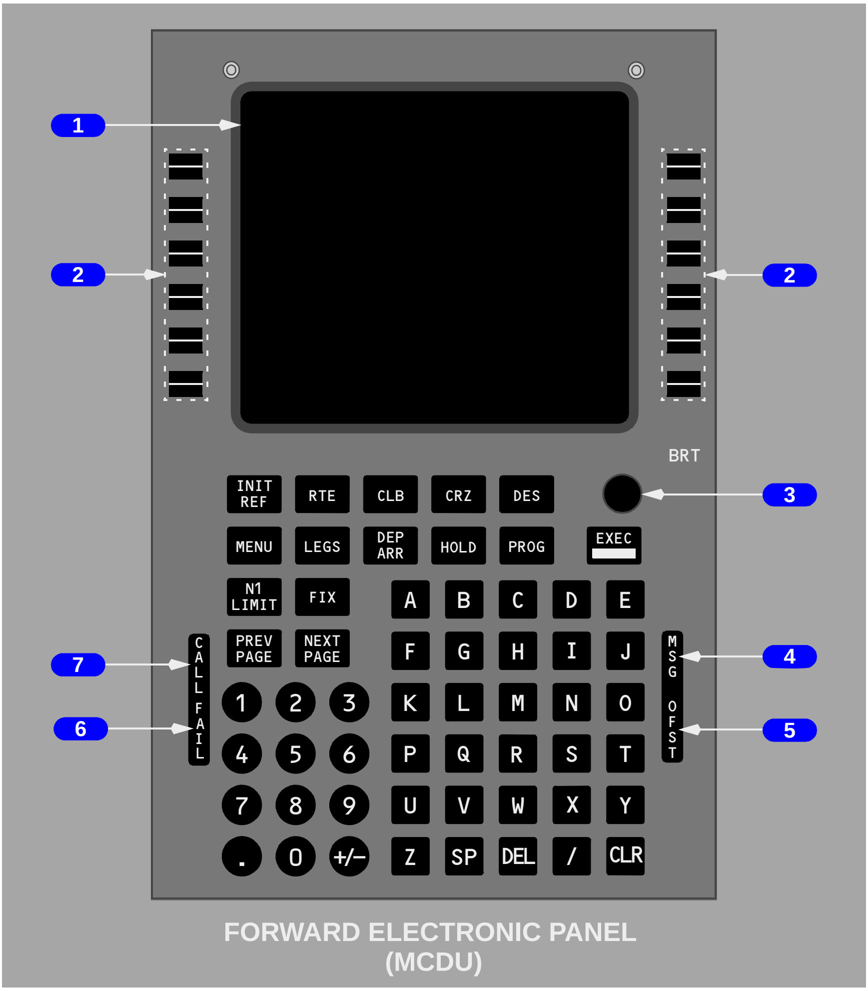
SYMBOL	NAME	MODE	REMARKS
	Angle of attack fault	PRI in flight, AIII approach, IMC, VMC	Loss of valid angle of attack data.

Flight Management, Navigation — Chapter 11

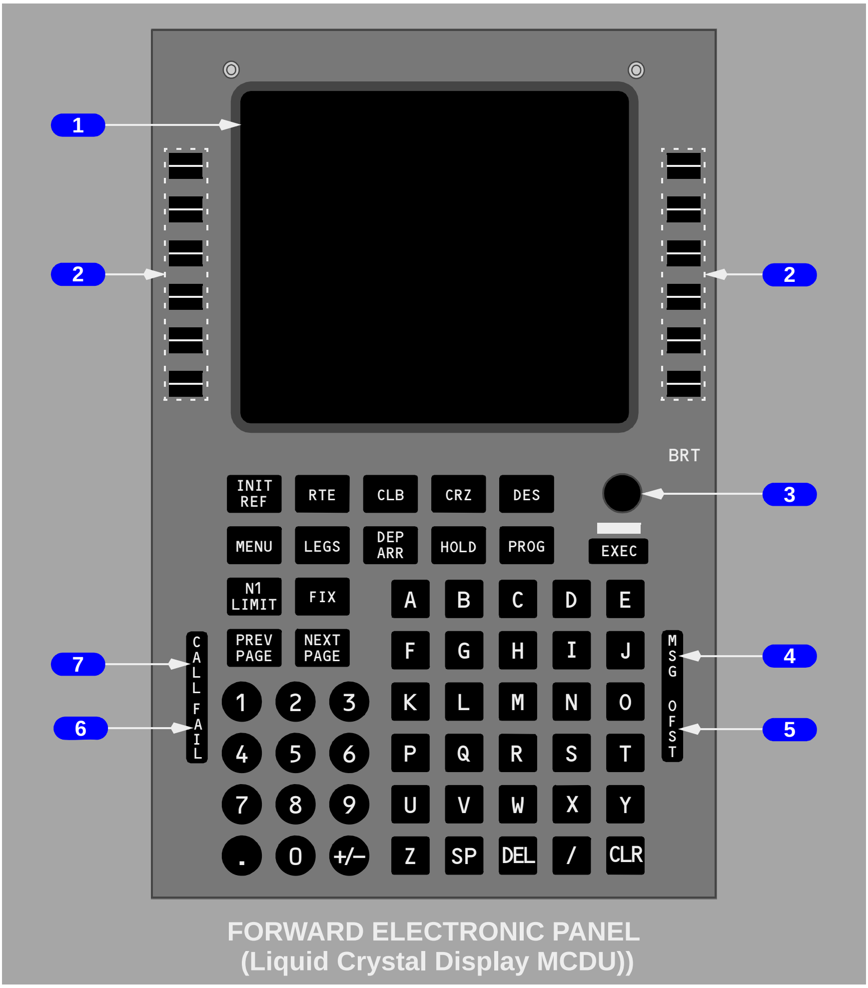
Table of Contents — Section TOC

Flight Management System Control Display Unit (CDU)

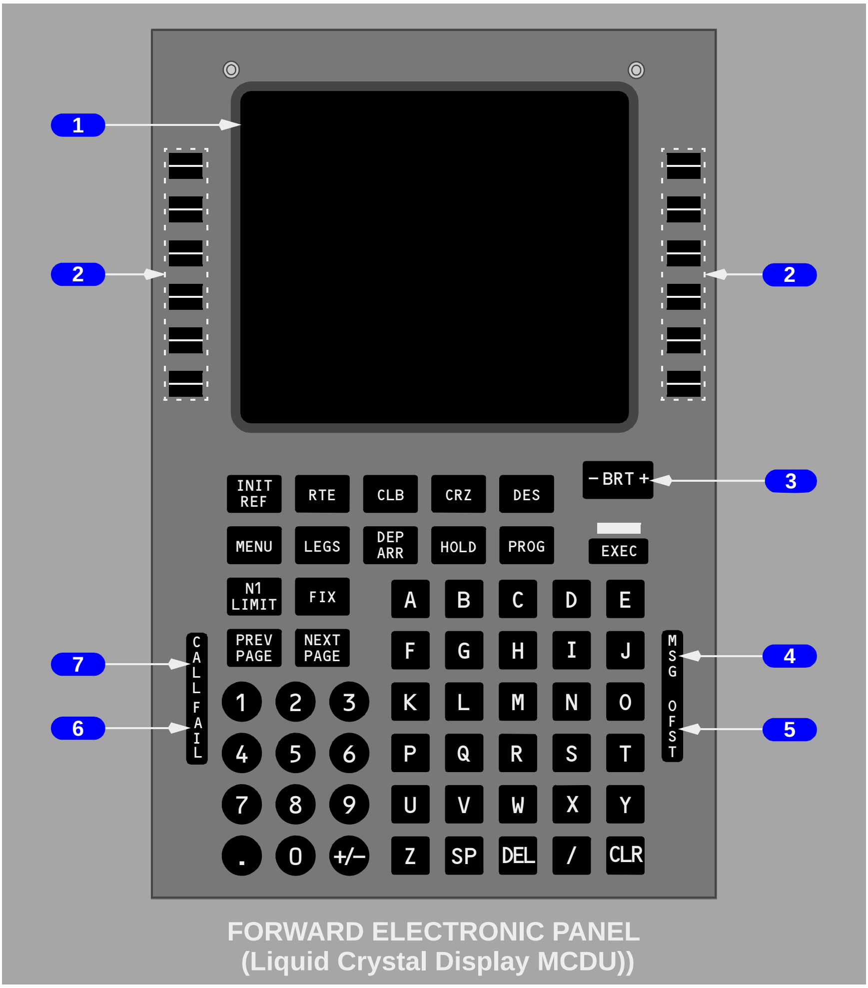
YA701 - YA704



YA705 - YS154, YT501 - YV754



YS155 - YS194



1 Control Display Unit (CDU) Display

Shows FMS data pages.

2 Line Select Keys

Push –

- moves data from scratchpad to selected line
- moves data from selected line to scratchpad
- selects page, procedure, or performance mode as applicable
- deletes data from selected line when DELETE is shown in scratchpad.

YA701 - YS154, YT501 - YV754

3 Brightness Control

Rotate – controls display brightness.

YS155 - YS194

3 Brightness Control

Rocker switch (plus or minus) - controls display brightness.

Note: New CDU/MCDU faceplate graphics have been added to depict the updated rocker arm style brightness control switch. Functionality and location of all keys remains the same.

4 Message (MSG) Light

Illuminated (white) – scratchpad message is shown.

5 Offset (OFST) Light

Illuminated (white) – LNAV gives guidance for lateral route offset.

6 FAIL Light

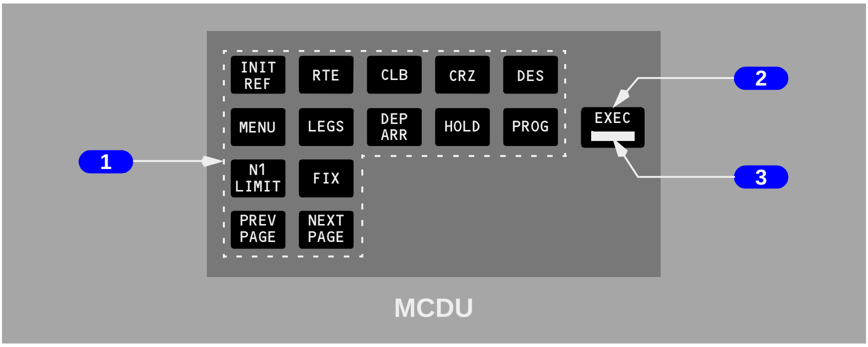
Illuminated (amber) for test purposes only. The MCDU FAIL lamp will not illuminate for an FMC failure.

7 CALL Light

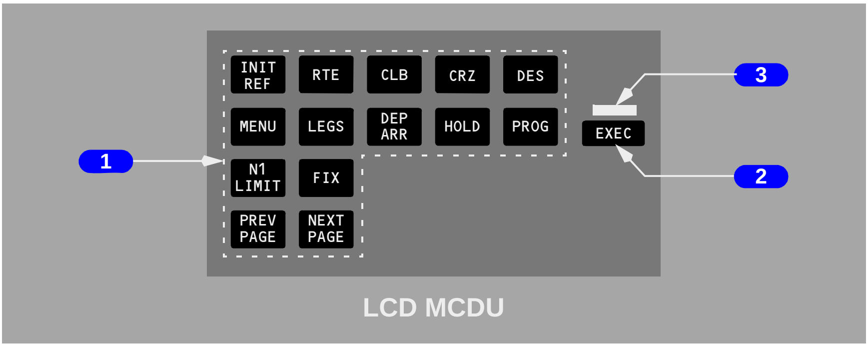
Illuminated (white) – a subsystem other than the FMC is requesting control of the CDU.

Function and Execute Keys

YA701 - YA704



YA705 - YV754



1 CDU Function Keys

Push –

- INIT REF – shows page for data initialization or for reference data
- RTE – shows page to input or change origin, destination, or route
- CLB – shows page to view or change climb data
- CRZ – shows page to view or change cruise data
- DES – shows page to view or change descent data
- MENU – shows page to choose subsystems controlled by CDU
- LEGS –
  - shows page to evaluate or modify lateral and vertical data
  - shows page to control PLAN mode display
- DEP ARR – shows page to input or change departure and arrival procedures
- HOLD – shows page to create holding patterns and show holding pattern data
- PROG – shows page to view dynamic flight and navigation data, including waypoint and destination ETAs, fuel remaining, and arrival estimates
- N1 LIMIT – shows page to view or change N1 thrust limits
- FIX – shows page to create reference points on map display
- PREV PAGE – shows previous page of related pages (for example, LEGS pages)
- NEXT PAGE – shows next page of related pages.

2 Execute (EXEC) Key

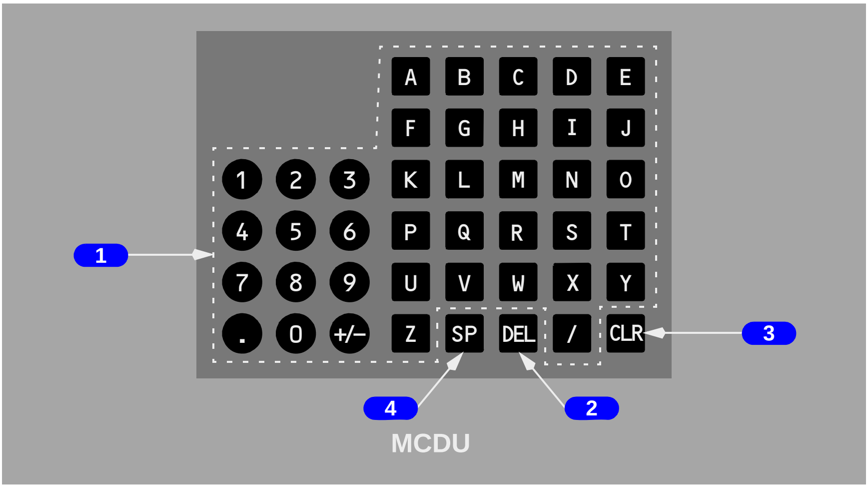
Push –

- makes data modification(s) active
- extinguishes execute light.

3 Execute Light

Illuminated (white) – active data is modified but not executed.

Alpha/Numeric and Miscellaneous Keys



1 Alpha/Numeric Keys

Push –

- puts selected character in scratchpad
- Slash (/) key – puts "/" in scratchpad
- Plus Minus (+/–) key – first push puts "–" in scratchpad. Subsequent pushes alternate between "+" and "–".

2 Delete (DEL) Key

Push – puts DELETE in scratchpad.

3 Clear (CLR) Key

Push –

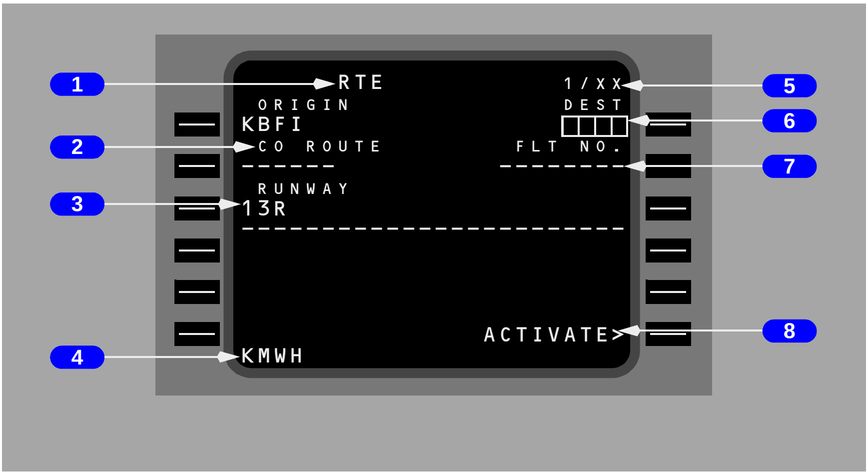
- clears the last scratchpad character
- clears scratchpad message.

Push and hold – clears all scratchpad data.

4 Space (SP) Key

Push – puts space in scratchpad.

CDU Page Components



1 Page Title

Subject or name of data shown on page.

ACT (active) or MOD (modified) shows whether page contains active or modified data.

2 Line Title

Title of data on line below.

3 Line

Shows –

- prompts
- selections
- options
- data.

4 Scratchpad

Shows messages, alpha–numeric entries or line selected data.

5 Page Number

Left number is page number. Right number is total number of related pages.

6 Boxes

Data input is mandatory.

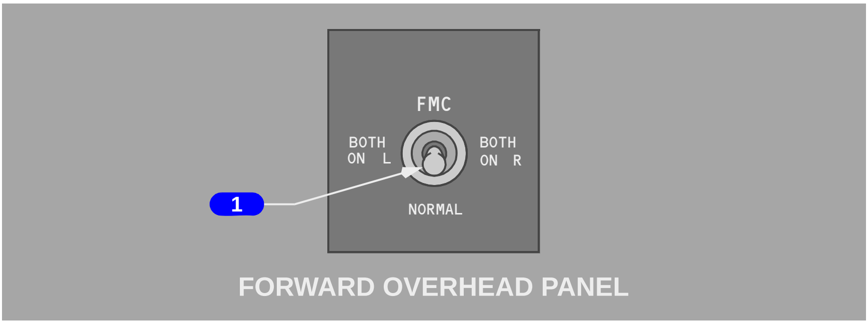
7 Dashes

Data input is optional. The data is not mandatory.

8 Prompts

Show pages, select modes, and control displays. Caret “<” or “>” is before or after prompt.

FMC Source Select Switch



1 FMC Source Select Switch

BOTH ON L –

- selects left FMC for all FMC operations
- right map will annunciate “FMC L.”

NORMAL –

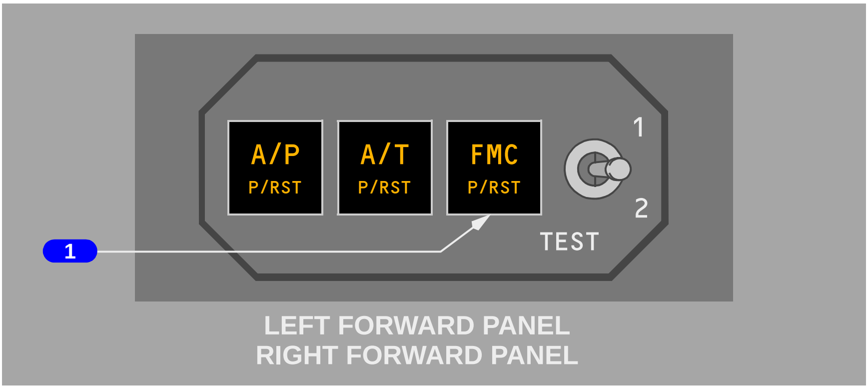
- left FMC controls CDUs and provides input to the autothrottle system
- right FMC operates in synchronization with left FMC
- maps display composite information from both FMCs

BOTH ON R –

- selects right FMC for all FMC operations
- left map will annunciate “FMC R.”

Note: Moving the source select switch will cause LNAV and VNAV to disengage.

FMC Alert Light



1 **FMC Alert Light**

Illuminated (amber) –

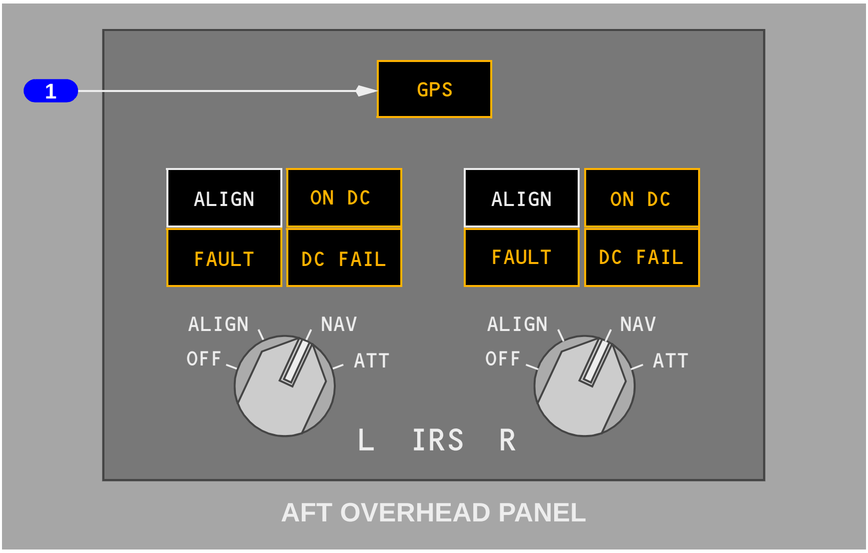
- an alerting message exists for both CDUs, or
- test switch is in position 1 or 2.

Push – both pilots’ FMC alert lights extinguish.

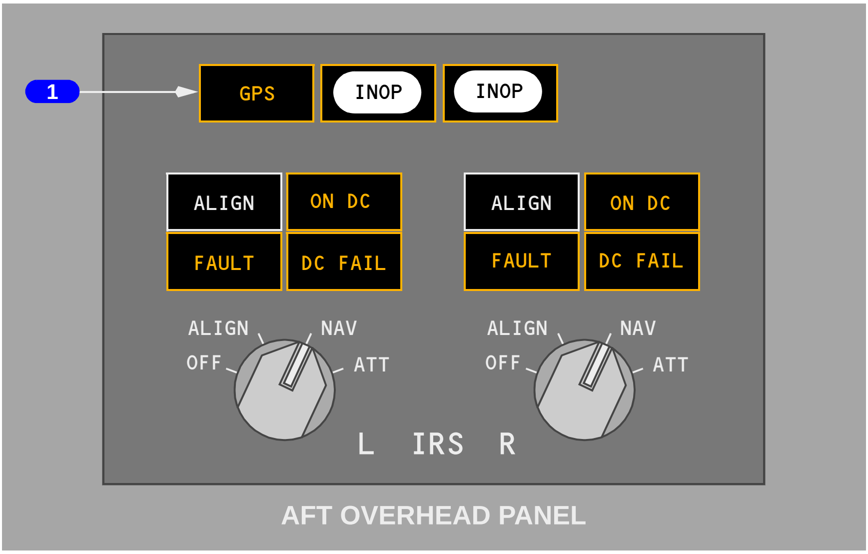
Global Positioning System (GPS) Light

YA701 - YV750

YA701 - YA710, YF921 - YK980, YL541 - YL544, YM482 - YM484



YF048, YF049, YL076, YL077, YL545 - YL551, YN531 - YV750



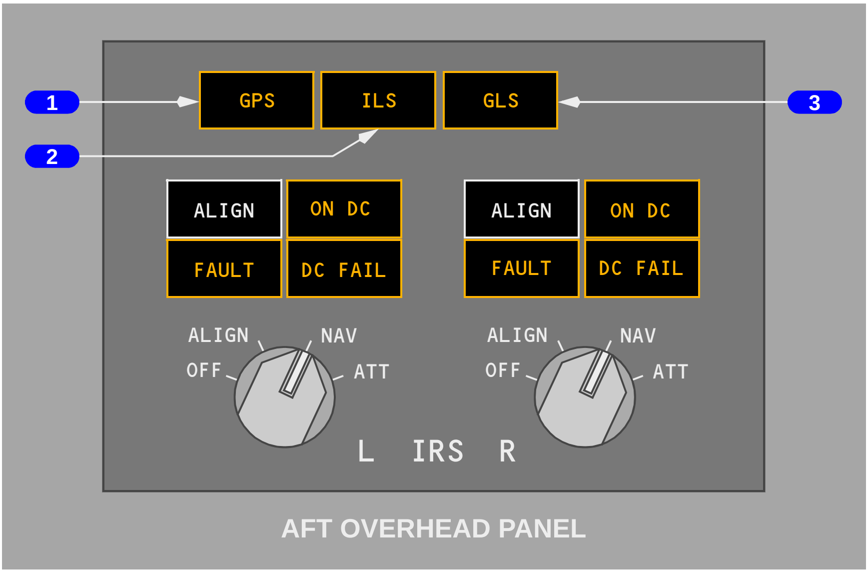
1 Global Positioning System (GPS) Light

Illuminated (amber) –

- indicates failure of both GPS sensor units
- indicates failure of a single GPS sensor unit when either system annunciator panel is pushed to initiate a recall
- with single GPS sensor failure, light extinguishes when the system recall is reset.

Landing System Lights

YV751 - YV754



1 Global Positioning System (GPS) Light

Illuminated (amber) –

- indicates failure of both GPS sensor units
- indicates failure of a single GPS sensor unit when either system annunciator panel is pushed to initiate a recall
- with single GPS sensor failure, light extinguishes when the system recall is reset.

2 Instrument Landing System (ILS) Light

Illuminated (amber) –

- indicates failure of both ILS sensor units
- indicates failure of a single ILS sensor unit when either system annunciator panel is pushed to initiate a recall
- with single ILS sensor failure, light extinguishes when the system recall is reset.

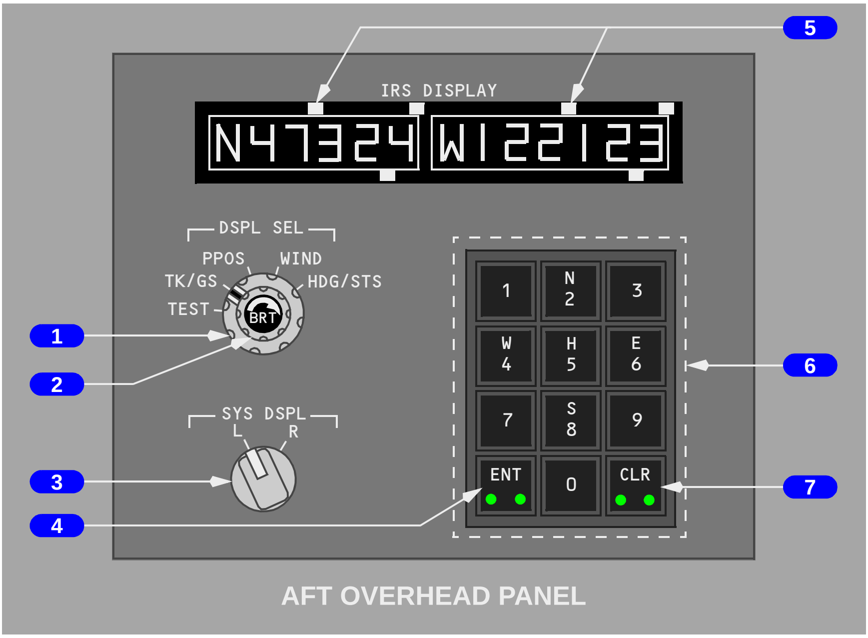
3 GBAS Landing System (GLS) Light

Illuminated (amber) –

- indicates failure of both GLS sensor units
- indicates failure of a single GLS sensor unit when either system annunciator panel is pushed to initiate a recall
- with single GLS sensor failure, light extinguishes when the system recall is reset.

Inertial System

IRS Display Unit (ISDU)



1 Display Selector (DSPL SEL)

TEST (spring–loaded to TK/GS) –

- all lights in data displays and on the mode selector unit momentarily illuminate, followed by a 10 second self–test
- use only during alignment.

TK/GS –

- left window displays true track (course)
- right window displays present ground speed (knots).

PPOS –

- left window displays present latitude
- right window displays present longitude.

WIND –

- left window displays present inflight true wind direction
- right window displays present inflight wind speed (knots).

HDG/STS –

- left window displays present true heading
- right window displays any applicable maintenance status codes
- during alignment, right window displays minutes remaining until alignment is complete. For alignments greater than 15 minutes, the window displays 15 until the time remaining reaches 14 minutes. The display then counts down in one minute intervals.

2 Brightness (BRT) Control

Rotate – adjusts brightness of the data displays.

3 System Display (SYS DSPL) Selector

L – selects left IRS for the data displays.

R – selects right IRS for the data displays.

4 Enter (ENT) Key

Illuminated (white) – N, S, E, W, or H entries are being keyed.

Push – keyed data is entered into IRS following completion of valid self–test for reasonableness.

5 Data Displays

Two windows display data for the IRS selected with the system display selector

- type of data displayed is normally determined by the display selector
- keyboard entry of present position or magnetic heading overrides the selected display
- last digit of each window is for a decimal place (tenths).

6 Keyboard

Push –

- alpha keys:
  - data displays are controlled by the keyboard when the N, S, E, W (latitude/longitude) or H (heading) keys are pushed
  - pushing an alpha key arms the keyboard for numeric entries.
- numeric keys:
  - permit manual entry of present position when ALIGN light is illuminated
  - permit manual entry of magnetic heading when either mode selector is in ATT.

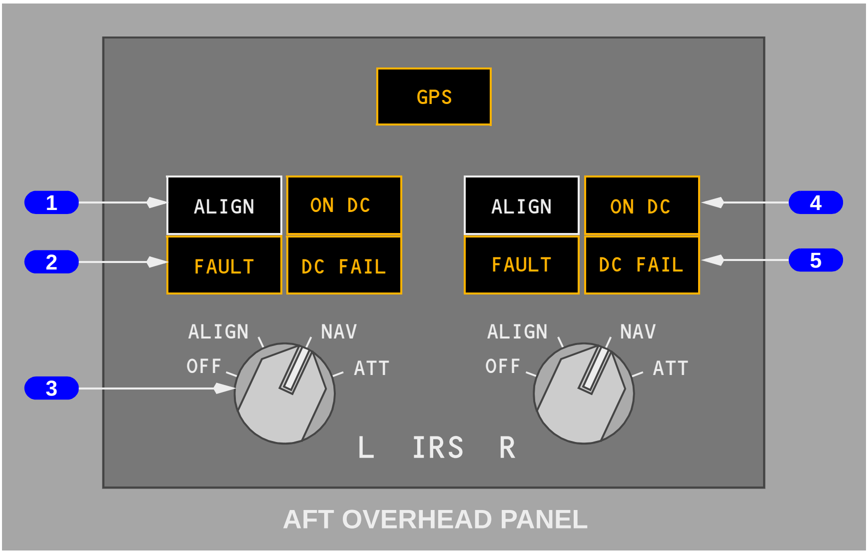
7 Clear (CLR) Key

Illuminated (white) – an ENT attempt has failed (entry not accepted by IRS).

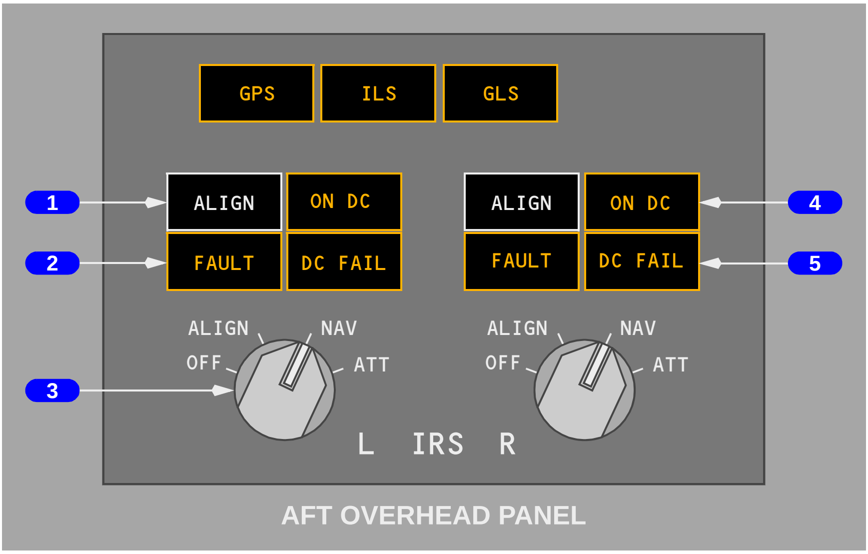
Push – clears data display of any data not yet entered or accepted. If illuminated, cue lights extinguish.

IRS Mode Selector Unit

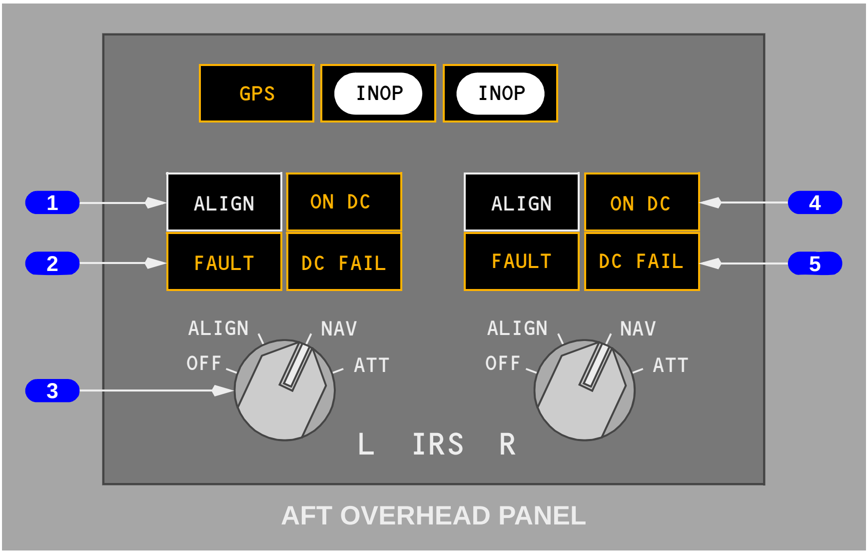
YA701 - YA710, YF921 - YK980, YL541 - YL544, YM482 - YM484



YV751 - YV754



YF048, YF049, YL076, YL077, YL545 - YL551, YN531 - YV750



1 ALIGN Light

Illuminated (white) –

- steady – the related IRS is operating in the ALIGN mode, the initial ATT mode, or the shutdown cycle
- flashing – alignment cannot be completed due to IRS detection of:
  - significant difference between previous and entered positions or an unreasonable present position entry
  - no present position entry.

Extinguished –

- IRS not in ALIGN mode
- with mode selector in NAV, alignment is complete, and all IRS information is available
- with mode selector in ATT, attitude information is available. Heading information is available following entry of initial magnetic heading.

2 FAULT Light

Illuminated (amber) – a system fault affecting the related IRS ATT and/or NAV modes has been detected.

3 Inertial Reference System (IRS) Mode Selector

OFF –

- alignment is lost
- all electrical power is removed from the system after a 30 second shutdown cycle.

ALIGN –

- rotating the selector from OFF to ALIGN initiates the alignment cycle
- rotating the selector from NAV to ALIGN automatically updates alignment and zeroes ground speed error.

NAV (detented position) –

- system enters the NAV mode after completion of the alignment cycle and entry of present position
- in NAV mode, all IRS information is available to airplane systems for normal operations.

ATT – provides only attitude and heading information:

- attitude information is invalid (attitude flag in view) until ALIGN light is extinguished
- heading information is invalid (heading flags in view) until the actual magnetic heading is manually entered after the ALIGN light is extinguished

- position and ground speed information is not available until the IRS is aligned on the ground
- the selector must be cycled to OFF before reselecting ALIGN or NAV.

4 ON DC Light

Illuminated (amber) –

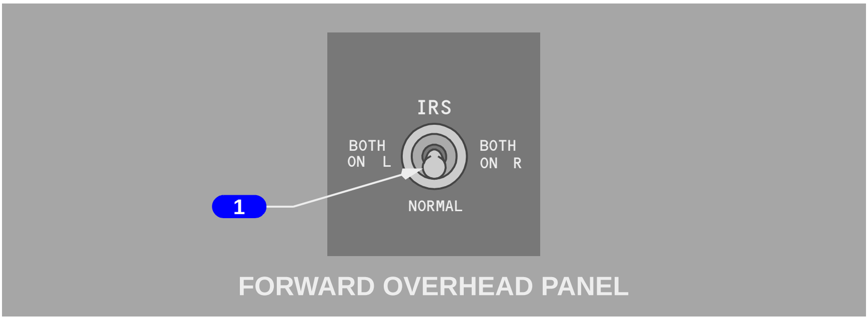
- the related IRS is operating on DC power from the switched hot battery bus (AC power not normal)
- if on the ground, the ground–call horn in the nose wheel well sounds, providing an alert that a battery drain condition exists
- momentary illumination is normal during alignment self–test.

5 DC FAIL Light

Illuminated (amber) –

- DC power for the related IRS is not normal
- if the other lights are extinguished, the IRS is operating normally on AC power.

IRS Transfer Switch



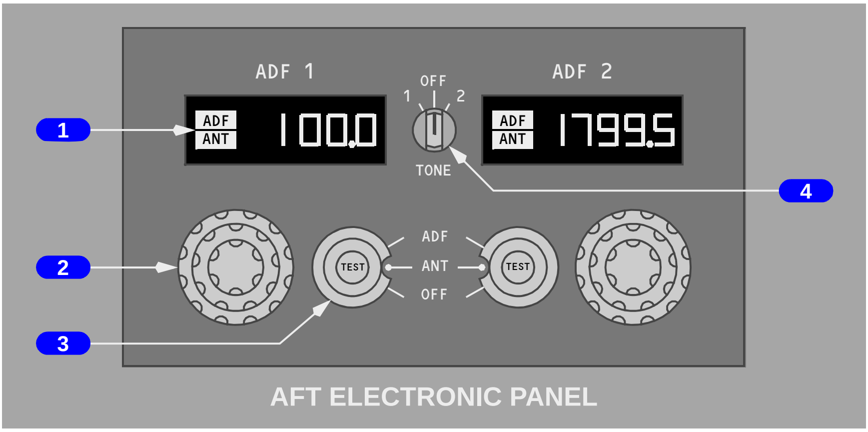
1 Inertial Reference System (IRS) Transfer Switch

BOTH ON L – switches the flight instruments attitude and heading source to left IRS.

NORMAL – flight instruments attitude and heading source is from default IRS.

BOTH ON R – switches the flight instruments attitude and heading source to right IRS.

Radio Navigation Systems
Automatic Direction Finding (ADF) Control



1 Frequency Indicator

Shows the frequency selected with the related frequency selector.

Shows if the system is in the ADF or antenna (ANT) mode.

2 Frequency Selector

Rotate –

- outer knob sets the hundreds number
- middle knob sets the tens number
- inner knob sets the tenths and ones number.

3 Mode Selector Switch

ADF –

- audio reception possible
- ADF bearing sent to the DUs and the standby radio magnetic indicator.

ANT –

- audio reception optimized
- no ADF bearing data available.

OFF – removes power from selected receiver.

TEST – tests related ADF bearing pointers and warning flags on the DUs and the standby radio magnetic indicator.

- DU ADF indications:
  - show ADF fail flag and ADF bearing pointer goes out of view
  - ADF fail flag goes out of view and ADF bearing pointer remains out of view
  - ADF bearing pointer slews to 135 degrees relative bearing.
- Standby radio magnetic indicator:
  - shows ADF fail flag
  - ADF fail flag goes out of view and ADF bearing pointer stays at its last position before test
  - ADF bearing pointer slews to 135 degrees relative bearing.

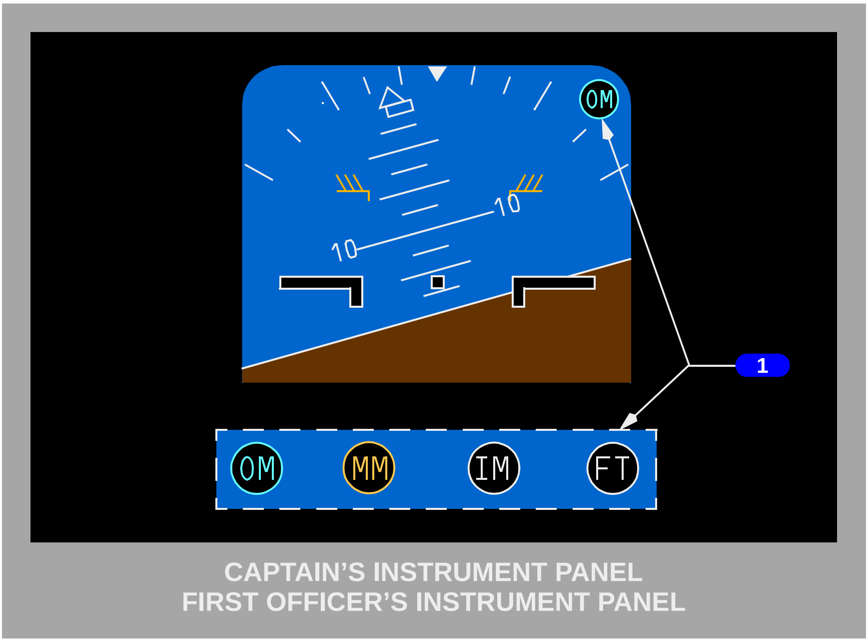
4 TONE Switch

1 – adds tone to ADF receiver No. 1 audio.

2 – adds tone to ADF receiver No. 2 audio.

OFF – disables tones.

Marker Beacon Annunciations



CAPTAIN’S INSTRUMENT PANEL
FIRST OFFICER’S INSTRUMENT PANEL

1 Marker Beacon Lights

OM (cyan) – illuminates over an outer marker beacon.

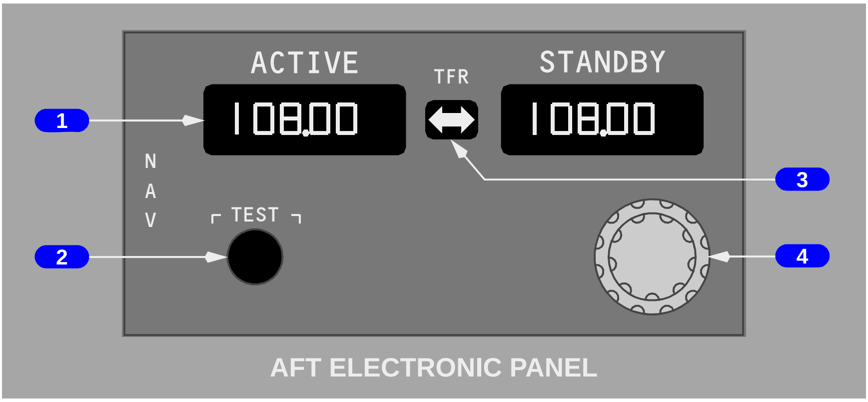
MM (amber) – illuminates over a middle marker beacon.

IM (white) – illuminates over an inner marker beacon.

FT (white) – illuminates during self test.

VHF Navigation Control

YA701 - YV750



1 Frequency Indicator

Indicates the frequency selected by the frequency selector

- tuned frequency displayed in STANDBY display
- TFR switch moves STANDBY frequency to ACTIVE frequency.

2 TEST Switch

With a VOR frequency tuned and a course of 000 selected:

- shows VOR fail flag
- deviation bar biases out of view and then returns to centered position
- bearing pointer slews to 180 degrees
- DME displays:
  - DME fail flag
  - dashes
  - normal DME distance.

With ILS frequency tuned and a course within 90 degrees of airplane heading:

- pointers disappear and LOC and G/S flags appear momentarily
- pointers appear and display one dot up and one dot left
- pointers then display one dot low and one dot right

- pointers then return to normal display
- DME displays:
  - DME fail flag
  - dashes
  - normal DME distance.

3 Transfer (TFR) Switch

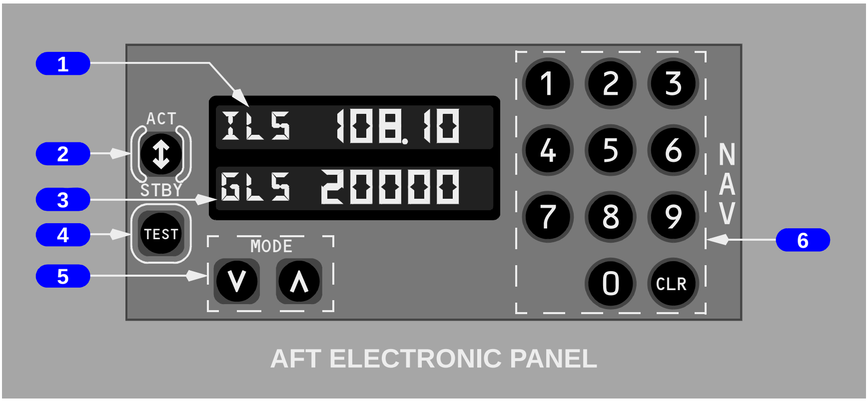
TFR – STANDBY frequency moved to ACTIVE frequency; ACTIVE frequency moved to STANDBY frequency.

4 Frequency Selector

Rotate – manually selects the standby frequency.

Multi-Mode Navigation Control

YV751 - YV754



1 Active (ACT) Mode and Frequency Indicator

Indicates the active mode and frequency.

2 Transfer Switch

Push – standby mode and frequency moved to active indicator window; active mode and frequency moved to standby indicator window.

3 Standby (STBY) Mode and Frequency Indicator

Indicates the standby mode and frequency.

4 TEST Switch

With a VOR frequency tuned and a course of 000 selected:

- shows VOR fail flag
- deviation bar biases out of view and then returns to centered position
- bearing pointer slews to 180 degrees
- DME displays:
    - DME fail flag
    - dashes
    - normal DME distance.

With a ILS frequency tuned and a course within 90 degrees of airplane heading:

- pointers disappear and LOC and G/S flags appear momentarily
- pointers appear and display one dot up and one dot left
- pointers then display one dot low and one dot right
- pointers then return to normal display
- DME displays:
    - DME fail flag
    - dashes
    - normal DME distance.

With a GLS frequency tuned and a course within 90 degrees of airplane heading:

- pointers disappear and LOC and G/S flags appear momentarily
- pointers appear and display one dot up and one dot left
- pointers then display one dot low and one dot right
- pointers then return to normal display.

Note: DME is not tested with GLS and no indications will be displayed.

5 Mode Switches

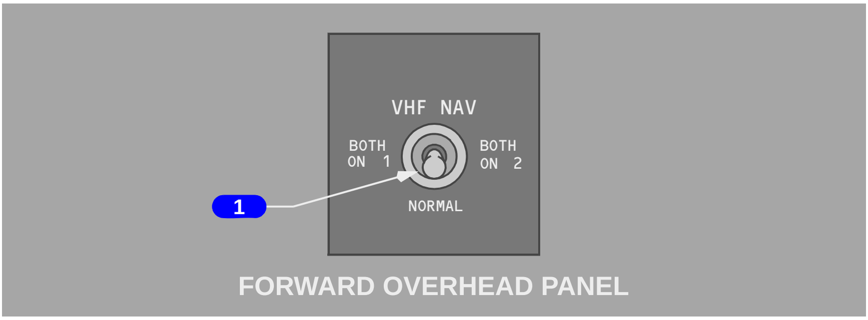
Push – manually inserts ILS, VOR or GLS into the standby indicator window.

6 Frequency Selection Keypad

Push – manually selects the standby frequency.

CLR – clears the standby frequency.

VHF NAV Transfer Switch



1 VHF NAV Transfer Switch

YA701 - YV750

The VHF NAV transfer switch changes the source of the data that the DEUs use for the navigation displays. The switch transfers the following data: DME, ILS, VOR, and MCP course.

YV751 - YV754

The VHF NAV transfer switch changes the source of the data that the DEUs use for the navigation displays. The switch transfers the following data: DME, ILS/GLS, VOR, and MCP course.

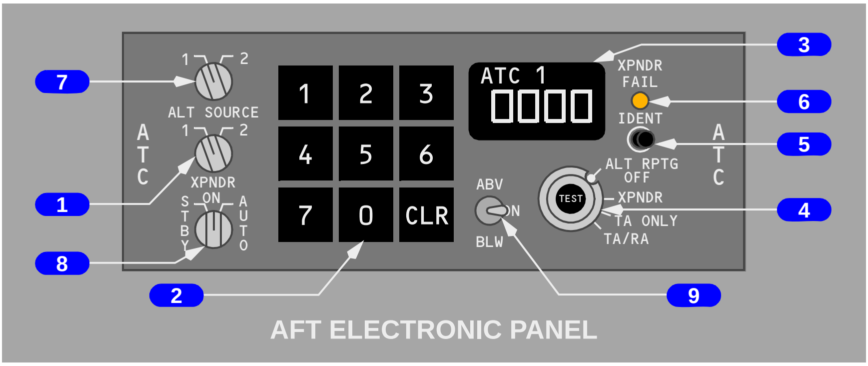
BOTH ON 1 – the DEUs use Multimode Receiver 1 as the source for the captains display and first officers display.

NORMAL – Multimode Receiver 1 supplies data for the captains display and Multimode Receiver 2 supplies data for the first officers display.

BOTH ON 2 – the DEUs use Multimode Receiver 2 as the source for the captains display and first officers display.

Note: The Digital Flight Control System cannot use VOR/ILS data that is not shown on the displays. Thus, when the Autopilot (A/P) system is engaged the VHF Navigation Control must match the primary Autopilot system that is ENGAGED for proper ILS/VOR operations; i.e. (CMD A uses VHF NAV 1 for control and CMD B uses VHF NAV 2 for control).

Transponder Panel



1 Transponder (XPNDR) Selector

1 – selects transponder No. 1.

2 – selects transponder No. 2.

2 Air Traffic Control (ATC) Code Switches

Push – sets transponder code in transponder.

3 Air Traffic Control (ATC) Code Indicator

Shows transponder code.

Shows operating transponder (1 or 2).

4 Transponder Mode Selector

TEST – starts ATC transponder functional test.

ALT RPTG (altitude reporting) OFF – transponder operates without altitude reporting.

XPDR (transponder) – transponder operates with altitude reporting.

TA (traffic advisory) ONLY, and TA/RA (traffic advisory/resolution advisory) – Refer to Chapter 15, Warning Systems.

5 Identification (IDENT) Switch

Push – transmits an identification signal.

6 Transponder (XPNDR) FAIL Light

Illuminated (amber):

- indicates transponder malfunction or
- ADS-B (if installed) inoperative.

7 Altitude (ALT) SOURCE Selector

1 – enables altitude reporting from air data computer No. 1.

2 – enables altitude reporting from air data computer No. 2.

8 Reply selector

Standby (STBY) – does not transmit.

ON – sets the selected transponder on.

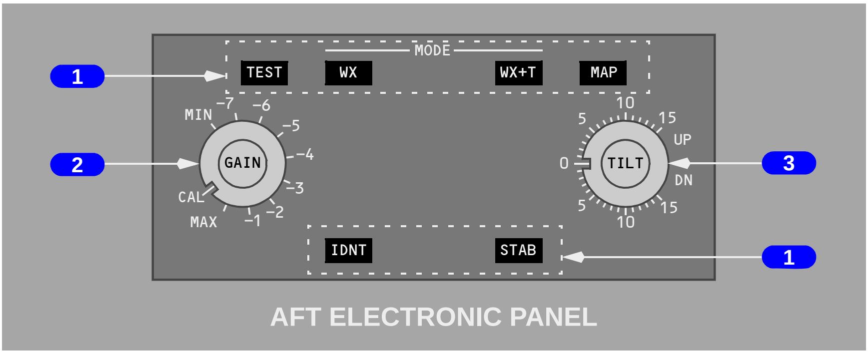
Automatic (AUTO) – selected transponder is active when the airplane is in the air.

9 Traffic Collision Avoidance System (TCAS) Functions

Refer to Chapter 15, Warning Systems.

Weather Radar Panel

YA701 - YA710, YM482 - YM484



1 Mode Switches

Push – selects mode.

TEST –

- tests weather radar system operation without transmitting
- shows test pattern and any fault messages on navigation display MAP, center MAP, VOR, and APP modes, with WXR selected.

Note: If the airplane is on the ground and the thrust levers are not advanced for takeoff, WXR tests the predictive windshear system (PWS) indications. These include PWS caution, PWS FAIL, and PWS warning. Deactivating WXR on the EFIS control panel will discontinue the test and can result in automatic WXR activation on both pilot displays. The PWS test lasts approximately 15 seconds.

WX (weather) – shows weather radar returns at selected gain level.

WX+T (turbulence) –

- shows weather radar returns
- shows turbulence within 50 miles.

Note: Turbulence detection requires presence of detectable precipitation. Clear air turbulence cannot be detected by radar.

MAP – shows ground returns.

IDNT – suppresses ground return in WX and WX+T modes.

STAB – antenna tilt automatically adjusts to correct for airplane attitude changes.

2 GAIN Control

Rotate – sets receiver sensitivity in WX, WX+T, and MAP modes.

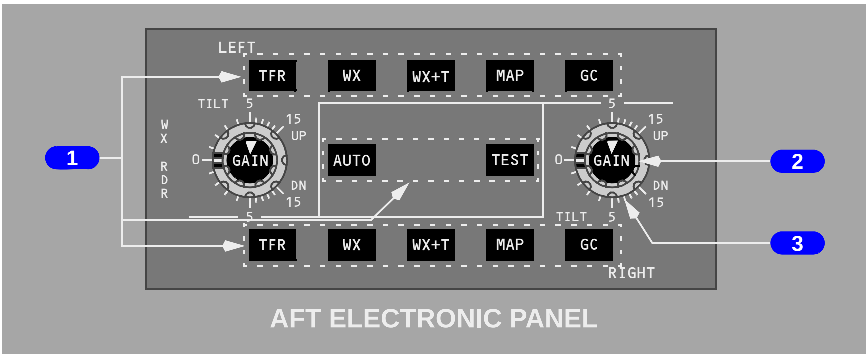
CAL (calibrated) – presets an optimum receiver sensitivity for best weather radar display.

3 TILT Control

Rotate clockwise – radar antenna tilts up to selected degrees above horizon.

Rotate counterclockwise – radar antenna tilts down to selected degrees below horizon.

YF048 - YL551, YN531 - YV754



1 Weather Radar Mode Switches

Push – selects mode. Left mode switches control the Captain’s radar display, right mode switches control the First Officer’s radar display.

- TFR (transfer) – transfers other map display selections to related map.

Note: Selecting both TFR switches at the same time results in the TEST mode test pattern being displayed until one of the TFR switches is deselected.

YF048 - YL551, YN531 - YS183, YS191 - YS194

- WX – displays weather radar returns without turbulence information.

YS184 - YS190, YT501 - YV754

- WX – displays weather radar returns without threat information.

YF048 - YL551, YN531 - YS183, YS191 - YS194

- WX+T (turbulence) – displays weather radar returns and turbulence. Turbulence is displayed out to 40 nm for all selected ranges.

Note: Turbulence detection requires presence of detectable precipitation. Clear air turbulence cannot be detected by radar.

YS184 - YS190, YT501 - YV754

- WX+T (threat) – displays: weather radar returns and turbulence in manual mode and weather radar returns and threats in auto mode. Turbulence is displayed out to 40 nm for all selected ranges.

Note: The WX+T switch must be selected and the WXR set to (AUTO) mode to show core, associated and path threat assessment, as well as level 2 turbulence and predictive overflight protection.

Note: Turbulence detection requires presence of detectable precipitation. Clear air turbulence cannot be detected by radar.

- MAP – displays both ground and weather returns without turbulence information.
- GC – temporarily displays ground clutter when radar is in auto mode.
- AUTO – activates the weather radar in multiscan mode:
  - both Captain's and First Officer's displays are updated simultaneously
  - tilt is automatically controlled
  - ground clutter may be temporarily displayed by pushing the GC switch
  - the weather radar automatically increases gain as outside air temperature decreases
  - significantly more gain is available in AUTO than in MAN, if the GAIN knob is turned to MAX while in AUTO mode the weather radar will use an additional amount of gain that is not available in MAN mode.
- TEST –
  - activates test mode for both left and right displays
  - transmitter is enabled for less than one second and then muted for the remainder of test
  - displays test pattern and any fault messages on navigation display MAP, center MAP, VOR, and APP modes, with WXR selected.

Note: If the airplane is on the ground and the thrust levers are not advanced for takeoff, WXR tests the predictive windshear system (PWS) indications. These include PWS caution, PWS FAIL, and PWS warning. Deactivating WXR on the EFIS control panel will discontinue the test and can result in automatic WXR activation on both pilot displays. The PWS test lasts approximately 15 seconds.

2 GAIN Control

CAL (calibrated) gain – is selected when the triangle is at the 12 o'clock position.

Rotate clockwise – from the CAL position increases gain in WX, WX+T and MAP modes.

Rotate counterclockwise – from the CAL position decreases gain in WX, WX+T and MAP modes.

There is no EFIS indication for CAL gain because CAL gain is the standard gain setting. The EFIS will display "VAR" when gain is moved above or below the CAL gain position.

During automatic operation, the MultiScan radar provides Gain PLUS, which includes: (Refer to Section 11.20 for expanded description)

- conventional increase and decrease of receiver sensitivity
- the weather radar automatically increasing gain as outside air temperature decreases
- Path Attenuation Compensation (PAC) Alert
- Oceanic Weather Reflectivity Compensation
- OverFlight Protection

YS184 - YS190, YT501 - YV754

- Predictive OverFlight (With WX+T selected)

YS184 - YS190, YT501 - YV754

- Associated Threat Function (With WX+T selected)

YS184 - YS190, YT501 - YV754

- Core Threat Adjustment (With WX+T selected)

YS184 - YS190, YT501 - YV754

- Two-Level Turbulence Detection (With WX+T selected)

YS184 - YS190, YT501 - YV754

- Flight Path/Descent Assessment

3 TILT Control

During Automatic mode operation, the TILT controls are not active.

When AUTO is selected, an A shows on the EFIS by the tilt angle. When operating in Manual mode M shows.

Rotate clockwise – radar antenna tilts up to selected degrees from horizon.

Rotate counterclockwise – radar antenna tilts down to selected degrees from horizon.

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Flight Management, Navigation — Chapter 11
Navigation Systems Description — Section 20

Introduction

Navigation systems include the flight management system (FMS); global positioning system (GPS); air data inertial reference system (ADIRS); radio navigation systems (ADF, DME, ILS, marker beacons, and VOR); transponder; and weather radar.

YK622 - YK625, YS179 - YS190
Many of the flight instrument display symbols listed in this chapter also appear on the Heads Up Display (HUD) System. Refer to Chapter 10, Flight Instruments, for HUD system display symbol descriptions.

Flight Management System

The flight management system (FMS) is comprised of the following components:

- flight management computer system (FMCS)
- autopilot/flight director system (AFDS)
- autothrottle (A/T)
- inertial reference systems (IRS)
- global positioning system (GPS).

Each of these components is an independent system, and each can be used independently or in various combinations. The term FMS refers to the concept of joining these independent components together into one integrated system which provides continuous automatic navigation, guidance, and performance management.

The integrated FMS provides centralized flight deck control of the airplane’s flight path and performance parameters. The flight management computer, or FMC, is the heart of the system, performing navigational and performance computations and providing control and guidance commands.

The primary flight deck controls are the AFDS MCP, two control display units (CDU’s), two electronic flight instrument system (EFIS) control panels, and an FMC source selector switch. The primary displays are the CDUs, outboard display units, inboard display units, and upper display unit.

The FMC uses crew entered flight plan information, airplane systems data, and data from the FMC navigation database and performance database to calculate airplane present position, and pitch, roll, and thrust commands required to fly an optimum flight profile. The FMC sends these commands to the autothrottle, autopilot, and flight director. Map and route information are sent to the respective pilot’s navigation displays. The EFIS control panels are used to select the desired information for navigation display. The mode control panel is used to select the autothrottle, autopilot, and flight director operating modes.

Global Positioning System (GPS)

Two GPS receivers receive GPS satellite positioning signals. The left and right GPS receivers are independent and each provides an accurate airplane geographical position to the FMC and other aircraft systems. GPS operation is automatic.

GPS Displays

POS REF page 2/3 shows the left and right GPS latitude and longitude position. POS SHIFT page 3/3 shows the left and right GPS position relative to the FMC position. NAV STATUS page 1/2 shows the GPS currently in use by the FMC for position calculation.

When the POS (position) switch on the EFIS control panel is selected, the navigation display shows the left and right GPS symbols. The GPS symbols are identical and show as a single symbol when the GPS receivers calculate the same position.

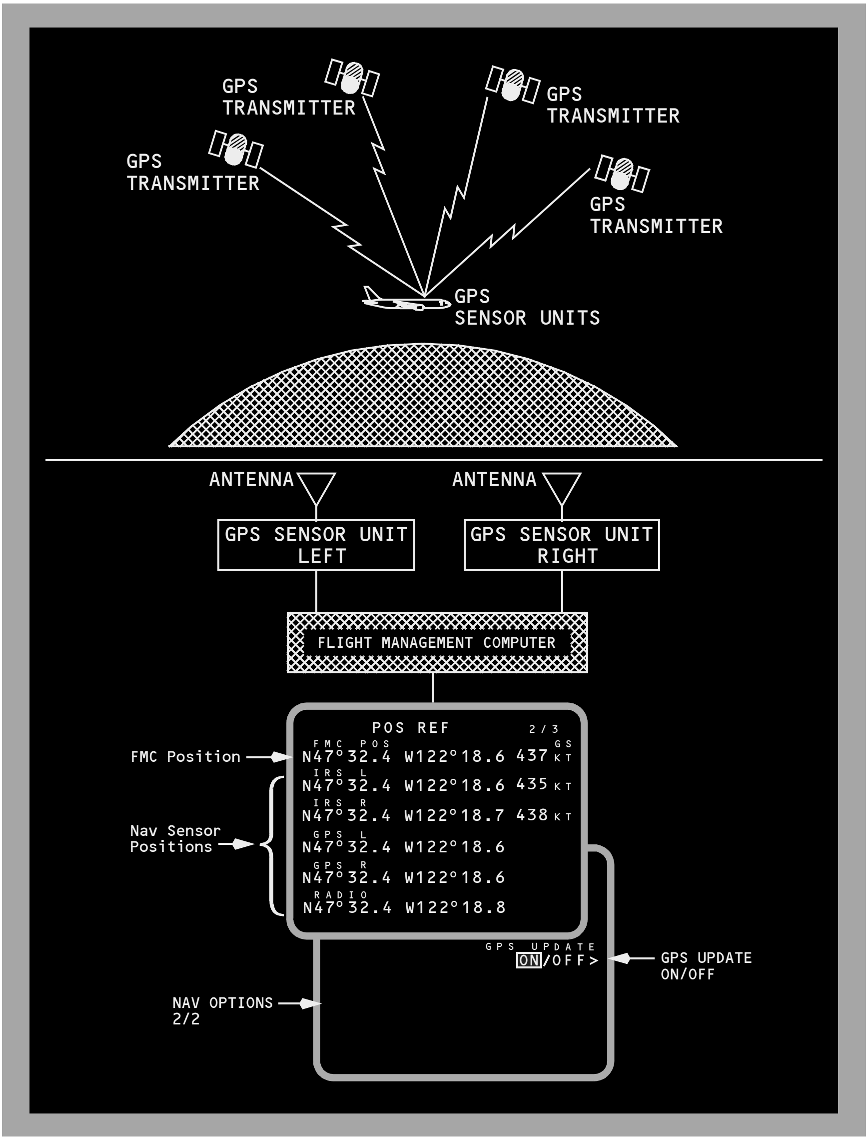
An amber GPS light illuminates to indicate a failure of both GPS sensor units. Failure of a single GPS sensor causes the light to illuminate when either system annunciator panel is pushed.

GPS Data

FMC logic selects the position from one of the GPS sensor units as the primary update to the FMC position. When GPS position data is available, radio updating can also occur. If all GPS data becomes unavailable, the FMC position will be determined by radio or inertial (IRS) updating.

GPS navigational information can be manually deselected on the NAV OPTIONS page 2/2. No other controls are provided because the operation of the GPS is completely automatic.

GPS System Schematic



Inertial System

The inertial system computes airplane position, ground speed, and attitude data for the DUs, flight management system, autoflight system, and other systems. The major components of the inertial system are the air data inertial reference units (ADIRU), an inertial system display unit (ISDU), IRS mode select unit (MSU), and an IRS transfer switch. For information about the air data part of the system, see chapter 10. The ADIRUs provide inertial position and track data to the FMC, and attitude, altitude, and airspeed data to the CDS. Each ADIRU has an IRS section and an air data section.

Inertial Reference System

Two independent IRSs are installed. Each IRS has three sets of laser gyros and accelerometers. The IRSs are the airplane's sole source of attitude and heading information, except for the standby attitude indicator and standby magnetic compass.

In their normal navigation mode, the IRSs provide attitude, true and magnetic heading, acceleration, vertical speed, ground speed, track, present position, and wind data to appropriate airplane systems. IRS outputs are independent of external navigation aids.

IRS Alignment

An IRS must be aligned and initialized with airplane present position before it can enter the navigation mode. The present position is normally entered through the FMC CDU. If the present position cannot be entered through the FMC CDU, it may be entered through the ISDU keyboard. The airplane must remain stationary during alignment.

Normal alignment between 78 degrees 15 minutes North or South is initiated by rotating the MSU switch from OFF to NAV. The IRS performs a short power test, during which the ON DC light illuminates. When the ON DC light extinguishes and the ALIGN light illuminates, the alignment process begins. Airplane present position should be entered at this time. Alignment time varies from five minutes to seventeen minutes depending on airplane latitude.

Magnetic variation between 82 degrees north and 82 degrees south is stored in each IRS memory. The data corresponding to the present position are combined with the true heading to determine magnetic heading.

If the latitude/longitude position is not within 4 NM of the origin airport, the CDU scratchpad message VERIFY POSITION is displayed. If the entered latitude/longitude position does not pass the IRS internal comparison tests, the scratchpad message ENTER IRS POSITION is displayed.

The flashing ALIGN light alerts the crew that the position entered does not pass one of the two internal comparison tests and should be checked for accuracy. If the entered position does not agree with the last stored position, the first internal test is failed, and the ALIGN light will flash. If the same position is reentered, the IRS will accept the position and continue the alignment process. A second internal position test compares the entered latitude with the system-computed latitude. If this test is failed, the ALIGN light will again flash. If two consecutive entries of the same position do not pass the second internal position test, the FAULT light will illuminate. If the test is passed, the IRS will proceed to complete the alignment process and enter NAV mode.

During transit or through–flight stops with brief ground times, a thirty second fast realignment and zeroing of ground speed error may be performed by selecting ALIGN while the airplane is parked. Present position should be simultaneously updated by manually entering latitude and longitude prior to selecting NAV.

Note: If the airplane is moved during alignment or fast realignment, the IRS automatically begins the full alignment process.

Loss of Alignment

If an IRS loses both AC and DC power, the alignment is lost. Alignment can be lost if the MSU switch is moved out of the NAV position.

If alignment is lost in–flight, the navigation mode (including present position and ground speed outputs) is inoperative for the remainder of the flight. However, selecting ATT allows the attitude mode to be used to relevel the system and provide an attitude reference. The attitude mode requires approximately thirty seconds of straight and level unaccelerated flight to complete releveling. Some attitude errors may occur during acceleration, but will be slowly removed after acceleration stops.

The attitude mode can also provide heading information, but to establish compass synchronization the crew must manually enter the initial magnetic heading. Drift of up to 15 degrees per hour can occur in the IRS heading. Therefore, when in attitude mode, an operating compass system must be periodically cross–checked and an updated magnetic heading entered in the IRS, as required.

IRS Entries

Manual IRS entries of present position or magnetic heading are normally accomplished on the POS INIT page of the FMC/CDU. The ISDU may also be used.

IRS Power

The IRSs can operate on either AC or DC power. The left IRS is normally powered from the AC standby bus, and the right IRS from the AC transfer bus 2. If AC power is not normal, either or both systems automatically switch to backup DC power from the switched hot battery bus. Backup DC power to the right IRS is automatically terminated if AC power is not restored within five minutes.

Initial power–up requires battery bus power available and the IRS mode selector to be in ALIGN, NAV, or ATT. If the IRS is turned off, it must complete a full realignment cycle before the airplane can be moved.

If AC electrical power is subsequently removed from the airplane, the switched hot battery bus continues to supply electrical power to the IRS. The ON DC light illuminates, and the ground-call horn in the nose wheel well sounds to alert maintenance personnel that the IRS is on battery power.

When the IRS mode selector is turned OFF, the IRS remains powered for approximately 30 seconds. The ALIGN light illuminates until the system is completely shut down.

Inertial System Display Unit (ISDU)

The ISDU is located on the aft overhead panel and displays data according to the position of the display selector and system selector. The ISDU also contains a keyboard for entry of present position and heading.

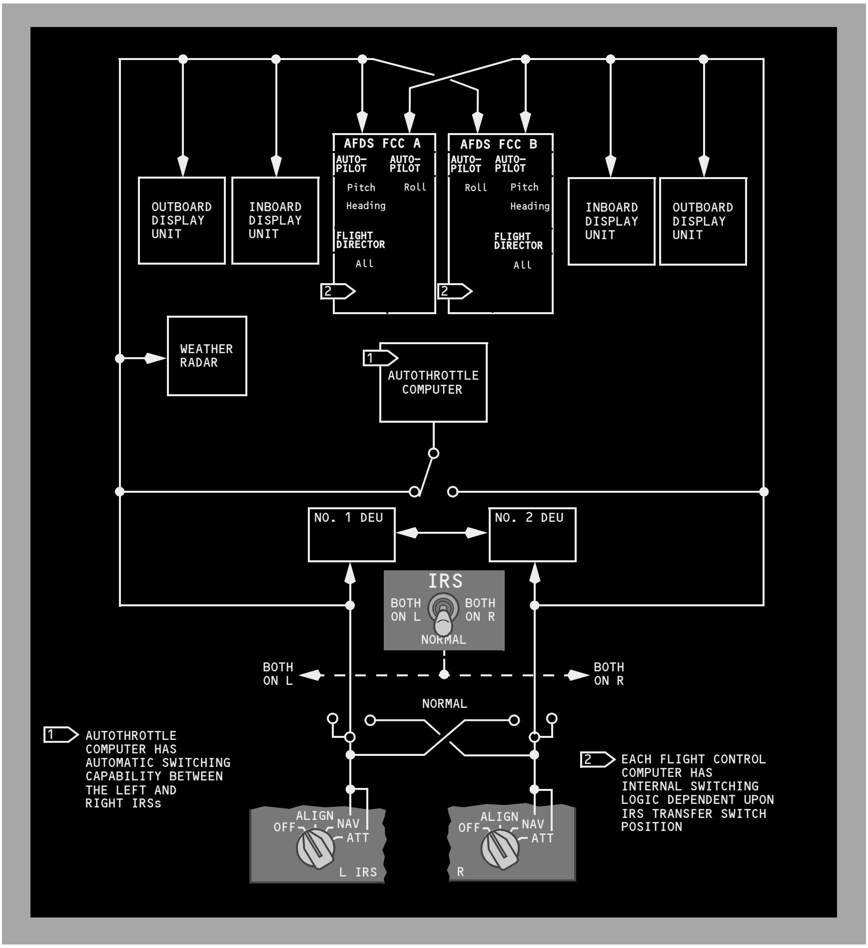
Mode Select Unit (MSU)

The MSU is located on the aft overhead panel and is used to select the operating mode for each IRS. Indicator lights on the MSU show status of each IRS.

IRS Transfer Switch

Should either IRS fail, the IRS transfer switch is used to switch all associated systems to the functioning IRU.

IRS Instrument Transfer Switch Schematic



Radio Navigation Systems

Automatic Direction Finding (ADF)

An automatic direction finding (ADF) system enables automatic determination of magnetic and relative bearings to selected facilities.

Two ADF receivers are installed. The ADF bearing signals are sent to the pointers on the DUs and the standby radio magnetic indicator. The audio is heard by using the ADF receiver control on the audio selector panel.

If heading or track information is lost or invalid, ADF bearing pointers on the DUs will be removed, and ADF bearing pointers on the standby radio magnetic indicator will not display correct magnetic bearing. Relative bearings indicated by pointers may be correct if the receiver is operating.

Distance Measuring Equipment (DME)

Two frequency scanning DME systems are installed.

The FMC autotunes DME receivers as necessary for position updating. During normal operations, two different DME signals or a signal from a collocated VOR/DME pair provide an accurate radio geographical position to the FMC. The identifiers of DMEs currently providing update data to the FMC are displayed on the NAV STATUS page 1/2. The radio position is displayed on the POS REF page 2/3. Specific DME station tuning for FMC position updating can be inhibited on the NAV OPTIONS page 2/2.

The flight crew must manually tune the DME on the VHF navigation control panel and the respective EFIS control panel VOR/ADF switch must be in the VOR position for DME to be displayed on the CDS. DME distance is also displayed on the CDS when the ILS receivers are tuned to a collocated DME and localizer facility.

Instrument Landing System (ILS)

Two ILS receivers are installed.

The ILS receivers are tuned manually on the VHF navigation control panel. The flight crew must manually tune the ILS for display on CDS. The ILS localizer and glideslope can also be displayed on the standby attitude indicator.

LOC updating of the FMC occurs only after the ILS is manually tuned.The tuned ILS frequency is displayed on the navigation display in the APP modes.

Navaid Identifier Decoding

YA701 - YV750

The Morse code identifier of a tuned VOR, ILS, or ADF can be converted to alpha characters. The decoded identifier is then shown on the PFD and ND. The crew should monitor this identifier for correct navigation radio reception. The identifier name is not compared with the FMC database.

YV751 - YV754

The Morse code identifier of a tuned VOR, ILS, GLS, or ADF can be converted to alpha characters. The decoded identifier is then shown on the PFD and ND. The crew should monitor this identifier for correct navigation radio reception. The identifier name is not compared with the FMC database.

Due to the large variation in ground station identifier quality, the decode feature may incorrectly convert the intended identifier name. Examples: the Hong Kong localizer “KL” may show as “KAI,” or the Boeing Field ILS may show as “QBFI” or “TTTT” instead of “IBFI.”

Pilots should verify the identity of the tuned navigation station from the audio Morse code when the tuned frequency remains shown or an incorrect identifier is shown.

Marker Beacon

Marker beacon indications for outer, middle and inner marker are displayed on the upper right hand corner of the attitude display located on the Captain’s and First Officer’s Primary Flight Display (PFD) units.

Very High Frequency Omni Range (VOR)

Two VOR receivers are installed.

The flight crew must manually tune the VOR on the navigation control panel for display on the DUs and the standby radio magnetic indicator. VOR–DME radio updating is available if the crew manually tunes a valid in–range VOR station.

Left and right VOR bearings are displayed on the DUs when a valid in–range VOR station is tuned and the respective EFIS control panel VOR/ADF switch is in the VOR position. The DUs also show course deviation.

VHF NAV Transfer Switch

Should either VOR receiver fail, the VHF NAV transfer switch enables selection of the opposite VHF NAV receiver for display.

ATC Transponder

Two ATC transponders are installed and controlled by a single control panel. The ATC transponder system transmits a coded radio signal when interrogated by ATC ground radar. Altitude reporting capability is provided.

Transmissions are automatically enabled when the air/ground system indicates air mode.

TCAS is also controlled from the transponder panel. The TCAS system is described in Chapter 15.

Transponders may also transmit information, such as flight number, airspeed or groundspeed, magnetic heading, altitude, GPS position, etc., depending on the level of enhancement. At some airports, airport equipment monitors airplane position on the ground when the transponder is active (mode selector not in STANDBY or OFF). TCAS modes should not be used on the ground for ground tracking. If installed, the Automatic Dependent Surveillance-Broadcast (ADS-B) data is downlinked to ATC and may be used for airplane tracking. The left GPS provides data to Transponder 1 containing ADS-B position information and the right GPS provides ADS-B position data to Transponder 2.

Weather Radar

The weather radar system detects and locates various types of precipitation bearing clouds along the flight path of the airplane and gives the pilot a visual indication in color of the clouds' intensity. The radar antenna sweeps a forward arc of 180 degrees.

The radar indicates a cloud's rainfall intensity by displaying colors contrasted against a black background. Areas of heaviest rainfall appear in red, the next level of rainfall in yellow, and the least rainfall in green.

In map mode, the radar displays surfaces in red, yellow, and green (most reflective to least reflective).

These displays enable identification of coastlines, hilly or mountainous regions, cities, or large structures. Ground mapping mode can be useful in areas where ground–based navigation aids are limited.

The radar system performs only the functions of weather detection and ground mapping. It should not be used or relied upon for proximity warning or anticollision protection.

The turbulence mode displays normal precipitation and precipitation associated with turbulence. When the radar detects a horizontal flow of precipitation with velocities of 5 or more meters per second toward or away from the radar antenna, that target display becomes magenta. This magenta area is associated with heavy turbulence. The detection of turbulence is automatically limited to a 40 nautical mile range, regardless of the selected range.

YA701 - YA710, YM482 - YM484

The IDNT position activates the ground clutter reduction feature. Signals that are determined to have a high probability of originating from ground returns will be automatically removed from the display. Some portions of weather targets may be removed as well. The IDNT position is provided for analysis by the pilot and is not for continuous use.

YA701 - YA710, YM482 - YM484
The weather radar also provides predictive windshear alerting below 1,200 feet RA. On the ground or in flight below 2,300 feet RA, radar antenna scan sweep is limited to 120 degrees with PWS enabled. Above 2,300 feet RA the radar sweep reverts to 180 degrees. (Refer to Chapter 15, Warnings.)

WXR-2100 Multiscan Radar

YF048 - YL551, YN531 - YV754

A MultiScan weather radar emulates an ideal radar beam by taking information from different radar scans and merging the information into a total weather picture. Ground clutter suppression algorithms are then used to eliminate ground clutter. The result is the ability for flight crews to view all significant weather from 0 to 320 NM on a single display that is essentially clutter free. With the multiscan process two scans are taken, each optimized for a particular region in front of the aircraft. In general, the upper beam detects intermediate range weather while the lower beam detects short and long range weather by automatically adjusting the beams tilt and gain settings. The information is then stored in a temporary database. When the captain or first officer selects a range, the computer extracts the appropriate portions of the desired information, merges the data, then eliminates the ground clutter. The result is an optimized weather display for whichever range scale the flight crew selects. During automatic operation, multiscan uses variable gain that is based on atmospheric temperature profiles to compensate for variations in geographic location, time of day, and altitude in order to optimize weather returns in all phases of flight. Gain is thus adjusted to suit the environment in which the aircraft is flying and provide the optimum weather picture in the prevailing conditions.

The Multiscan Radar includes the following features:

Path Attenuation Compensation (PAC) Alert places a yellow arc on the outer most range scale to warn the pilot if intervening rain fall has created an attenuated area. PAC Alert is operative whenever the radar is being operated in CAL gain and the aircraft is within 80 NM of a thunderstorm. PAC Alert is activated during both automatic and manual radar operation.

Oceanic Weather Reflectivity Compensation uses aircraft navigation inputs to identify oceanic regions and adjusts gain and tilt to account for the decreased reflectivity of oceanic thunderstorms. Thunderstorm thresholds are adjusted to more accurately represent the true thunderstorm threat to the aircraft.

OverFlight protection is designed to prevent thunderstorms that are in the aircraft flight path from falling below the radar beam and off the radar display during high altitude cruise. At extended ranges the upper MultiScan radar beam scans the wet, reflective portion of a thunderstorm in the same manner that conventional radar scans weather. As the aircraft approaches the storm and the cell begins to fall below the upper radar beam, MultiScan utilizes 6000 ft of bottom beam information to keep the reflective part of the storm in view. Within approximately 15 NM of the aircraft, MultiScan compares the stored digital image of the thunderstorm with the latest sweep information and shows whichever return is greater. If a cell that is a threat to the aircraft begins to fall below the radar beam, MultiScan shows the stored digital image of the storm to make sure that any threat thunderstorm remains on the display until it moves behind the aircraft. OverFlight protection is operational above 22000 ft MSL

YS184 - YS190, YT501 - YV754

Predictive OverFlight tracks cells below the aircraft and measures their growth rate and intensity when in AUTO and WX+T mode is selected. The system predicts turbulence above the cell and the increasing storm threat along the aircraft flight path. Predictive OverFlight is based on actual radar returns and the resultant analysis of cell growth, not on inference. Predictive Overflight shows as a red enclosure filled with red dots. Predictive OverFlight functions in AUTO mode only with WX+T selected.

YS184 - YS190, YT501 - YV754

Associated Threats are shown while the system is in AUTO and WX+T mode is selected. Associated threats show as red dots on the display and can be within the cell boundary or outside. They are determined by temperature as well as horizontal and vertical radar data. Two type of indications can be shown. The first is the electrified region found in precipitation around the freezing level. This indication shows when the freezing point is within 6000 feet of the aircraft. Associated hazards include icing and lightning. The second type of indication shows as red dots in a rectangle shape over the thunderstorm cell, and may extend beyond the cell in the downwind direction any time the wind is greater than 10 knots above 25 000 feet. The anvil pattern above a storm cell is inferred from the detected cell intensity, and indicates a potential of icing, hail and/or lightning. This shows no matter which altitude the aircraft is at. The electrified region is active for aircraft temperatures warmer than negative
20 degrees C.

YS184 - YS190, YT501 - YV754

Core Threat Adjustment provides a color and size adjustment to closer represent the actual threat. The core threat assessment uses horizontal and vertical growth rates and increases the color and size on the display if a return is below a certain decibel threshold. Core Threat Adjustment functions in AUTO mode only with WX+T selected.

YS184 - YS190, YT501 - YV754

Two-Level Turbulence Detection provides two levels of turbulence detection when in AUTO and WX+T mode is selected. Severe turbulence is shown by solid magenta areas, while light and moderate turbulence (known as ride quality turbulence) is shown by magenta dots. Severe turbulence is indicated when the aircraft g-load is 0.3 g or greater, while ride quality turbulence is indicated when aircraft g-load is 0.2 g. When not in AUTO, the single level of turbulence (0.3g) is available. Two-Level Turbulence Detection functions in AUTO mode only with WX+T selected.

YS184 - YS190, YT501 - YV754

Flight Path/Descent Assessment shows weather for the descent profile as soon as the aircraft starts a descent. All Multiscan Radar functions are available on the descent. The user does not need to switch to Manual mode to observe weather along the descent.

Windshear

On takeoff Warnings and Cautions are enabled from the beginning of the takeoff roll (0 knots) until the aircraft reaches 80 knots. From 80 knots until the aircraft passes 400 ft, only Warnings are enabled. From 400 ft through 1200 ft, Warnings and Cautions are enabled. All new alerts are disabled from the time the aircraft passes 100 knots until it reaches 50 ft.

On descent, below 2300 ft the weather scan switches from a 180 degree scan to a 120 degree scan, which indicates the windshear detection system is activated. The smaller scan sector allows faster updates and also allows weather and windshear events to be shown simultaneously during the entire windshear event. Windshear detection is always activated when the aircraft is below 2300 ft in the takeoff and landing environment even when the radar is turned off. Warnings and Cautions are enabled from the time the aircraft passes 1200 ft until 400 ft. From 400 ft until 50 ft, only Warnings are enabled. From 50 ft until touchdown (0 ft), all new alerts are disabled.

Windshear detection is activated during both manual and automatic radar operation.

If the radar is on in the MAP or TEST mode and the system detects a windshear event, the system display automatically changes to the WX+T mode to show the weather and windshear icons. The selected range does not change automatically.

A windshear WARNING is generated whenever a detected windshear event occurs within ± 0.25 NM of the longitudinal axis of the aircraft and within ± 30 degrees of the aircraft heading. When the aircraft is on the ground (takeoff roll), the windshear WARNING occurs for windshear events within 3 NM.

A windshear CAUTION is generated whenever a detected windshear event occurs outside the windshear warning region and within ± 30 degrees of the aircraft heading and less than 3 NM from the aircraft.

Introduction

The flight management system (FMS) aids the flight crew in managing automatic navigation, in–flight performance optimization, fuel monitoring, and flight deck displays. Automatic flight functions manage the airplane lateral flight path (LNAV) and vertical flight path (VNAV). The displays include a map for airplane orientation and command markers (bugs) on the airspeed and N1 indicators to assist in flying efficient profiles.

The flight crew enters the desired route and flight data into the CDUs. The FMS then uses its navigation database, airplane position and supporting system data to calculate commands for manual or automatic flight path control.

The FMS can automatically tune the navigation radios and determine LNAV courses. The FMS navigation database provides the necessary data to fly routes, SIDs, STARs, holding patterns, and procedure turns. Lateral offsets from the programmed route can be calculated and commanded.

For vertical navigation, computations include items such as fuel burn data, optimum speeds, and recommended altitudes. Cruise altitudes and crossing altitude restrictions are used to compute VNAV commands. When operating in the Required Time of Arrival (RTA) mode, the computations include required speeds, takeoff times, and enroute progress information.

Flight Management Computer (FMC)

The basis of the flight management system is the flight management computer. Since the term FMC is universally understood, it is used here for standardization and simplification.

The FMC uses flight crew–entered flight plan information, airplane systems data, and data from the FMC navigation database to calculate airplane present position, and pitch, roll, and thrust commands required to fly an optimum flight profile. The FMC sends these commands to the autothrottle, autopilot, and flight director. Map and route information are sent to DUs. The EFIS control panels are used to select the desired information for the navigation displays. The mode control panel is used to select the autothrottle, autopilot, and flight director operating modes. Refer to the following chapters for operation of these other systems:

- Chapter 4, Automatic Flight
- Chapter 10, Flight Instruments, Displays.

The FMC and CDU are used for enroute and terminal area navigation, RNAV approaches and to supplement primary navigation means when conducting all types of instrument approaches.

The dual FMC installation is certified as a “sole source” navigation system. Airplanes equipped with two FMCs are certified to operate outside radio navaid coverage. The second FMC serves as a backup, providing complete navigational functions if the other FMC fails.

With a dual FMC installation, one FMC is always designated as primary. This is controlled by the position of the FMC Source Select switch. Refer to Chapter 11, FMC Source Select Switch.

The primary FMC:

- allocates navaid tuning and updating functions between FMCs
- insures synchronization between FMCs
- controls CDU displays
- provides input to the autopilot
- provides input to the autothrottle system
- processes ACARS (data link) messages.

Positioning the FMC Source Select Switch to BOTH ON L or BOTH ON R isolates FMC operation to use only the left or right FMC respectively. In the NORMAL position, the left FMC is primary by default. Although the aircrew can enter information into either CDU, the primary FMC is responsible for synchronizing this information with the secondary FMC and updating both CDU displays.

When external position updating is not available, the FMC uses the IRS position as reference. When the IRS is the only position reference, the FMC applies an automatic correction to the IRS position to determine the most probable FMC position. This correction factor is developed by the FMC’s monitoring IRS performance during periods of normal position updating to determine the typical IRS error value. It is important to note that, when external position updating is not available, navigation accuracy may be less than required. Flight crews should closely monitor FMC navigation, especially when approaching the destination. The accuracy of the FMC navigation should be determined during descent phase by using radio navaids and radar information if available.

Note: Inaccurate position updating may cause the airplane to deviate from the desired track.

Control Display Units (CDUs)

Two identical, independent CDUs provide the means for the flight crew to communicate with the FMC. The crew may enter data into the FMC using either CDU, although simultaneous entries should be avoided. The same FMC data and computations are available on both CDUs; however, each pilot has control over what is displayed on an individual CDU.

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Flight Management, Navigation — Chapter 11

Flight Management System Operation — Section 31

Introduction

When first powered, the FMS is in the preflight phase. As a phase is completed, the FMS automatically transitions to the next phase in this order:

- preflight
- takeoff
- climb
- cruise
- descent
- approach
- flight complete.

Preflight

During preflight, flight plan and load sheet information are entered into the CDU. The flight plan defines the route of flight from the origin to the destination and initializes LNAV. Flight plan and load sheet information provide performance information to initialize VNAV.

Required preflight information consists of:

- initial position
- route of flight
- performance data
- takeoff data.

Optional preflight data includes:

- navigation database
- SID
- STAR

YT514 - YT521, YV741 - YV754

- Route 2
- RTA data
- cruise wind
- reduced takeoff and climb thrust limits.

Each required or optional data item is entered on specific preflight pages.

Preflight begins with the IDENT page. If the IDENT page is not displayed, it can be selected from the IDENT prompt on the INIT/REF INDEX page. Visual prompts provide assistance in selecting the appropriate CDU pages. Preflight pages can be manually selected in any order.

After entering and checking the necessary data on each preflight page, the lower right line select key is pushed to select the next page. When ACTIVATE is selected on the RTE page, the execute light illuminates. The EXEC key is then pushed to complete the task of making the route active before continuing with the preflight.

If a standard instrument departure (SID) is to be entered into the route, the departure/arrival (DEP/ARR) page is selected. After selecting the desired SID, the resulting modification must be appropriately linked to the existing route and executed. This can be accomplished on the RTE or RTE LEGS page.

When all required preflight entries are complete, the preflight status prompts on the TAKEOFF REF page are no longer displayed.

Takeoff

The takeoff phase begins with selection of TO/GA and extends to the thrust reduction altitude where climb thrust is normally selected.

Climb

The climb phase begins at the thrust reduction altitude and extends to the top of climb (T/C) point. The T/C point is where the airplane reaches the cruise altitude entered on the PERF INIT page.

Cruise

The cruise phase begins at the T/C point and extends to the top of descent (T/D) point. Cruise can include step climbs and en route descents.

Descent

The descent phase begins at the T/D point or when either a level change or vertical speed descent is initiated. The descent phase extends to the beginning of the approach phase.

Approach

The approach phase begins two miles from the first waypoint of a published approach or approach transition selected from the ARRIVALS page.

Flight Complete

After landing, the flight complete phase clears the active flight plan and load data. Some preflight data fields initialize to default values in preparation for the next flight.

FMC and CDU Terminology

The following paragraphs describe FMC and CDU terminology.

Active – flight plan information currently being used to calculate LNAV or VNAV guidance commands.

YA701 - YT513, YV604, YV605

Activate – designating an entered route as the active route for navigation. It is a two step process:

- push the ACTIVATE prompt
- push the execute (EXEC) key.

YT514 - YT521, YV741 - YV754

Activate – changing an inactive route to an active route for navigation is a two step process:

- push the ACTIVATE prompt
- push the execute (EXEC) key.

Altitude restriction – a crossing restriction at a waypoint.

Delete – remove FMC data and revert to default values, dash or box prompts, or a blank entry using the DELETE key.

Econ – a speed schedule calculated to minimize operating cost. The economy speed is based on the flight crew CDU–entered cost index. A low cost index reflects high fuel costs and results in a lower cruise speed.

Enter – placing an entry into the CDU scratchpad and then line selecting the information to the desired location. New characters can be typed, or existing data can be line selected into the scratchpad.

Erase – removing flight crew–entered information, which has resulted in a modification, by pushing the ERASE prompt.

Execute – making modified information part of the active flight plan by pushing the EXEC key.

Inactive – route, climb, cruise, or descent information not currently being used to calculate LNAV or VNAV commands.

Initialize – entering information required to make the system operational.

Message – information the FMC automatically writes in the scratchpad to inform the flight crew of a system condition.

Modify – active data that is changed but not yet executed. When a modification is made to the active route or performance mode, MOD is displayed in the page title, ERASE appears next to line select key 6 left, and the execute key illuminates.

Prompt – CDU displays that aid the flight crew in accomplishing a task. Prompts can be boxes, dashes, or a careted (< or >) line to remind the flight crew to enter or validate information.

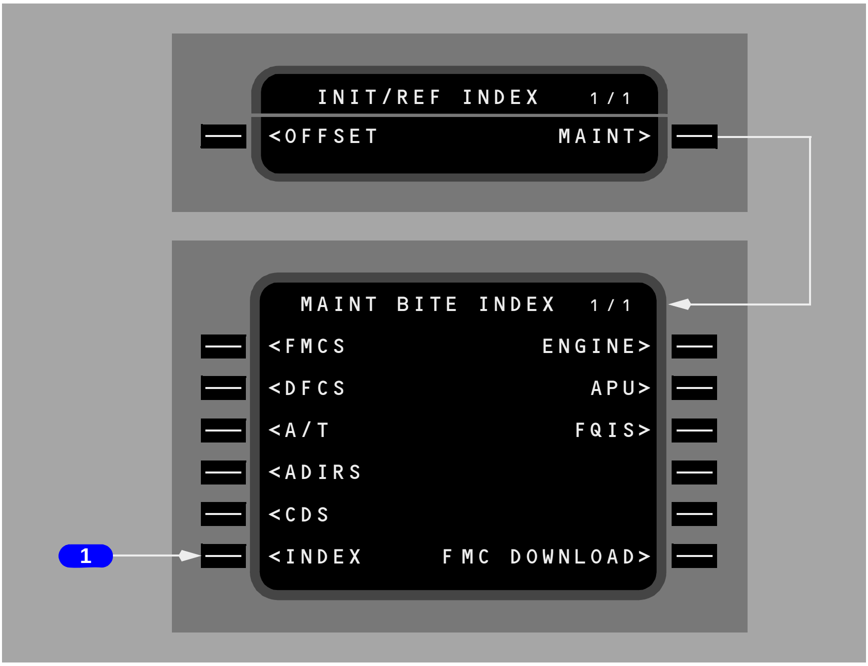
Select – pushing a key to obtain the desired information or action, or to copy selected data to the scratchpad.

Speed restriction – an airspeed limit associated with a specified altitude or waypoint.

Waypoint – a point on the route. It can be a fixed point such as a latitude and longitude, VOR or ADF station, airway intersection, or a non–fixed point such as a conditional waypoint. A conditional waypoint is not necessarily associated with a land reference; it reflects a time position, or altitude requirement. An example of a conditional waypoint is “when reaching 1000 feet.”

Maintenance Index Page

The MAINT BITE INDEX page is available only on the ground and provides access to data for use by maintenance personnel.



1 INDEX

Push – displays the INIT/REF INDEX page.

Navigation Position

The FMC determines present position from the IRS, GPS, and navigation radios. The FMC uses its calculated present position to generate lateral steering commands along the active leg to the active waypoint.

When the FMC Source Select Switch is positioned to NORMAL, the left FMC becomes primary, however, data from both FMCs is combined to determine a composite position and velocity for guidance and map displays.

FMC Position Update

On the ground, the FMC calculates present position based on GPS data. If GPS data is not available, the FMC calculates present position based on IRS data.

If GPS UPDATE is OFF, the FMC updates position to the takeoff runway threshold when a TO/GA switch is pushed. When making an intersection takeoff, the intersection data must be entered on the TAKEOFF REF page. If GPS UPDATE is ON, the TO/GA update is inhibited. GPS UPDATE is on the NAV OPTIONS page.

In flight, the FMC position is continually updated from the GPS, navigation radios, and IRS. Updating priority is based on the availability of valid data from the supporting systems.

FMC position updates from navigation sensor positions are used in the following priority order:

- GPS
- two or more DME stations
- one VOR with a collocated DME
- one localizer and collocated DME
- one localizer.

The station identifiers and frequencies of the selected radio navigation aids are displayed on the NAV STATUS page 1/2.

FMC logic selects the GPS position as the primary update to the FMC position. If all GPS data becomes unavailable, the FMC reverts to radio or IRS updating.

The dual frequency–scanning DME radios are automatically tuned by the FMC. The stations to be tuned are selected based upon the best available signals (in terms of geometry and strength) for updating the FMC position, unless a specific station is required by the flight plan. Radio position is determined by the intersection of two DME arcs.

If the DME radios fail, or if suitable DME stations are not available, FMC navigation is based on IRS position information only. The two VHF Nav radios are used by the FMC for localizer updating during an ILS approach and by the crew for navigation monitoring.

Note: The FMC is designed to automatically reject unreliable navaid data during FMC position updating. However, in certain conditions, navaids which are in error may satisfy the reasonableness criteria and provide the FMC with an inaccurate radio position. One of the most vulnerable times is when a radio position update occurs just after takeoff. This is usually manifested in an abrupt heading correction after engaging LNAV. The position shift can be seen on the map which will shift the desired track and runway symbol to a position significantly different from that displayed during ground roll.

Note: If the flight crew observes either of these indications, the FMC should be carefully monitored.

When adequate radio updating is not available, navigation display map mode may display a shift error. This error results in the displayed position of the airplane, route, waypoints, and navigation aids shifted from their actual positions.

An across track, undetected map shift may result in the airplane flying a ground track that is offset from the desired track. An along track, undetected map shift may result in the flight crew initiating altitude changes earlier or later than desired. In either case, an undetected map shift may compromise terrain or traffic separation.

Map shift errors can be detected by comparing the position of the airplane on the navigation display map mode with data from the ILS, VOR, DME, and ADF systems.

Navigation Performance

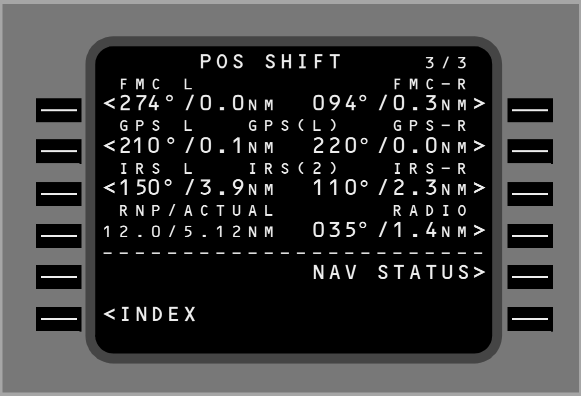
The FMC uses data from the navigation systems to accurately calculate the position of the airplane. The current FMC position is shown on line 1 of the POS REF page 2/3.

The FMC position is derived from a mathematical combination of the positions determined by the IRS, radio, and GPS systems. It represents the FMC's estimate of the actual position of the airplane. Its accuracy varies according to the accuracy of the other position determining systems.

Note: If the GPS position update is excessive, GPS updating is suspended until the GPS position can be determined to be reasonable.

Actual Navigation Performance (ANP)

Actual navigation performance (ANP) is the FMC's estimate of the quality of its position determination. It is shown on POS SHIFT page 3/3 and on RTE LEGS pages. ANP represents the estimated maximum position error with 95% probability. That is, the FMC is 95% certain that the airplane's actual position lies within a circle with a radius of the ANP value around the FMC position. The lower the ANP value, the more confident the FMC is of its position estimate.



```
      POS SHIFT       3/3
 FMC L             FMC-R
<274°/0.0NM   094°/0.3NM>
 GPS L    GPS(L)   GPS-R
<210°/0.1NM   220°/0.0NM>
 IRS L    IRS(2)   IRS-R
<150°/3.9NM   110°/2.3NM>
 RNP/ACTUAL        RADIO
12.0/5.12NM   035°/1.4NM>
------------------------
              NAV STATUS>

<INDEX
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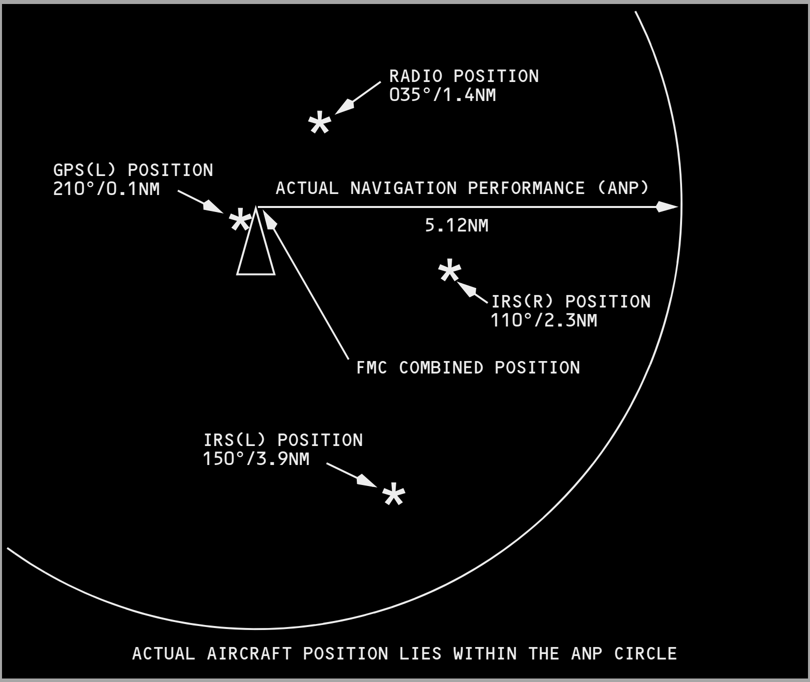


Vertical Actual Navigation Performance (VANP)

YL545 - YL551, YN531 - YV754

Vertical Actual Navigation Performance (VANP) is the FMC's estimate of the quality of its altitude determination. It is shown on RNP PROGRESS page 4/4. VANP represents the estimated maximum altitude error with 99.7% probability. That is, the FMC is 99.7% certain that the airplane's actual altitude lies within a vertical band equal to plus or minus the ANP value. The lower the VANP value, the more confident the FMC is of its altitude estimate.

Note: VANP is calculated from the baro-corrected altitude provided by the Air Data System. The pilot must set the baro setting reported by ATIS or provided in the approach clearance for the 99.7% confidence level to be valid.

Required Navigation Performance (RNP)

The FMC supplies a default required navigation performance (RNP) value for oceanic, en route, terminal, and approach environments. RNP can also be supplied by the Navigation Database or may be entered by the crew. Actual navigation performance (ANP) should not exceed RNP.

Environment	Default RNP	Time to Alert
Oceanic	12.0 NM	60 sec.
Environment	**Default RNP**	**Time to Alert**
En route	2.0 NM	30 sec.
Environment	**Default RNP**	**Time to Alert**
Terminal	1.0 NM	10 sec.

YA701 - YL544, YM482 - YM484

Environment	Default RNP	Time to Alert
Approach	0.5 NM	10 sec.

YL545 - YL551, YN531 - YV754

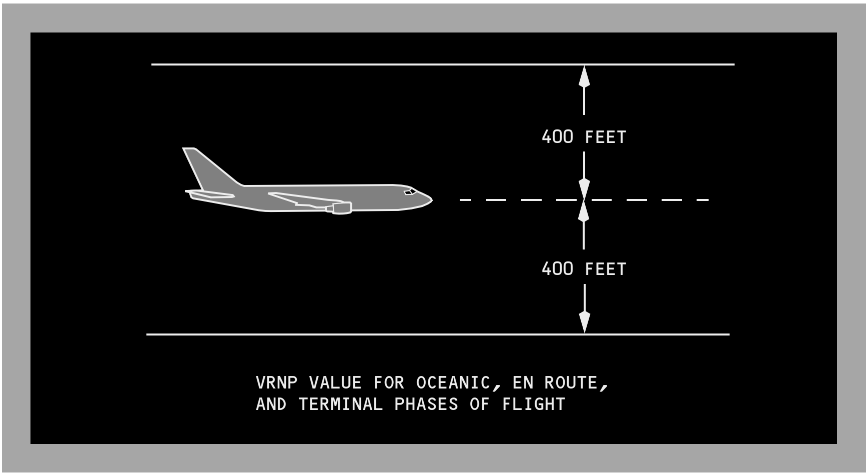
Environment	Default RNP	Time to Alert
Approach	0.3 NM	10 sec.

If ANP exceeds the displayed RNP value, the UNABLE REQD NAV PERF–RNP message will be displayed on the CDU scratchpad after the designated time to alert has elapsed. An additional amber UNABLE REQD NAV PERF–RNP will be displayed on the MAP. The amber FMC lights located on the forward instrument panel will also illuminate with the annunciation of this message. RNP is shown on the POS SHIFT, RNP PROGRESS 4/4 and the RTE LEGS pages.

Vertical Required Navigation Performance (VRNP)

YL545 - YL551, YN531 - YV754

The FMC uses 400 feet as a default Vertical Required Navigation Performance (VRNP) value for oceanic, en route, and terminal phases of flight.



When required, VRNP values may be manually entered or displayed on RNP PROGRESS page 4/4. The FMC will accept manual entry of a VRNP value greater than the default value, but the VERIFY VERT RNP VALUE advisory message will be displayed in the scratchpad. Manual entries are cleared at flight completion.

Lateral Navigation (LNAV)

YA701 - YT513, YV604, YV605

LNAV provides steering commands to the next waypoint. If selected, LNAV engages when laterally within 3 nautical miles of the active route leg. If outside of 3 nautical miles of the active route leg, LNAV engages if on an intercept heading of 90 degrees or less and the intercept will occur before the active waypoint. FMC LNAV guidance normally provides great circle courses between waypoints. However, when an arrival or approach from the FMC database is entered into the active route, the FMC can supply commands to fly a constant heading, track, or follow an arc, as required by the procedure.

YT514 - YT521, YV741 - YV754

LNAV provides steering commands to the next waypoint. If selected, LNAV engages when laterally within 3 nautical miles of the active route leg. If outside of 3 nautical miles of the active route leg, LNAV engages if on an intercept heading of 90 degrees or less and the intercept will occur before the active waypoint. FMC LNAV guidance normally provides geodetic paths between waypoints. However, when an arrival or approach from the FMC database is entered into the active route, the FMC can supply commands to fly a constant heading, track, or follow an arc, as required by the procedure.

Waypoints

Waypoint (navigation fix) identifiers are displayed on the CDU and navigation display.

The CDU message NOT IN DATA BASE is displayed if a manually entered waypoint identifier is not stored in the database. The waypoint can still be entered as a latitude/longitude, place–bearing/distance or place–bearing/place–bearing waypoint.

FMC–generated waypoints contain a maximum of five characters assigned according to the following rules.

Navaid Waypoint Names

VHF – waypoints located at VHF navaids (VOR/DME/LOC) are identified by the official one, two, three or four character facility identifier. Examples:

- Los Angeles VORTAC – LAX
- Tyndall TACAN – PAM
- Riga, Latvia – RIX.

NDB – waypoints located at NDBs are identified by use of the station identifier. Example:

- Fort Nelson, CAN – YE.

Fix Waypoint Names

Fixes with one–word names – waypoints located at fixes with names containing five or fewer characters are identified by the name. Examples:

- DOT
- ACRA
- ALPHA.

Long Waypoint Names

Names with more than five characters are abbreviated using the following rules sequentially until five characters remain. Double letters are deleted. Examples:

- KIMMEL becomes KIMEL
- COTTON becomes COTON
- RABBITT becomes RABIT.

Keep the first letter, first vowel and last letter. Delete other vowels starting from right to left. Examples:

- ADOLPH becomes ADLPH
- BAILEY becomes BAILY
- BURWELL becomes BURWL.

Keep the last letter, then delete consonants from right to left. Examples:

- ANDREWS becomes ANDRS
- BRIDGEPORT becomes BRIDT
- HORSBA becomes HORSA.

Fixes with multiword names use the first letter of the first word and abbreviate the last word, using the above rules sequentially until a total of five characters remain. Examples:

- CLEAR LAKE becomes CLAKE
- ROUGH ROAD becomes RROAD.

Unnamed Point Waypoint Names

Unnamed turn points, intersections and DME fixes – if an unnamed turn point, intersection or fix is collocated with a named waypoint or navaid on a different route structure (such as low altitude routes or an approach), the name or identifier of the collocated waypoint is used. Example:

- Unnamed turn point on J2 between the Lake Charles (LCH) and New Orleans (MSY) VORTACs is coincidental with the Lafayette (LFT) low altitude VORTAC. LFT is used as the identifier for the turn point.

Identifier codes for unnamed turn points not coincidental with named waypoints are constructed from the identifier of a navaid serving the point and the distance from the navaid to the point. If the distance is 99 nautical miles or less, the navaid identifier is placed first, followed by the distance. If the distance is 100 nautical miles or more, the last two digits are used and placed ahead of the navaid identifier. Examples (NAVAID – DISTANCE – IDENT):

- INW – 18 – INW18
- CSN – 106 – 06CSN
- TCS – 89 – TCS89.

Unnamed flight information region (FIR), upper flight information region (UIR), and controlled airspace reporting points – waypoints located at unnamed FIR, UIR, and controlled airspace reporting points are identified by the three–letter airspace type identification followed by a two–digit sequence number.

Unnamed oceanic control area reporting points – positions in the northern hemisphere use the letters N and E, while positions in the southern hemisphere use the letters S and W. Latitude always precedes longitude. For longitude, only the last two digits of the three digit value are used.

Placement of the designator in the five character set indicates whether the first longitude digit is 0 or 1. The letter is the last character if the longitude is less than 100° and is the third character if the longitude is 100° or greater.

N is used for north latitude, west longitude. E is used for north latitude, east longitude. S is used for south latitude, east longitude. W is used for south latitude, west longitude. Examples:

- N50° W040° becomes 5040N
- N75° W170° becomes 75N70
- N50° E020° becomes 5020E
- N06° E110° becomes 06E10
- S52° W075° becomes 5275W
- S07° W120° becomes 07W20
- S50° E020° becomes 5020S
- S06° E110° becomes 06S10.

Procedure Arc Fix Waypoint Names

Unnamed terminal area fixes along a DME arc procedure – unnamed fixes along a DME arc procedure are identified with the first character D. Characters 2 through 4 indicate the radial on which the fix lies. The last character indicates the arc radius. The radius is expressed by a letter of the alphabet where A = 1 mile, B = 2 miles, C = 3 miles, and so forth. Examples:

- EPH252°/24 = D252X
- EPH145°/24 = D145X
- GEG006°/20 = D006T.

An unnamed waypoint along a DME arc with a radius greater than 26 miles is identified as an unnamed turn point that is not coincidental with a named waypoint. Examples:

- CPR338°/29 = CPR29
- GEG079°/30 = GEG30.

When there are multiple unnamed waypoints along a DME arc with a radius greater than 26 miles, the station identifier is reduced to two characters, followed by the radius, and then a sequence character. Examples:

- CPR134°/29 = CP29A
- CPR190° /29 = CP29B
- CPR201°/29 = CP29C.

Procedure Fix Waypoint Names

Marker beacons – a marker beacon is identified by the marker type identifier followed by the runway number. Examples:

- Outer Marker 13R = OM13R
- Middle Marker 21 = MM21.

Runway–related fixes – waypoints located at unnamed runway–related fixes are identified by adding a two–letter prefix to the runway number. The following list is used to determine the appropriate prefix:

- RX – runway extension fix
- FA – VFR final approach fix
- CF – final approach course fix
- FF – final approach fix
- IF – initial approach fix
- OM – outer marker
- MM – middle marker
- IM – inner marker
- BM – back course marker
- MD – minimum descent altitude
- A – (+ an alpha) step down fix
- RW – runway threshold
- MA – missed approach point other than RW
- TD – touchdown point inboard of RW.

Examples: OM25L, MM09, IM23, RW04, RW18L.

For airports with more than one approach to the same runway, the two letter prefix may change to allow different identifiers for the same waypoint. The first letter identifies the type of fix and the second letter identifies the type approach as follows:

- C( ) – final approach course fix
- F( ) – final approach fix
- P( ) – missed approach point
- I( ) – initial approach fix
- D( ) – minimum descent altitude
- T( ) – touch down point
- R( ) – runway centerline intercept.
- ( )I – ILS
- ( )L – localizer only( )B – backcourse ILS
- ( )D – VOR/DME
- ( )V – VOR only
- ( )S – VOR with DME points
- ( )N – NDB
- ( )Q – NDB with DME points
- ( )M – MLS
- ( )T – Tacan
- ( )R – RNAV.

Examples: CI32R, PV15, FN24L.

Unnamed turn points – unnamed turn points that are part of a procedure are identified as a latitude and longitude waypoint. These include waypoints (except conditional waypoints) defined by flying a course or track from a waypoint (except conditional waypoints) to a radial or DME distance. These waypoints are automatically entered in a route by selection of a procedure using these waypoints, from the departures or arrivals page.

Airport reference points – airport reference points are identified by the ICAO identifier.

Duplicate Waypoint Names

Duplicate identifiers – should application of these rules result in more than one waypoint having the same identifier, then a CDU page change occurs when an attempt is made to enter the duplicated identifier.

The page title is SELECT DESIRED XXX, where XXX is the three letter identifier of the waypoint in question.

The page lists the latitude and longitude of waypoints with the same identifier and the type of facility or waypoint. Selecting the latitude/longitude of the desired waypoint enters the correct waypoint on the original page. See chapter 11, section 42, “Select Desired Waypoint Page” for additional information.

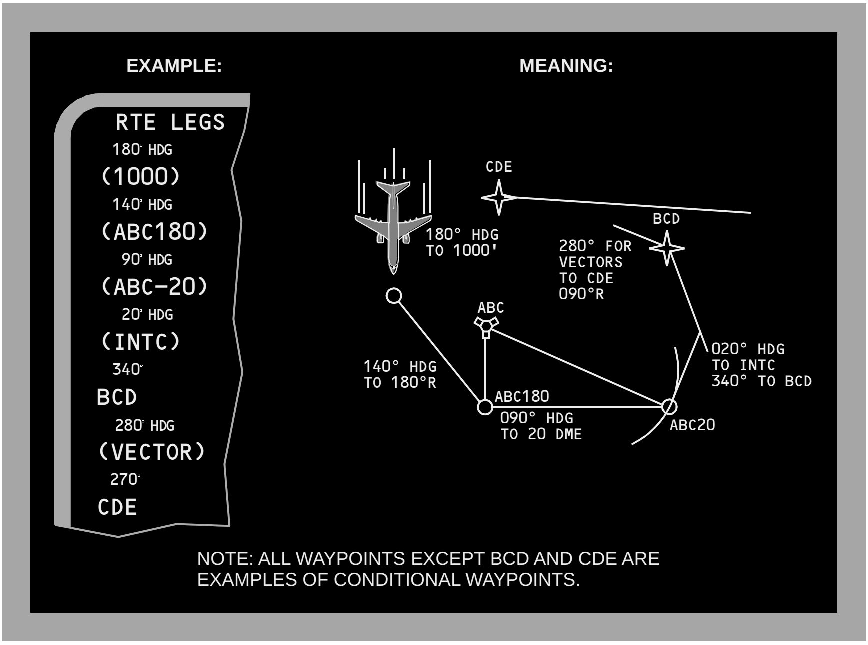
When a waypoint identifier is listed in the route more than once, certain route modifications (such as DIRECT TO or HOLD) use the first occurrence of the waypoint even if the second occurrence is selected. If a new waypoint entry is attempted that has the same identifier as a waypoint already in the route, the select desired waypoint page will not be displayed and the first waypoint will be used. To use the second occurrence waypoint, the first occurrence waypoint must be deleted from the route.

Conditional Waypoint Names

Conditional waypoints are automatically entered into a route as a result of selecting a procedure on a DEPARTURES or ARRIVALS page. Normally, conditional waypoints cannot be manually entered on a route or legs page. These waypoints are events when a condition occurs and are not at a geographically–fixed position. The types of conditions are:

- passing through an altitude
- flying a heading to a radial or DME distance
- intercepting a course
- heading vector to a course or fix.

Altitude and course intercept conditional waypoints are displayed on the CDU inside (parentheses) marks. The following diagram depicts conditional waypoints.



NOTE: ALL WAYPOINTS EXCEPT BCD AND CDE ARE EXAMPLES OF CONDITIONAL WAYPOINTS.

Note: When (VECTOR) is the active leg and LNAV is not engaged, the FMC automatically sequence to the next waypoint when within 3 nm of the next leg. If (VECTOR) is the active waypoint and LNAV is engaged, the FMC does not automatically sequence to the next waypoint. The next waypoint becomes active only upon EXECution of the procedures for Proceeding Direct To a Waypoint or Intercepting a Leg to a Waypoint.

Manually Entered Latitude/ Longitude Waypoint Names

Pilot defined waypoints entered as a latitude and longitude are displayed in a five–character format. The first three characters are WPT followed by a two digit sequence number. Latitude and longitude waypoints are entered with no space or slash between the latitude and longitude entries. Leading zeroes must be entered. All digits and decimal points (to 1/10 minute) must be entered unless the latitude or longitude are full degrees. Examples:

- N47° W008° is entered as N47W008 and displayed as WPT01
- N47° 15.4’ W008° 3.4’ is entered as N4715.4W00803.4 and displayed as WPT02.

Manually Entered Place–Bearing/Distance or Place–Bearing/Place–Bearing Waypoint Names

Waypoints entered as a place–bearing/distance or place–bearing/place–bearing are identified by the first three characters of the entry followed by a two–digit sequence number. Examples:

- SEA330/10 becomes SEA01
- SEA330/OLM020 becomes SEA02.

Manually Entered Along–Track Waypoint Names

Along–track waypoints are a special case of place–bearing/distance waypoints applied to the current route. When a waypoint is desired on the route where none exists, the along–track waypoint feature creates the desired waypoint without creating a route discontinuity.

Along–track waypoints are entered using the waypoint name (the place), followed by a slash and minus sign, for points before the waypoint, or no sign for points after the waypoint, followed by the mileage offset for the newly defined waypoint. The route course takes the place of the bearing which is not entered. The created waypoint is then inserted over the original waypoint. The distance offset must be less than the distance between the originating waypoint and next (positive value) or preceding (negative value) waypoint. Latitude and longitude waypoints cannot be used to create along–track waypoints. Examples:

- VAMPS/25 is 25 miles after VAMPS on the present route, and is displayed as VAM01
- ELN/–30 is 30 miles before ELN on the present route, and is displayed as ELN01.

Greater Than 99 Numbered Waypoints

When the quantity of numbered waypoints exceeds 99 the identifier will use the first two characters of the entry followed by the smallest three-digit sequence number beginning with 100. Examples:

- SEA104/74 becomes SE100
- SEA104/OLM064 becomes SE101.

Navigation Displays

The route is displayed on the navigation display in the map, map center, and plan modes. The display color and format represent the following status:

- an inactive route is displayed as a cyan dashed line
- an activated but not yet executed route is displayed as a cyan dashed line
- the active route is displayed in magenta
- modifications to an active route are displayed as dashed white lines

- modified waypoints are displayed in white
- executed route offsets are displayed as a dot and dash magenta line.

Vertical Navigation (VNAV)

VNAV provides vertical profile guidance through the climb, cruise, and descent phases of flight.

Speed/Altitude Restrictions

VNAV controls the path and speed to comply with waypoint crossing restrictions. Waypoint crossing restrictions are entered on the LEGS page waypoint line by pushing the applicable key on the right side of the CDU. Barometric altitude restrictions must be below the cruise altitude to be valid. Values entered as part of a procedure and manually entered restrictions are shown in large font. FMC predicted values do not act as restrictions, and are shown in small font.

All speed restrictions are considered by the FMC as “at” restrictions, unless modified by the pilot.

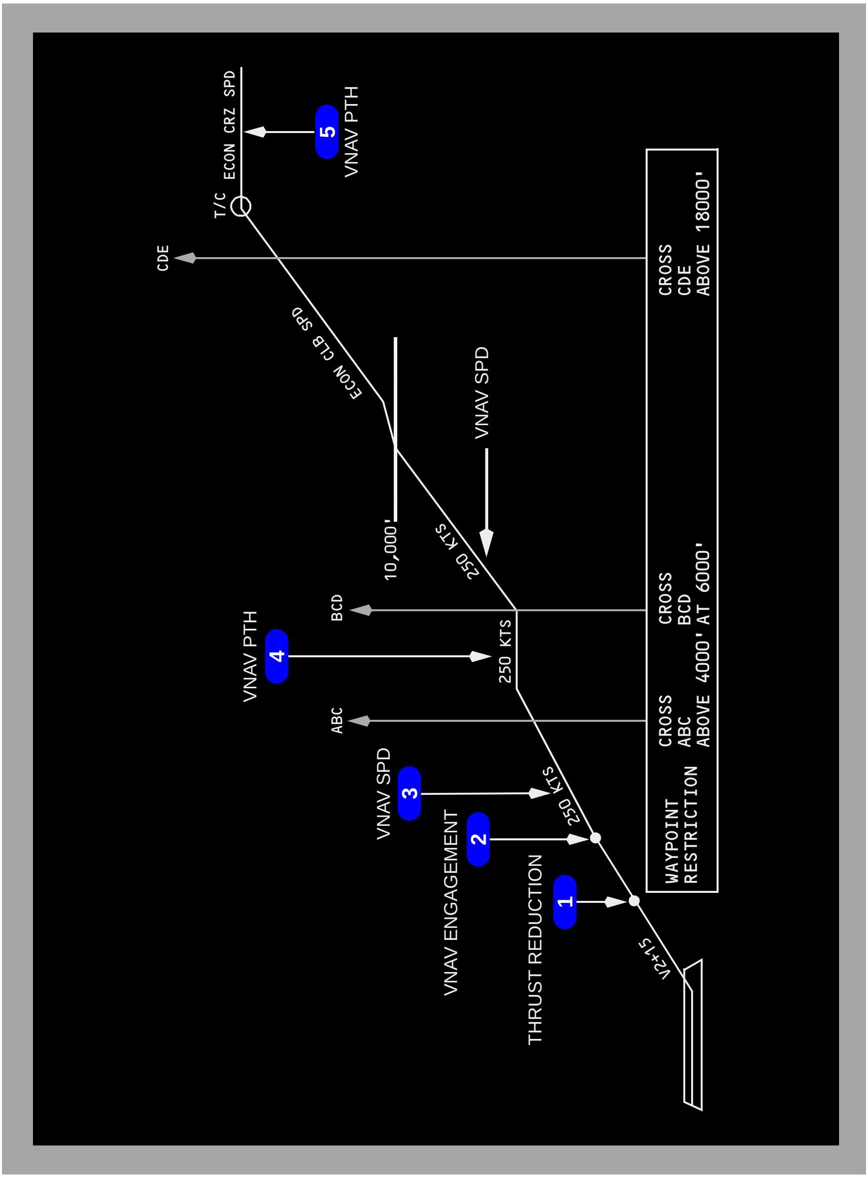
When modified by the pilot:

- “At or above” airspeed restrictions are entered with a suffix letter A (example: 250A/).
- “At or below” airspeed restrictions are entered with a suffix letter B (example: 200B/).
- Mandatory airspeed restrictions are entered without any suffix letter (example: 220/).

At or above altitude restrictions are entered with a suffix letter A (example: 220A). At or below altitude restrictions are entered with a suffix letter B (example: 240B). Mandatory altitude restrictions are entered without any suffix letter (example: 270).

Altitude restrictions that are between two altitudes are displayed with the lower limit first, followed by a suffix letter A, then the upper limit, followed by a suffix letter B (example: 220A240B).

Takeoff and Climb



1 Thrust Reduction

Climb thrust is selected by pushing the N1 switch or automatically upon reaching the thrust reduction altitude.

2 VNAV Engagement

VNAV commands an airspeed increase to the planned climb speed profile, limited by configuration.

3 VNAV Climb

The VNAV climb profile uses VNAV SPD at the default climb speed or pilot selected climb speed to remain within all airspeed and altitude restrictions that are part of the SID entered into the active route. Autothrottle uses selected climb thrust limit.

Note: Selection of ENG OUT on the CLB page provides the crew with advisory engine out performance information.

If the climb speed profile cannot achieve an altitude restriction, the UNABLE NEXT ALTITUDE scratchpad message is shown.

4 Climb Restrictions

VNAV enters the VNAV PTH mode to remain within departure or waypoint restrictions. Speed maintained during this time can be:

- procedure based speed restriction
- waypoint speed restriction
- default VNAV climb speed
- manually entered climb speed.

5 Top Of Climb (T/C)

The point where the climb phase meets the cruise altitude is called the top of climb. Approaching this point, the FMC changes from the climb phase to the cruise phase. The T/C is shown any time the FMC calculates a change from a climb phase to a cruise phase, such as a step climb.

The T/C point is shown on the map as a green open circle with the label T/C.

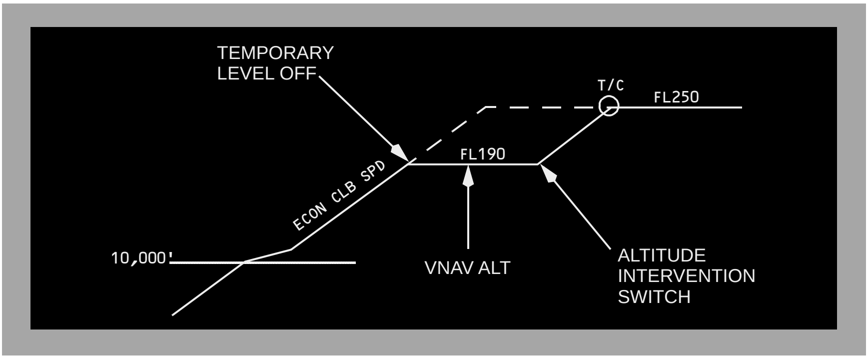
MCP Altitude Intervention

YF048 - YV754

The altitude intervention switch may be used to resume climb after a temporary level off.

YT514 - YT521, YV741 - YV754

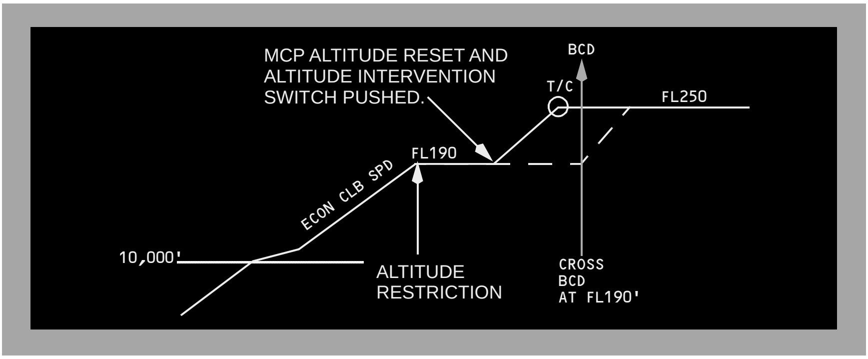
The Altitude Intervention function will only apply to the active flight plan.



Whenever the airplane levels off at an MCP altitude that is not in the FMC, VNAV ALT engages. In the illustration above, FMC cruise altitude is FL250 and the clearance altitude, FL190, is set in the MCP. Pitch maintains altitude and thrust maintains FMC target speed. In the illustration above, the speed after the temporary level off would be ECON CLB SPEED.

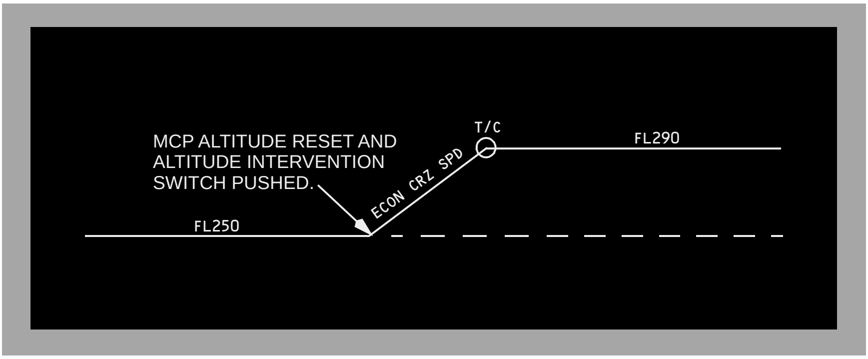
To resume the climb, put the clearance altitude into the MCP altitude window and push the altitude intervention switch. VNAV SPD engages. Pitch maintains FMC speed and thrust increases to the climb limit. In the example, the airplane climbs to FMC CRZ ALT and then levels off in cruise.

The altitude intervention switch may be used during climb or descent to delete altitude restrictions between the current altitude and the MCP altitude. When level at a restriction altitude, and cleared to a higher altitude prior to crossing the restriction waypoint, reset the MCP altitude to the new clearance altitude and push the altitude intervention switch.



In the illustration above, the current altitude restriction is deleted and the airplane continues VNAV climb to the cruise altitude. T/C moves to match the new climb profile.

The altitude intervention switch may be used to increase cruise altitude. When level at a cruise altitude, and then cleared to a higher cruise altitude, reset the MCP altitude to the new cruise altitude and push the altitude intervention switch.



In the illustration above, the cruise altitude is increased and the airplane enters a VNAV cruise climb at the economy cruise speed.

YF048 - YT513, YV604, YV605
Altitude intervention cannot be used to decrease cruise altitude. Setting a lower altitude then pushing the altitude intervention switch causes the FMC to enter an early descent in the selected descent mode.

YT514 - YT521, YV741 - YV754
The Altitude Intervention function will only apply to the active flight plan.

The altitude intervention software will enabled a climb or descent to a new cruise altitude to be initiated from the Mode Control Panel.

The altitude intervention option will allow the crew to initiate a cruise descent using the altitude intervention feature on the Mode Control Panel when the airplane is not in close proximity to the top of descent. A distance of 50 NM will be used as a determinant for this operation. If the airplane is greater than 50 NM from T/D. The pilot may dial the MCP altitude down and press the ALT INTV button on the MCP. FMC response is similar to use of altitude intervention for a cruise climb initiation. FMC ALT is set to the new cruise altitude and cruise descent is initiated using existing guidance techniques for cruise descent. A CRZ DES can be initiated using altitude intervention when greater than 50 NM from top of descent provided that the MCP ALT is not set below a descent altitude constraint. For this condition of more than 50 nm to T/D, and the MCP altitude dialed below a descent constraint, the result of pressing the ALT INTV button will be to transition from CRZ to EARLY DES and to honor the constraint. Subsequent presses of the ALT INTV button may be used to delete the constraint.

This feature enables a cruise descent to sequence into a path descent to eliminate a condition which can occur when the pilot initiates a cruise descent close to the original top of descent, less than 50 nm to top of descent. The change monitors an extension of the descent path during a cruise descent, in a manner similar to an early descent operation, to capture the extension of the path if it is intersected. Transition from cruise descent to descent occurs at the time of path capture in a manner similar to a transition from early descent to descent.

Cruise

At cruise altitude, the FMC sets cruise speed at the default or pilot entered speed until reaching the top–of–descent (T/D) point. Alternate cruise speed options are:

- long range (LRC)
- flight crew entered speed.

Cruise thrust is set as required to maintain level flight at the target speed, with the autothrottle engaged. The FMC uses maximum range cruise speed if cost index is set to zero.

Fuel and ETA predictions are based on a constant altitude cruise unless a step climb altitude is entered.

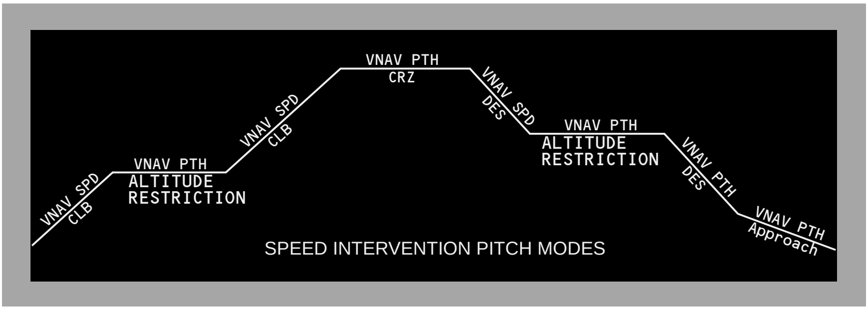
Step Climb

If a step climb altitude is entered in the CRZ page STEP altitude, the FMC calculates the point where the step climb should begin.

The distance and ETA to the next step point are shown on the CRZ and PROGRESS pages. The next step point is shown on the map as a green open circle with the label S/C.

MCP Speed Intervention

YF048 - YV754



The above illustration shows VNAV mode for each phase of flight during speed intervention.

With VNAV engaged, pushing the speed intervention switch enables speed intervention. Speed intervention allows the flight crew to change airplane speed with the IAS/MACH selector.

In a path descent using speed intervention, VNAV PTH changes to VNAV SPD when the active descent segment is an idle or non-idle thrust segment. In VNAV PTH, thrust controls speed; in VNAV SPD, pitch controls speed.

Note: Aircraft equipped with geometric descent path will transition to VNAV PTH after the first altitude restriction.

YT514 - YT521, YV741 - YV754

FMCS speed targets constrain the aircraft within its operating limits except when in the speed intervention mode. These operating limits include stall protection, maximum operating speed, flap placards, thrust limits, and maneuver margins.

When a navigation data base vertical angle leg is flown (GP x.xx on RTE LEGS page), VNAV switches to VNAV PTH if not already in VNAV PTH.

In approach phase during speed intervention, the pitch mode remains in VNAV PTH after speed intervention is exited. The FMC will remain in the current vertical mode regardless of IAS MACH selector changes.

When speed intervention is exited the descent mode will switch back to path mode.

Descent

VNAV can perform a descent in either of two modes – path descent or speed descent. During a path descent, the FMC uses idle thrust and pitch control to maintain a vertical path, similar to a glideslope in three dimensions. During a speed descent, the FMC uses idle thrust and pitch control to maintain a target descent speed, similar to a level change descent.

Top Of Descent (T/D)

The point where the cruise phase changes to the descent phase is the top of descent. The T/D point is shown on the map as a green open circle with the label T/D. T/D is calculated from an end of descent (E/D) point.

Intermediate T/D points show on the map as green open circles with the label T/D–XXXXX (altitude). Intermediate T/D points exist when path segments between altitude restricted waypoints produce a level path segment. The intermediate T/D point shows where the descent will resume.

YT514 - YT521, YV741 - YV754
When an exit from a holding pattern is requested by the pilot through CDU action:

- a turn path to the inbound leg will be generated immediately if the airplane is on the outbound leg or in the fix end turn when the T/D does not occur in the hold pattern.
- the entire hold pattern will be flown when the T/D does occur in the hold pattern.

End of Descent (E/D)

The FMC calculates a descent path based on airspeed restrictions, altitude restrictions and the end of descent (E/D) point. The E/D point is shown on the map as a green open circle with the label E/D. The E/D is the last of the following which is not preceded by a lateral discontinuity:

YA701 - YT513, YV604, YV605
- the runway threshold for approaches with a runway waypoint on the RTE LEGS page, or

YT514 - YT521, YV741 - YV754
- the runway threshold for approaches with a runway waypoint on the active RTE LEGS page, or

YA701 - YT513, YV604, YV605
- the missed approach point for approaches not showing a runway waypoint on the RTE LEGS page, or

YT514 - YT521, YV741 - YV754

- the missed approach point for approaches not showing a runway waypoint on the active RTE LEGS page, or
- the last descent waypoint, or
- the lowest “at” altitude restriction if no arrival procedure is entered.

Entering an instrument arrival procedure provides an E/D point.

If there is no E/D point, FMC predictions assume a computed profile to 1000 feet above the destination field elevation, at a position which will vary according to selection of arrival procedures. The FMC will provide a slowdown profile for approach. VNAV path descent is not available if there is no E/D point.

VNAV Descent and Approach Path

The descent path starts at the calculated top of descent (T/D) point and includes waypoint altitude restrictions. The path is based on:

- idle thrust
- speedbrakes retracted
- descent wind speed decreasing with decreasing altitude
- applicable target speed.

After the first “at” or “at or below” restriction, the path angle is constant between waypoints.

Note: When passing top of descent and using high target speeds (within approximately 6 knots of Vmo/Mmo), VNAV may revert to LVL CHG to prevent overspeed. Reduce airspeed to the VNAV target descent speed prior to reengaging VNAV.

Normally, the target speed is economy speed above the airspeed restriction altitude and 240 knots below that altitude, until deceleration for approach. VNAV will not permit descent below the airspeed restriction altitude until the airspeed is at or below the restricted value plus ten knots. The start and end of the airport speed restriction deceleration segment is shown on the map as a green open circles with no labels.

The descent path assumes deceleration to reach the final approach fix (FAF), or the glideslope intercept point at VREF 40+20 knots.

Target speeds are changed by entries on the DESCENT page. Entries made on the LEGS page are “at or below” and may limit the target speed. Wind and thrust assumptions are changed on the DES FORECASTS page.

Deceleration points show on the map as green open circles with the label DECEL. Deceleration points show prior to:

- airspeed constrained waypoints
- holding patterns
- approach flap extension.

If more than one deceleration segment exists in the flight plan, only the next deceleration point shows. Deceleration points can also show prior to cruise holding patterns or other speed reductions.

YF048 - YV754
During descent, VNAV ALT engages if the airplane levels at an MCP altitude not in the FMC.

VNAV Path Descent

An E/D point must be defined in order to accomplish a path descent. It may be defined manually or by the selection of an arrival procedure.

The FMC defaults to the path descent mode for planning purposes. If the necessary information for a path descent is not available by the time the airplane reaches the T/D point, the FMC will revert to the speed descent mode.

The path descent normally begins automatically at the calculated T/D point, provided the MCP altitude is reset for the descent. If descent is not initiated by the T/D, a path descent may not be achievable. At the T/D, the FMC commands idle thrust and pitch to follow the descent path.

The descent complies with waypoint altitude restrictions by following the calculated vertical path.

Note: A path descent uses the target speed for planning purposes only. There is no attempt to maintain the target speed during the idle portion of the descent.

YT514 - YT521, YV741 - YV754
Note: When in path descent, if actual airplane speed is less than the descent target speed by a customized threshold amount loaded in the Loadable Defaults Database, the FMC will transition to FMC SPD as the thrust mode. The valid range for the threshold is 5 to 15 knots. The A/T mode returns to the retard/arm mode when the airplane speed is then equal to the target speed.

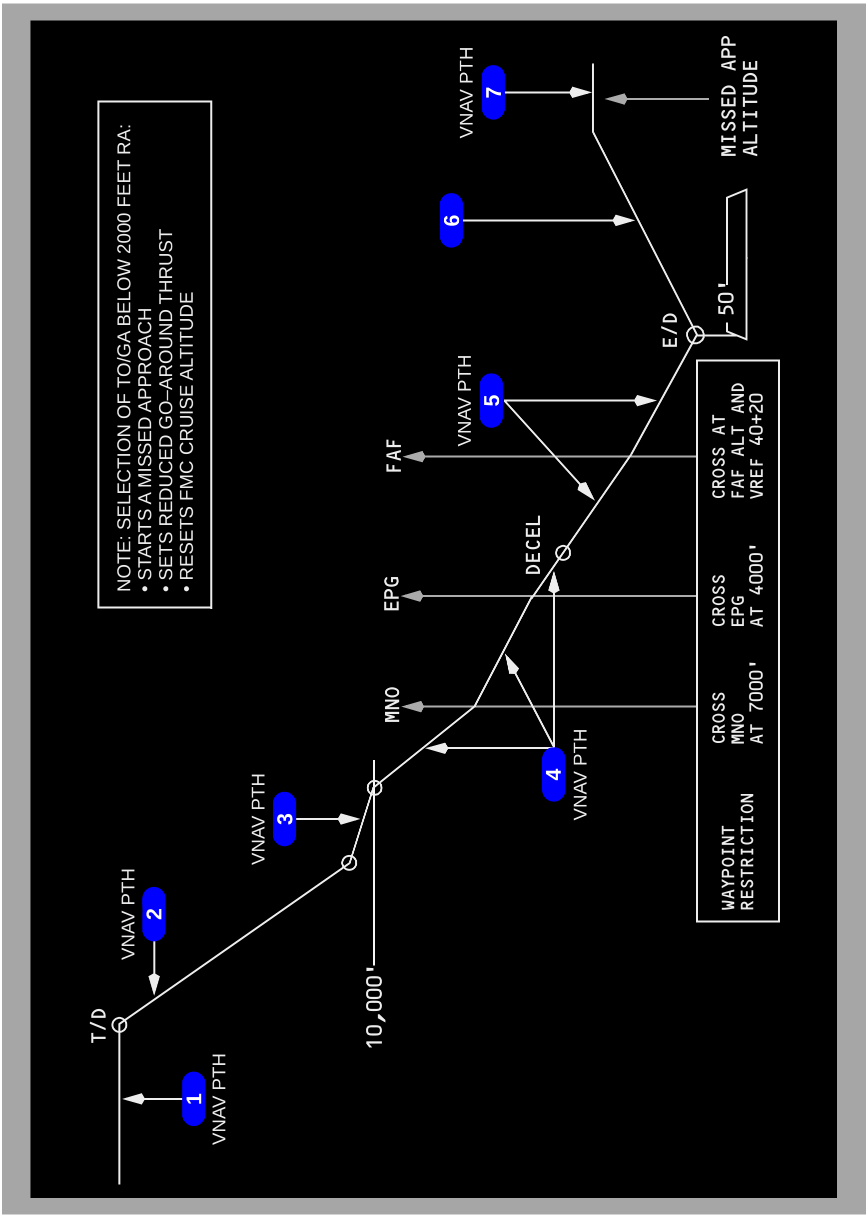
Note: When descending in VNAV PTH, the FCC will disengage VNAV and switch to LVL CHG if actual speed becomes equal to or slightly less than the minimum speed, denoted by the underspeed limiting symbol in the MCP IAS/Mach window. This can also happen in turbulence or gusty conditions when the minimum speed may momentarily increase due to G loading. See section 4.20, Minimum Speed Reversion.

The FMC uses a special program called “Energy Compensation” at certain times during an ACT PATH DES. This program goes into effect when the MCP has been temporarily set to an altitude above the planned descent path. The airspeed cursor will slowly move toward a slower airspeed while the “TARGET” speed on the FMC remains constant. The airspeed reduction improves the capability of recapturing the planned descent path. When the airplane is cleared to resume the descent, the airspeed will slowly build up to the FMC target speed as the airplane recaptures the planned descent path.

The CDU message DRAG REQUIRED is displayed if an unexpected tailwind results in a significant increase in airspeed to maintain path. The CDU message DES PATH UNACHIEVEABLE is displayed if the FMC determines that the planned descent profile cannot be accomplished. VNAV disengages if a limit speed will be exceeded.

A path descent must be initiated while within the allowable cross–track error for LNAV, however LNAV may be disengaged during descent while remaining in the path mode. VNAV will remain in path regardless of cross–track.

VNAV Cruise and Path Descent Profile (Instrument Approach using VNAV)



1 Cruise

Before the top of descent, FMC is in cruise mode and uses VNAV PTH and ECON cruise speed.

2 Descent

After top of descent, FMC is in descent mode and VNAV changes to economy descent speed and descends in VNAV PTH.

3 Speed Restriction Deceleration

Before the speed restriction altitude, VNAV decelerates to commanded speed using VNAV PTH.

When at restricted speed, VNAV commands decreased pitch and descends in VNAV PTH.

4 Altitude Restrictions

The VNAV path conforms to altitude restrictions at MNO, EPG, and the FAF. The thrust mode changes to FMC SPD as required to maintain the target speed.

5 Approach

VNAV descends and starts approach in VNAV PTH at the commanded speed.

6 Missed Approach

When TOGA is pushed during approach, or when crossing the missed approach point, VNAV disengages.

When selected during missed approach, VNAV engages in VNAV SPD.

7 Missed Approach Level Off

At missed approach altitude VNAV changes to VNAV PTH.

VNAV Speed Descent

A speed descent may be selected manually by selecting the SPEED prompt on the PATH DES page. With no E/D specified, the speed descent is the only descent mode available.

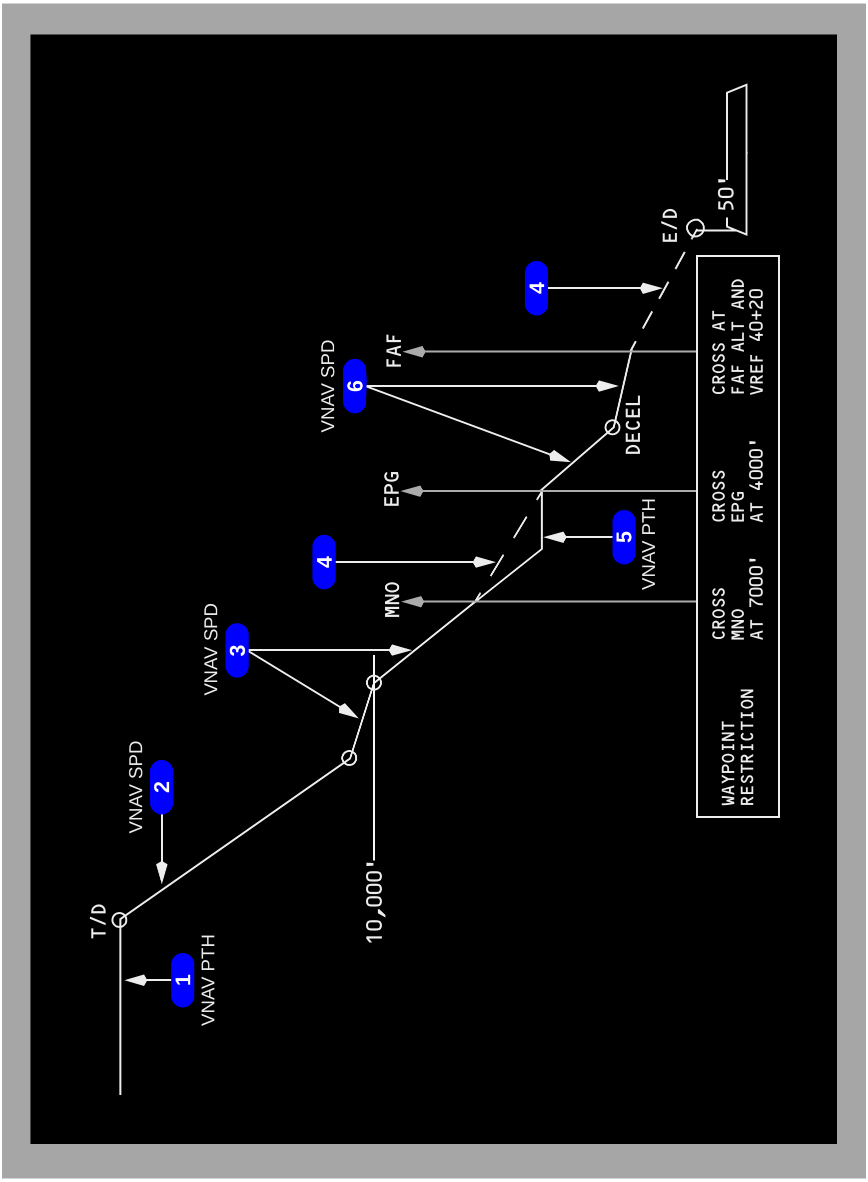
The speed descent maintains the target speed. Normally, the target speed is economy above the airspeed restriction altitude and 240 knots below that altitude, until deceleration is necessary for the approach. VNAV will not permit descent below the altitude restriction until the airspeed is at or below the restricted value.

The speed descent normally begins automatically at the calculated T/D, provided the MCP altitude is reset for the descent. At the T/D, the FMC commands pitch to maintain target descent speed. LNAV does not have to be engaged in order to fly a VNAV speed descent.

The descent attempts to comply with waypoint altitude restrictions, and will not violate these restrictions. The VNAV speed descent will not, however, guarantee the airplane reaches an altitude restriction at the required point.

A speed descent cannot automatically revert to a path descent, except during STAR, approach transition, or approach leg with a vertical angle. However, if all required parameters for a path descent are available, a path descent may be manually selected at any time by selecting the PATH prompt on the speed descent page.

VNAV Cruise and Speed Descent Profile (Instrument Approach using VNAV)



1 Cruise

Before the top of descent, FMC is in cruise mode and uses VNAV PTH and ECON cruise speed.

2 Descent

After top of descent, FMC is in descent mode and VNAV changes to economy descent speed and descends in VNAV SPD.

3 Speed Restriction Deceleration

Before the speed restriction altitude, VNAV decelerates to commanded speed using VNAV SPD.

When at restricted speed, VNAV commands decreased pitch and descends in VNAV SPD.

4 VNAV Path

During a speed descent, VNAV may not maintain the FMC computed VNAV path. However, if E/D shows, a VNAV path is available.

5 Altitude Restrictions

VNAV conforms to altitude restrictions at MNO and EPG. After MNO VNAV continues an idle thrust descent using VNAV SPD.

Upon reaching the next altitude restriction, VNAV commands level flight using VNAV PTH. The thrust mode changes to FMC SPD.

6 Descent and Approach

After EPG, VNAV continues the idle thrust descent using VNAV SPD.

Prior to the approach, VNAV decelerates to approach speed. The FMC prompts manual flap extension.

Vertical Angle

A vertical angle can be assigned to a waypoint from the navigation database. This vertical angle defines a VNAV path between the waypoint and the waypoint preceding it. This feature can be available in approaches, approach transitions, and STARs. For example, the vertical angle for the glideslope of an ILS approach would typically be 3 degrees. This angle is displayed on the ACT RTE LEGS page above the speed/altitude line for the associated waypoint. Vertical angles may be expected in any approach ending at RWXXX or MAXXX. The E/D will be RWXXX or MAXXX, and the E/D altitude will be either threshold crossing height (TCH – typically 50 feet above the touchdown zone elevation) or the altitude specified at MAXXX.

If a path (VNAV PTH) descent is active when a vertical angle leg becomes active, the path mode will remain active, but VNAV will follow the vertical angle rather than the idle thrust descent path.

If the vertical angle leg becomes active during a speed (VNAV SPD) descent, the VNAV mode will change to VNAV PTH automatically, and there will be no SPEED prompt on the descent page.

Early Descent

A descent in VNAV started before the top of descent point is an early descent. If a path descent is planned, VNAV commands a 1000 fpm descent until the idle descent path is intercepted. If a speed descent is planned, VNAV commands an idle thrust descent.

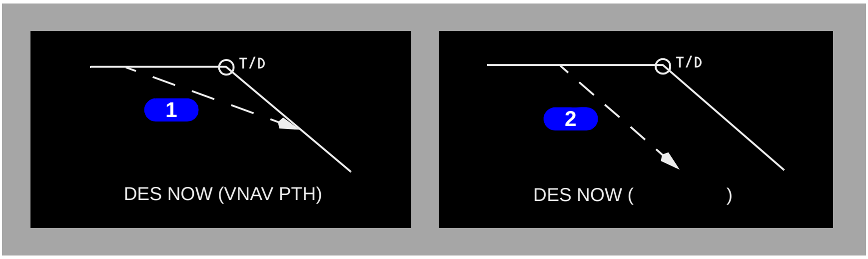
To start an early descent, use DES NOW prompt on the DES page.

YF048 - YT513, YV604, YV605
An early descent can also be started by pushing the altitude intervention switch.

YT514 - YT521, YV741 - YV754
A CRZ DES will occur upon lowering the MCP ALT to a lower altitude, but at or above any descent constraint altitude and pressing ALT INTV if the airplane is further than 50 nm from the top of descent at the current cruise altitude. If within 50 nm of the top of descent, the Early Descent mode will be invoked. In the previous Operational Flight Programs (OFPs), this action resulted in always going into the Early Descent mode of operation regardless of distance from the top of descent.

- This allows the crew to initiate a cruise descent using the altitude intervention feature on the Mode Control Panel when the airplane is not in close proximity to the Top of Descent. A distance of 50 NM is used as a determinant for this operation.
- Altitude Intervention may be used to initiate early descent when the airplane is 50 nm or less to Top of Descent.
- If Altitude Intervention is used to initiate descent when 50 NM or less to T/D with VNAV engaged and the MCP ALT below current altitude, Early Descent vertical speed commands of -1000 fpm will be generated by the FMC for Autopilot V/S tracking until path intercept or MCP ALT level off occurs.

- If Altitude Intervention is used to initiate descent when more than 50 NM to T/D with VNAV engaged and the MCP ALT below current altitude but at or above any descent constraint altitude, the result will be a cruise altitude reset to the MCP ALT and Cruise Descent vertical speed commands of -1000 fpm to the new cruise altitude.
- If Altitude Intervention is used to initiate descent when more than 50 NM to T/D with VNAV engaged and the MCP ALT below current altitude and below a descent constraint altitude, the result will be Early Descent vertical speed commands of -1000 fpm until path intercept or MCP ALT level off occurs.



1 **DES NOW (VNAV PTH)**

With a VNAV path descent planned, VNAV starts an early descent at 1000 fpm and captures the idle descent path. VNAV uses FMC SPD for the autothrottle mode and VNAV PTH for the pitch mode.

2 **DES NOW (VNAV SPD)**

With a VNAV speed descent planned, VNAV starts an idle thrust early descent. VNAV does not attempt to capture the VNAV descent path. VNAV uses VNAV SPD for the pitch mode and the autothrottle commands IDLE, followed by ARM.

Approach

The FMC transitions to “on approach” when the airplane is within:

- 2 NM of the first approach waypoint (including approach transitions such as arcs and procedure turns), or
- 2000 feet of airport elevation, whichever occurs first.

When the FMC is “on approach”, the following features are available:

- UNABLE RNP alerting levels are higher
- when preparing for a missed approach and the MCP altitude is set at least 300 feet above the current airplane altitude, VNAV will continue to command a descent

- if the airplane is more than 200 feet below the vertical path, VNAV commands zero vertical speed until intercepting the path.
- if the MCP altitude is set more than 250 feet above the current altitude, VNAV remains in VNAV PATH

Note: Display of a specified path angle is not limited to approaches. A path angle may be defined for a leg in a STAR and displays on the RTE LEGS page for the procedure.

The FMC transitions out of "on approach" under the following conditions:

- selecting TO/GA
- the airplane lands
- the waypoint cycles to the first waypoint of the missed approach
- executing a direct-to waypoint in the missed approach.

The following situations are generally encountered during approach operations, but are not determined by "on approach" logic:

YF048 - YV754

- If speed intervention is engaged:
  - during a path descent with flaps up on an idle or non-idle leg, VNAV switches to VNAV SPD
  - with flaps down, VNAV remains in VNAV PTH
  - when a point to point (geometric path) leg is active, VNAV remains in VNAV PTH
  - while a vertical angle leg (GP x.xx on RTE LEGS page) is active, VNAV remains in VNAV PTH
- if a vertical angle leg (GP x.xx on RTE LEGS page) becomes active, VNAV switches to VNAV PTH without pilot action
- if on a vertical angle leg, and cross track exceeds two times the RNP value, while LNAV is not engaged, VNAV will disengage.

VNAV will remain engaged at all flap settings, allowing approaches to be flown using the vertical angle guidance. Speed for final approach can be set on the APPROACH REF page.

If an ILS approach is flown in VNAV using vertical angle guidance, VNAV will disconnect when passing the GS–XXX point if G/S is armed, but it can be reengaged. If the GS–XXX point is deleted, VNAV will remain engaged throughout the approach.

For an approach without a runway waypoint on the RTE LEGS page, the VNAV path is calculated to the MDA or a calculated altitude at the missed approach point. The calculated altitude may be below the MDA to ensure a flight path angle and normal threshold crossing height.

Note: It is the flight crew's responsibility not to descend below the MDA until adequate visual contact is achieved.

Go-Around

Below 2000 feet radio altitude, the FMC transitions to go-around logic from approach logic when any of the following events occur:

- pushing either TO/GA switch while in a descent
- executing a direct-to waypoint in the missed approach (other than the missed approach point)
- automatically while in a descent and the last waypoint of the approach cycles to the first waypoint of the missed approach.
- the airplane climbs at a vertical speed greater than 600 fpm and the flaps are retracted from a landing setting toward a flap setting of 15 or 1

Once the FMC go-around logic is established:

- the FMC transitions from active descent to active climb
- the thrust limit changes to go-around thrust
- all descent altitude constraints below the current airplane altitude are deleted and replaced with predicted altitudes
- the original destination airport (airport from which the go-around was just initiated) becomes the new origin airport allowing SID selection if a diversion to another airport is required.

Note: LNAV may be engaged when the airplane climbs above 400 feet radio altitude, but VNAV should not be engaged until after flap retraction.

If the go-around was initiated by pushing a TO/GA switch or selection of go-around thrust, the CRZ ALT will change to the highest of:

- the highest constraint in the missed approach
- 1500 feet above airport elevation
- the MCP altitude.

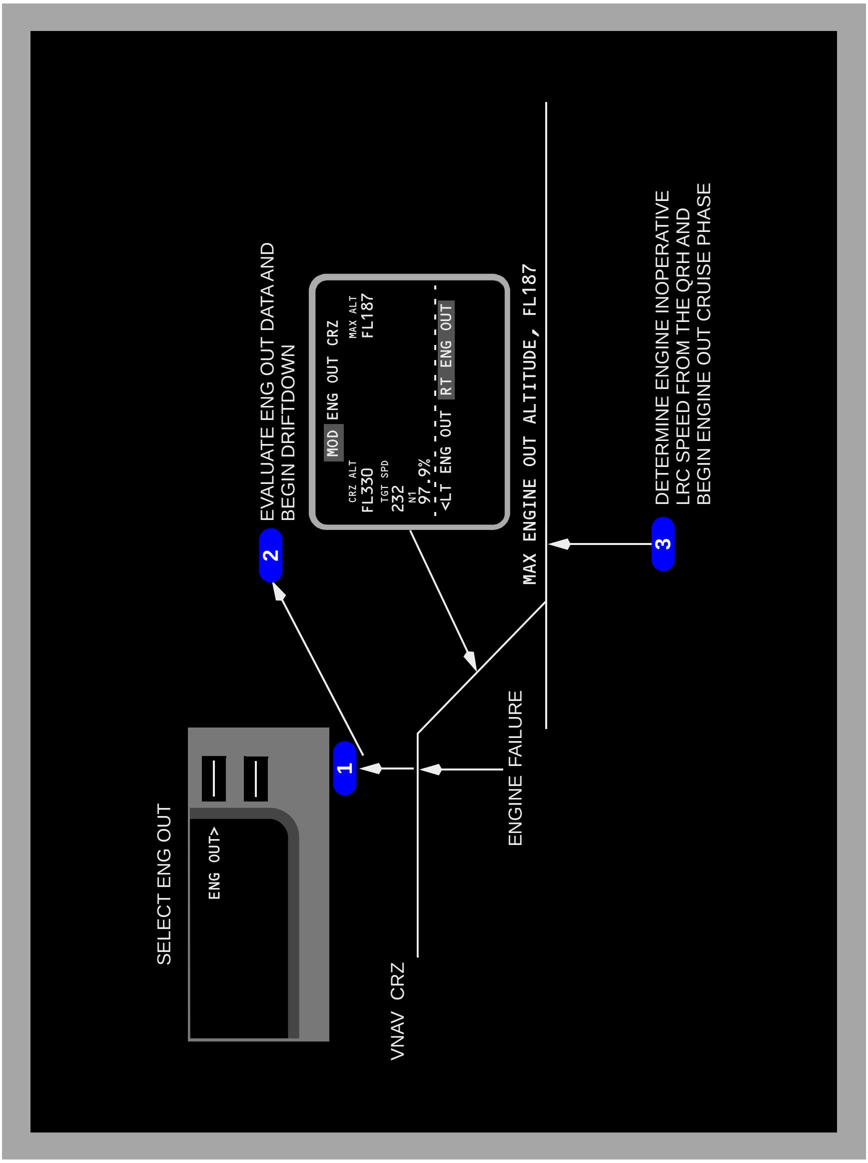
Note: If the MCP altitude is the lowest of the three, the autopilot, if engaged, will level off at the MCP altitude.

If the go-around was initiated by direct-to or waypoint sequencing, the CRZ ALT will change to the highest of:

- the highest constraint in the missed approach
- 1500 feet above airport elevation.

Refer to section NP21.xx, Go-Around Procedure and section 4.20, Go-Around for additional information.

VNAV Cruise (Engine Out Above Eng Out Max Alt)



1 Engine Out Modification

Select the ENG OUT prompt on the CRZ page. The ENG OUT page displays the appropriate engine out driftdown performance data to enable the airplane to descend to the engine out maximum altitude. Refer to FMC Cruise, section 11.42 for a complete description of the ENG OUT CRZ page.

2 Drift Down Execution

After selecting the left or right ENG OUT mode, perform the driftdown as follows:

- disconnect A/T
- set maximum continuous thrust on operating engine (N1 line)
- set MCP speed to ENG OUT SPD
- set MCP altitude to MAX ALT or lower altitude as required
- select LVL CHG.

The airplane then descends at CON thrust and the driftdown airspeed to the MAX ALT. As the driftdown proceeds and airplane gross weight decreases, the maximum altitude may increase.

Note: The engine out cruise page provides advisory performance data for operating with one engine.

3 Engine Out Cruise

Engine out cruise operates like normal cruise with engine out cruise speeds. If range is a factor, determine Engine Inoperative LRC speed from the QRH. Thrust limit remains in CON.

Required Time of Arrival (RTA)

VNAV controls cruise speed to achieve a flight crew specified arrival time at a specified waypoint. After the appropriate waypoint and RTA are input to the FMC, the FMC will compute a recommended takeoff time, speeds required to comply with the RTA, and progress information for the flight. If the RTA is not achievable, the RTA UNACHIEVABLE scratchpad message is displayed.

Data Entry Rules

Altitude Entry

Altitudes can be entered into the FMC as three digit (xxx), four digit (xxxx), five digit (xxxxx), or flight level (FLxxx) numbers. The FMC automatically displays altitude or flight level entries in the proper form based on the transition altitude. Some data lines further restrict the valid entry forms.

Three digit entries represent altitude or flight levels in increments of 100 feet. Leading zeros are required.

Examples of three digit (xxx, FLxxx) entries with transition altitude = 10,000 feet:

- 800 feet is entered as 008 or FL008 and displayed as 800
- 1,500 feet is entered as 015 or FL015 and displayed as 1500
- 11,500 feet is entered as 115 or FL115 and displayed as FL115
- 25,000 feet is entered as 250 or FL250 and displayed as FL250.

Four digit entries represent feet, rounded to the nearest ten feet. Leading zeros are required. This form is used when the altitude does not exceed 9,994 feet.

Examples of four digit (xxxx) entries with transition altitude = 18,000 feet:

- 50 feet is entered as 0050 and displayed as 50
- 835 feet is entered as 0835 and displayed as 840
- 1,500 feet is entered as 1500 and displayed as 1500
- 8,500 feet is entered as 8500 and displayed as 8500
- 9,994 feet is entered as 9994 and displayed as 9990.

Five digit entries represent feet, rounded to the nearest ten feet. This form is used when the altitude exceeds 9,994 feet.

Examples of five (xxxxx) digit entries with transition altitude = 4,000 feet:

- 50 feet is entered as 00050 and displayed as 50
- 835 feet is entered as 00835 and displayed as 840
- 1,500 feet is entered as 01500 and displayed as 1500
- 8,500 feet is entered as 08500 and displayed as FL085
- 9,995 feet is entered as 09995 and displayed as FL100
- 11,500 feet is entered as 11500 and displayed as FL115
- 25,000 feet is entered as 25000 and displayed as FL250.

Negative altitude entries are allowed to –1000 feet.

Airspeed Entry

Airspeeds can be entered into the FMC as calibrated airspeed or Mach number. Calibrated airspeeds are entered as three digits (xxx) in knots. Mach numbers are entered as one, two, or three digits following a decimal point.

Data Pairs

Many CDU pages display data in pairs separated by a slash “/.” Examples of these pairs include wind direction/speed and waypoint airspeed/altitude restrictions. When entering both values in a pair, the slash is inserted between the values. When it is possible to enter only one value of the pair, the slash may not be required. When entering only the outboard value of a pair, the trailing or leading slash may be entered, but is not required before transferring to the data line. When entering the inboard value of a pair, the trailing or leading slash must be entered before transferring to the data line. Omission of the required slash normally results in an INVALID ENTRY message.

Bearing Entry

Entry of a bearing value requires three digits. For example, key 090, not 90. A bearing entry of 360 is displayed as 000.

Plus/Minus Signs

When entering temperature or an along–track displacement distance, positive values are assumed by the FMC and + signs are not required. For negative values, key in the – sign.

FMC Databases

The FMC contains two databases:

- performance database
- navigation database.

The performance database eliminates the need for the flight crew to refer to a performance manual during flight, and provides the FMC with the information required to calculate pitch and thrust commands. All information normally required can be displayed on the CDU. The database includes:

- airplane drag and engine characteristics
- maximum and optimum altitudes
- maximum and minimum speeds.

Maintenance personnel can refine the database by entering correction factors for drag and fuel flow.

The navigation database includes most information normally determined by referring to navigation charts. This information can be displayed on the CDU or navigation display. The database contains:

- the location of VHF navigation aids
- waypoints
- airports
- runways
- other airline selected information, such as SIDs, STARs, approaches, and company routes.

If the permanent database does not contain all of the required flight plan data, additional airports, navaids, and waypoints can be defined by the crew and stored in either a supplemental or a temporary navigation database. Use of these additional databases provides world–wide navigational capability, with the crew manually entering desired data into the FMC via various CDU pages. Information in the supplemental navigation database is stored indefinitely, requiring specific crew action for erasure; the temporary navigation database is automatically erased at flight completion.

The supplemental and temporary databases share storage capacity for forty navaids and six airports, the entries being stored in either database on a first come, first served basis. For the waypoint category, exclusive storage is reserved in the temporary database for twenty entries (including those created on the RTE or RTE LEGS pages). An additional twenty waypoints (up to a maximum of forty) can be stored in either the temporary or supplemental database on a first come, first served basis.

When any storage capacity is full, entries which are no longer required should be deleted by the crew to make space for additional new entries. Created waypoints cannot be stored in the database runway category.

The FMC contains two sets of navigation data, each valid for 28 days. Each set corresponds to the normal navigation chart revision cycle. The FMC uses the active set for navigation calculations. The contents of the navigation database are periodically updated and are transferred to the FMC before the expiration date of the current data.

Thrust Management

The autothrottle operates in response to flight crew mode control panel inputs or to automatic FMC commands. Reference thrust can be selected on the N1 LIMIT page. Automatic FMC autothrottle commands are made while VNAV is engaged. The autothrottle system:

- uses reference thrust limits calculated by the FMC
- commands the thrust levers
- commands thrust equalization through the electronic engine controls.

Thrust limits are expressed as N1 limits. Thrust equalization references N1.

YA701 - YM484, YS151 - YV754
The FMC calculates a reference thrust for the following modes:

- takeoff
- derated takeoff
- assumed temperature takeoff
- climb
- reduced climb
- cruise
- continuous
- go–around.

YN531 - YN534
The FMC calculates a reference thrust for the following modes:

- takeoff
- derated takeoff
- assumed temperature takeoff
- takeoff bump
- climb
- reduced climb
- cruise
- continuous
- go–around.

The thrust reference mode automatically transitions for the respective phase of flight. These modes can be selected on the N1 LIMIT page. The selected thrust reference mode is displayed on the thrust mode display.

The flight crew can specify the thrust reduction height where the transition from takeoff to climb thrust takes place by making an entry on TAKEOFF REF page 2. Allowable entries are 800 feet to 9,999 feet.

The default value is determined by the airline and is stored in the model/engine database.

Reduced Thrust Takeoff

Reduced thrust takeoffs lower EGT and extend engine life. They are used whenever performance limits and noise abatement procedures permit.

Takeoff Derate

Fixed derates can be selected on the N1 LIMIT page. Performance data for these derates is provided in the Airplane Flight Manual (AFM).

With derated takeoff selected, the thrust setting parameter is considered a limitation for takeoff; therefore, thrust levers should not be advanced further except in an emergency. A further thrust increase following an engine failure could result in a loss of directional control while on the ground. Use the takeoff speeds supplied by the FMC or specified in Chapter PI, Performance-Inflight, for the selected derate condition.

Derated takeoff rating can be further reduced by assumed temperature.

Use the takeoff speeds specified in Chapter PI, Performance–Inflight, for the selected derate or variable takeoff rating condition.

Assumed Temperature Thrust Reduction Takeoff

A takeoff thrust less than the full rated thrust may be achieved by using an assumed temperature that is higher than the actual temperature. The desired thrust level is obtained through entry of a SEL TEMP value on the N1 LIMIT page or TAKEOFF REF page 2. Use approved sources for selecting the assumed temperature.

The maximum thrust reduction authorized is 25 percent below any certified rating. Do not use assumed temperature reduced thrust if conditions exist that affect braking, such as slush, snow, or ice on the runway, or if potential windshear conditions exist.

If the assumed temperature method is applied to a fixed derate, application of additional power should not exceed the fixed derate N1 limit as loss of directional control could occur while on the ground.

When the assumed temperature method is used with full rate, the reduced thrust setting is not considered a limitation. If conditions are encountered where additional thrust is desired, the crew can manually apply full thrust.

Takeoff Bump Thrust

YN531 - YN534

Takeoff bump thrust may be used to meet extra thrust requirements for takeoff at certain airports. Takeoff bump thrust provides thrust above normal maximum takeoff thrust. The takeoff thrust bump setting may be selected on the N1 LIMIT page. Takeoff thrust bump is available for takeoff, go around, max continuous, and max climb thrust ratings. If takeoff thrust bump is selected, assumed temperature reduced thrust is not available.

Derated Thrust Climb

Two fixed climb thrust derates can be selected on the N1 LIMIT page. CLB–1 provides a climb limit reduced by 3% N1 (approximately 10% thrust). CLB–2 provides a climb limit reduced by 6% N1 (approximately 20% thrust). The reduced climb setting gradually increases to full rated climb thrust by 15,000 feet. In cruise, the thrust reference automatically changes to CRZ. The reference can be manually selected on the N1 LIMIT page.

Use of an assumed temperature reduced thrust takeoff or takeoff derate affects the FMCs climb derate computation. If a reduced thrust takeoff has been specified on the TAKEOFF REF page, the FMC will re-compute CLB-1 and CLB-2 values as required to avoid a climb N1 value greater than the reduced thrust takeoff N1 value.

Use of derated climb thrust reduces engine maintenance costs, but increases total trip fuel.

Fuel Monitoring

The FMC receives fuel data from the fuel quantity indicating system. Fuel quantity values show on the PERF INIT page and on PROGRESS page 1/3.

The scratchpad message VERIFY GW AND FUEL shows if total fuel quantity data is invalid. The PERF INIT page FUEL line changes to dashes. The FMC uses the last valid fuel quantity for performance predictions and VNAV operation. The flight crew should manually enter estimated fuel weight. Periodic fuel weight update is required for the remainder of the flight to keep gross weight current. The FMC does not update the manual fuel weight entry. The scratchpad message VERIFY GW AND FUEL shows again each 30 minutes if subsequent entries are not performed. The scratchpad message does not show during descent with Vref selected.

The scratchpad message CHECK FMC FUEL QUANTITY shows if the FMC has detected an unexpected drop in fuel quantity.

The FMC continually estimates the amount of fuel that will remain when the destination airport is reached if the active route is flown. The CDU message USING RSV FUEL is displayed if the estimate is less than the fuel reserve value entered on the PERF INIT page. The CDU message INSUFFICIENT FUEL is displayed if predicted fuel at destination will be 2000 lb. (900 kg) or less.

Loss of FMC Electrical Power

The FMC requires continuous electrical power to operate. When the electrical power is interrupted for less than ten seconds:

- LNAV and VNAV disengage
- all entered data is retained by the FMC
- the FMC resumes normal operation when power is restored.

If power is lost for ten seconds or more on the ground, all preflight procedures and entries must be done again when power is restored.

If power is lost for more than ten seconds in flight:

- LNAV and VNAV disengage
- all entered data is retained by the FMC, and when power is restored the RTE LEGS page is displayed with the scratchpad message SELECT ACTIVE WPT/LEG.

Before LNAV can engage, the FMC must be instructed how to return to the route. Select the desired active waypoint and proceed direct or intercept a course to the waypoint.

FMC Failure

Single FMC Failure

The FMC/CDU is designed to automatically preserve the most capable modes of navigation and guidance that can be maintained with the equipment and navigation aids available. If an error or system failure results in reduced capability, then the FMC may generate a crew message for display in the CDU scratchpad. If other system inputs to the FMC should fail, affected CDU displays are blanked to prevent the display of misleading or erroneous data. For example, loss of the total fuel input causes some performance related data to be blank. The messages and FMC internal responses provide an orderly transition from full FMC guided flight to less automated capability.

If the right FMC fails, the FMC alert light and the FMC message light will illuminate. The message SINGLE FMC OPERATION will be displayed in both scratchpads. VTK will display on the right navigation display. LNAV and VNAV will disengage if autopilot B is in use (can be reengaged if autopilot A is selected). After 25 to 30 seconds, the right navigation display will display failure information. The right navigation display may be restored by placing the FMC source select switch to BOTH ON L.

If the left FMC fails, the FMC alert light will illuminate. The MENU page will appear on both CDUs. VTK will appear on the left navigation display. LNAV and VNAV will disengage, but can be reengaged if autopilot B is in use or is selected. After 25 to 30 seconds, the left navigation display will display failure information. To restore full operation, the FMC source select switch must be moved to BOTH ON R.

Note: During an FMC software restart, the navigation display map track may rapidly slew to 0 degrees then to the correct value.

Dual FMC Failure

If both FMCs fail, the FMC alert light will illuminate. The MENU page will appear on both CDUs. VTK will appear on both navigation displays. LNAV and VNAV will disengage. After 25 to 30 seconds, both navigation displays will display failure information.

Software Exception Handling Logic

Note: A Software Exception is the disruption in the normal flow execution of the software code; i.e. an attempt to solve an unsolvable map calculation.

Prior to U10.8, the FMC would shut down after three consecutive software resets within 60 seconds. U10.8 and on, is revised such that FMC resets are managed more effectively. The software exceptions handling logic has been revised to prevent a complete FMC restart in the event of most software exceptions. If performance data is entered, an exception in most processing will result in a downgrade of FMC operation, not a complete loss of function.

In the downgrade mode:

- LNAV and Map are retained
- FMC Predictions are halted
- VNAV is disconnected

If the software exception occurs in processing of the active flight plan, an alerting level message, VNAV INVALID - PERF, will be displayed for the pilot indicating re-entry of Cost Index is required in order to restart the internal software predictions process, which is required before reengagement of VNAV. Predictions can be restarted allowing VNAV to be reengaged after entry and EXEC of Cost Index on the PERF INIT page.

When a software reset occurs in the MOD PLAN and not the ACT PLAN, the FMC will delete the MOD PLAN. An advisory message, INVALD MOD PLAN, will be displayed for the pilot indicating that this has occurred. LNAV and VNAV will remain engaged for this case.

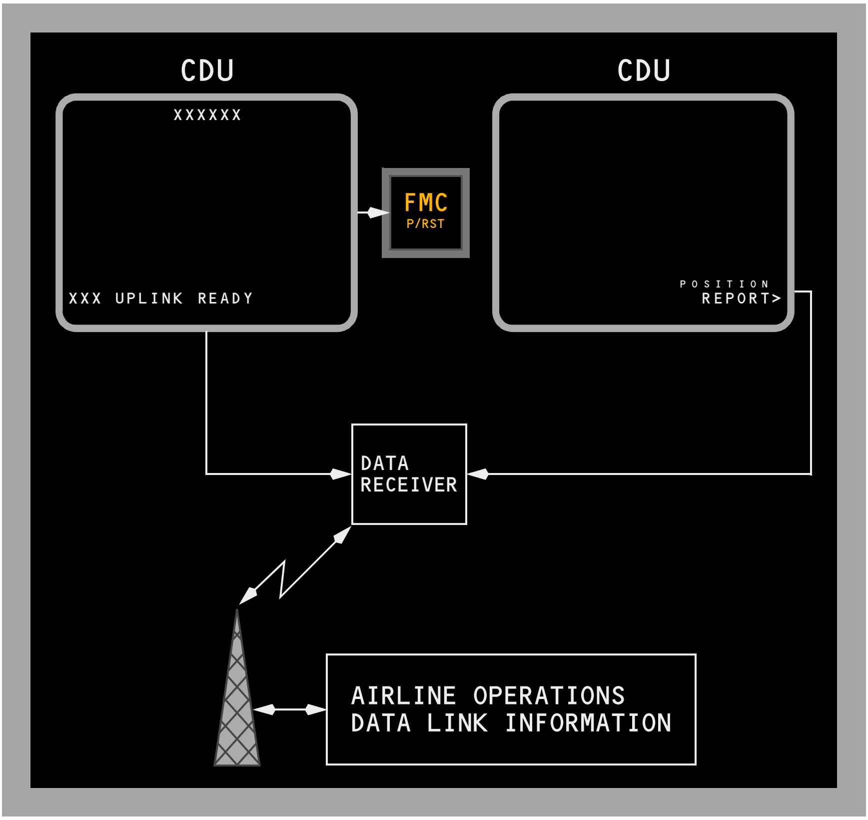
When a software reset occurs in an INACTIVE PLAN, the FMC will delete the INACTIVE PLAN (no change from current operation). An advisory message, INVALD INACTIVE PLAN, will be displayed for the pilot indicating that this has occurred.

This improvement will not prevent all restarts; it does not cover those that may leave the FMC's memory in an inconsistent state.

Intentionally
Blank

Company Data Link

The airplane communications system enables two–way data link communications between the FMC and airline operations. A downlink occurs when data is transferred from the FMC and transmitted through the airplane communications system to a receiver on the ground. Data may be downlinked from the FMC either manually or automatically. An uplink is the opposite of a downlink; data is transmitted from a ground station for input to the FMC. Data may be uplinked at the discretion of the airline operations dispatcher or in response to a downlink request.



Data Link

Downlinks are data link messages transmitted to a ground station. Requests for data and reports of FMC information are two types of downlinks. Requests are made manually by the flight crew. Reports can be made manually or may occur automatically.

Uplinks are messages transmitted to the airplane. Most uplinks require manual selections by the flight crew. Some uplinks are input automatically.

Manual Downlinks

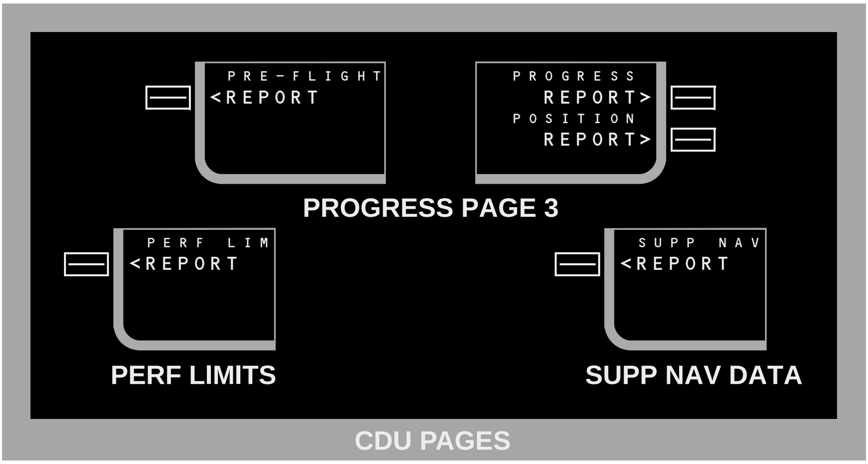
Select a REQUEST prompt to start the downlink request for data. REQUEST prompts are on PERF INIT, PERF LIMITS, TAKEOFF REF, PROGRESS, DES FORECASTS, RTE, ALTERNATE DEST, RTE DATA, and SUPP NAV DATA pages. Downlink reports of the active route may be accomplished by selection of the REPORT prompt on the PERF LIMITS or PROGRESS page and a position report may be downlinked by selection of the REPORT prompt on the PROGRESS page. The contents of the supplemental navigation database can be downlinked by selection of the REPORT prompt on the SUPP NAV DATA page.

When the communications function is unable to process FMC downlinks, the words FAIL, VOICE, NO COMM, or FULL are displayed on the CDU pages in place of the REQUEST and REPORT prompts and the header line displays the word DATALINK. The status messages are:

- FAIL – the ACARS management unit is inoperative
- VOICE – radio is operating in the VOICE mode
- NO COMM – radio is operational but not available
- FULL – all available downlink space is full.

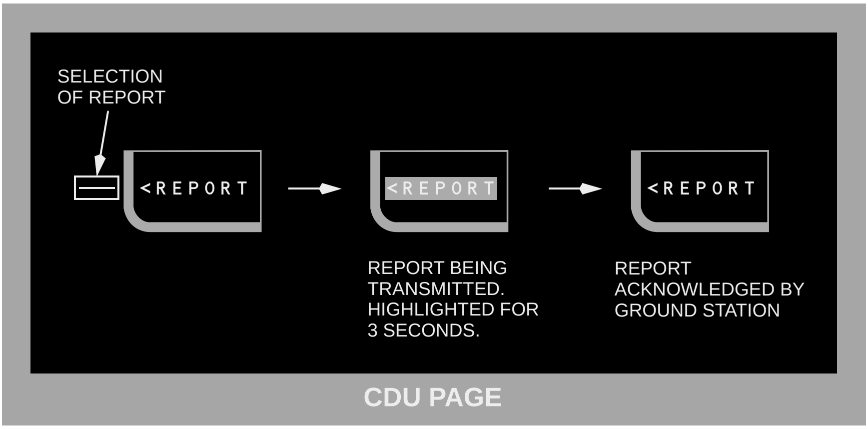
Reports

A REPORT prompt on each page downlinks a unique report applicable to that page. The pages below contain report prompts.



Report Status

Below is a typical sequence of status in response to sending a report.



Automatic Downlinks

The FMC can be configured by the airline to automatically transmit downlinks of FMC data at predetermined points during the flight or in response to specific information requests from the airline dispatcher. The FMC response in these cases is completely automatic and no crew action is necessary.

Uplinks

Uplinked data may be loaded automatically or may require flight crew action. Three uplinks automatically load data into the FMC when the REQUEST prompt is selected and do not require execution.

Uplinked data that waits in system memory for flight crew action are considered to be pending. A pending uplink is included or discarded when the flight crew selects the applicable prompt. Flight crew response to an uplink depends on the type of uplink. Flight crew action is made with ACCEPT/REJECT or LOAD prompts, FMC modification ERASE prompt or EXEC key, or when the page with the uplink is selected.

Data can be uplinked from the airline dispatcher directly to the FMC. The uplinks are annunciated to the crew by the FMC alert lights. The uplink is identified by a CDU scratchpad message.

PERF INIT uplinks are available only on the ground and after an origin airport has been entered on the RTE page.

RTE DATA cruise winds are available when not in descent and a cruise altitude and a flight plan route exist.

DES FORECASTS winds are available if a cruise altitude exists.

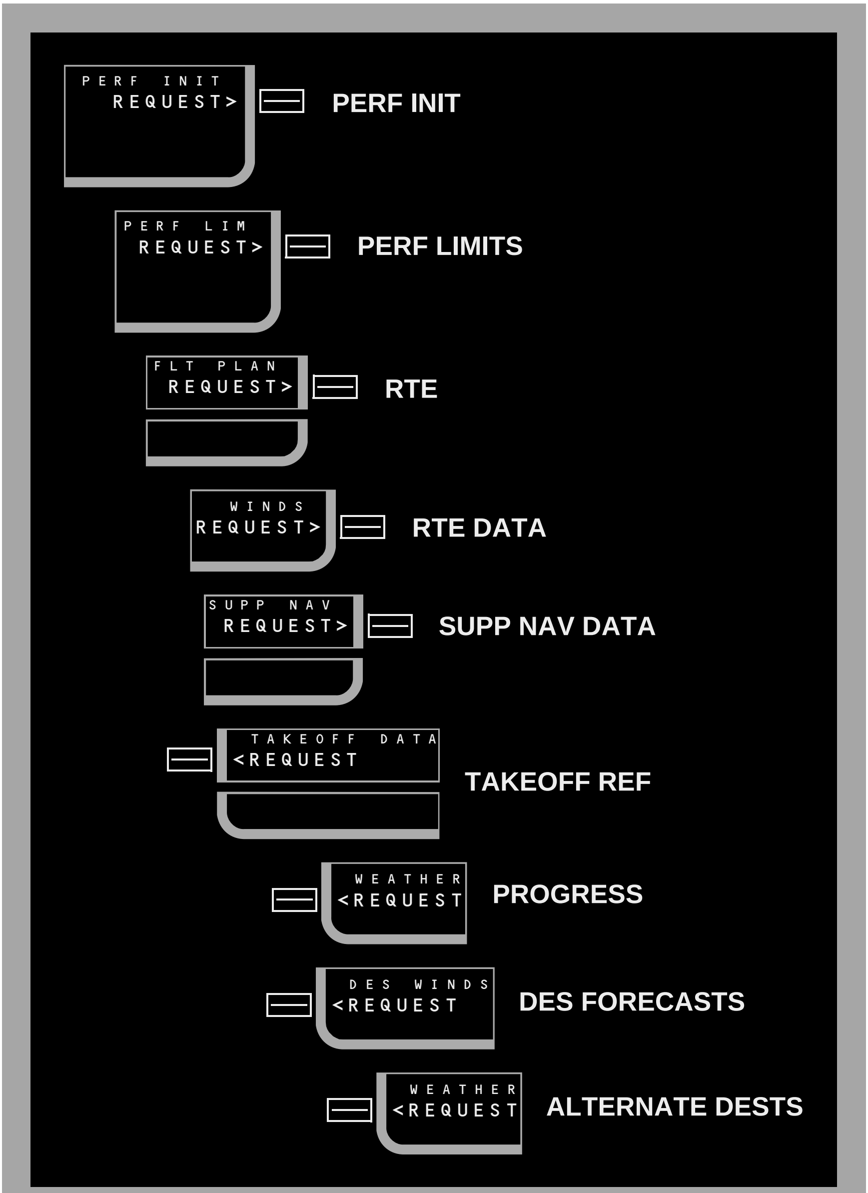
Long Delete Function

During uplink, CDU keys are ignored until data is loaded into the FMC. The uplink may be suspended by pressing and holding down the DEL key for at least one second. For all uplinks, except SUPP NAV DATA uplinks, the loaded data is then removed from the flight plan and placed back into the ready to be loaded state. Uplinks that do not generate a modified plan are reloaded when there has been no CDU pushbutton activity for 30 seconds. Uplinks that do generate a modified plan can be reloaded using the LOAD prompt on the appropriate page.

When the long delete is used during a SUPP NAV DATA uplink, the uplink is suspended, but the data loaded up to that point remains in the database. After 30 seconds of keyboard inactivity, the remaining data is loaded.

Requests

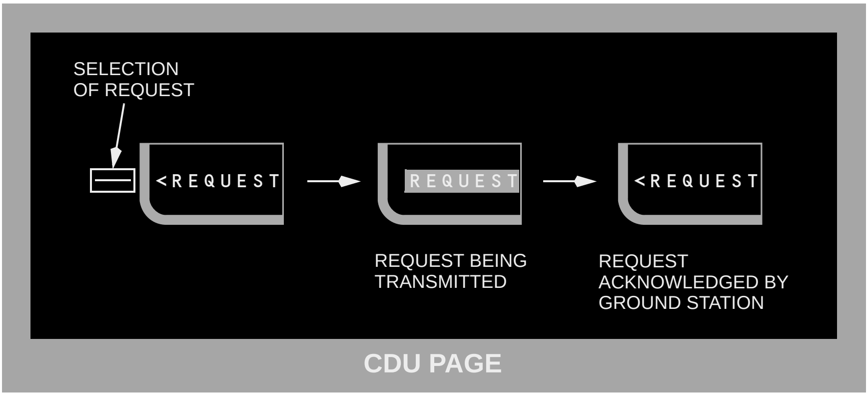
A REQUEST prompt on each page downlinks a unique request applicable to that page. The pages below contain request prompts.



CDU PAGES

Request Status

Below is a typical sequence of status in response to sending a request.



FMC Data Link Uplinks (Accept/Reject)

ACCEPT and REJECT are shown on the TAKEOFF REF 1/2 page following receipt of uplink data.

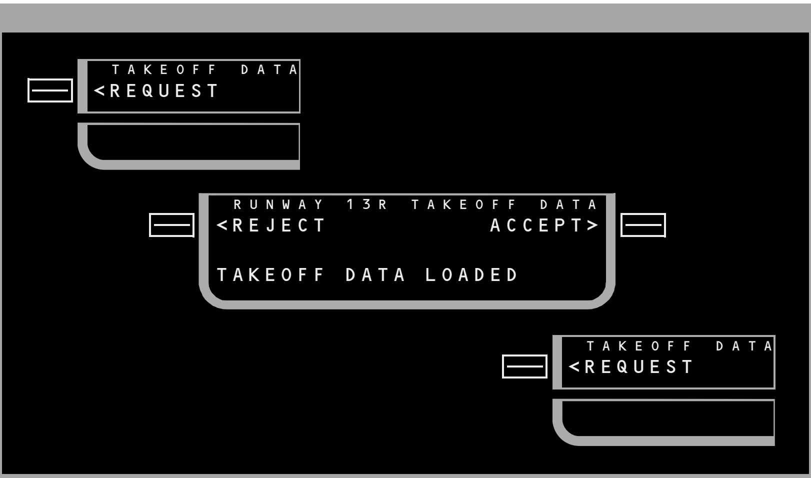
Uplink data for the current runway is shown initially in small font for preview.

Selecting ACCEPT:

- displays uplinked data in large font
- replaces previous data with uplinked data
- returns page display to normal (pre–uplink) format
- clears scratchpad message
- transmits a downlink accept message (if enabled) to acknowledge acceptance.

Selecting REJECT:

- replaces uplinked data with previous data
- returns page display to normal (pre–uplink) format
- clears scratchpad message
- transmits a downlink reject message (if enabled) to inform of rejection.



CDU PAGES

FMC Data Link Uplinks (Load/Activate/Exec)

LOAD is shown on the RTE page after receipt of uplink data. After the uplinked data is loaded, the ACTIVATE prompt is shown. After selecting ACTIVATE, the EXEC light illuminates.

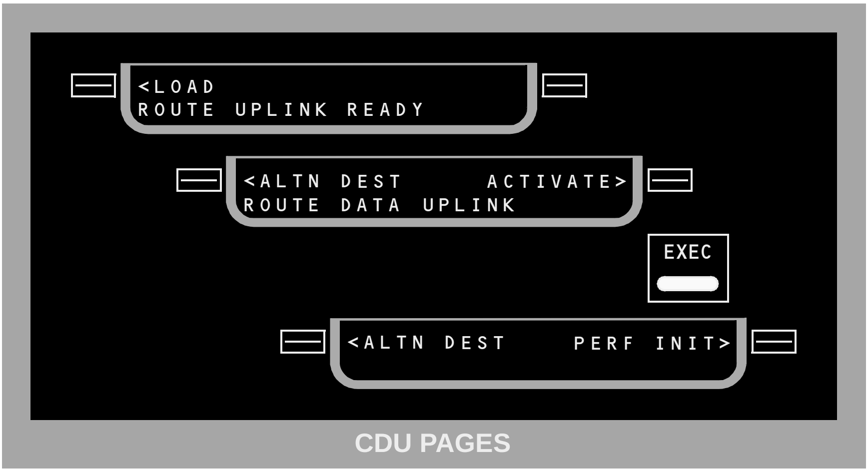
Selecting LOAD:

- loads uplinked data into FMC for viewing
- updates scratchpad message
- transmits a downlink accept message (if enabled) to acknowledge acceptance.

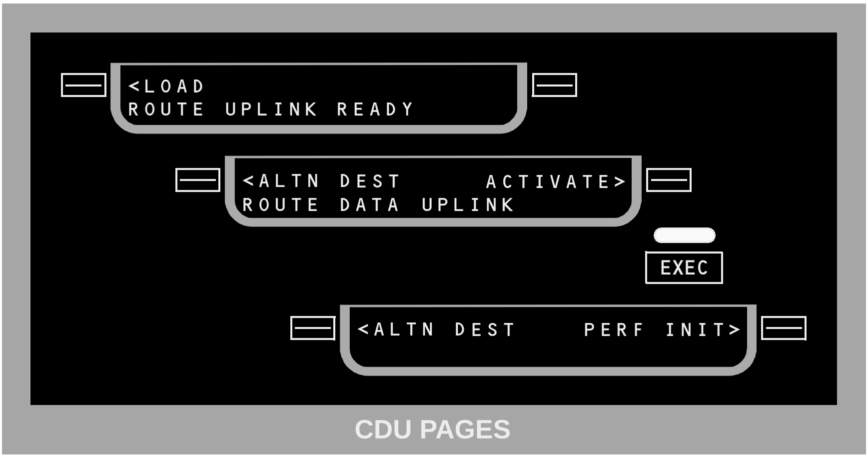
Selecting ACTIVATE and EXEC:

- puts uplinked data in active flight plan
- returns page display to normal (pre–uplink) format
- clears scratchpad message
- transmits a downlink accept message (if enabled) to acknowledge acceptance.

YA701 - YA704



YA705 - YV754



FMC Data Link Uplinks (Load/Exec–Erase)

LOAD shows on the PERF INIT, PERF LIMITS, RTE DATA, and DES FORECASTS pages after receipt of uplink data.

After the uplinked data is loaded, the EXEC light illuminates and the ERASE prompt is displayed.

Selecting LOAD:

- loads uplinked data into FMC for viewing
- updates scratchpad message
- uplinked data modifies previous data

- ERASE prompt displays
- EXEC light illuminates.

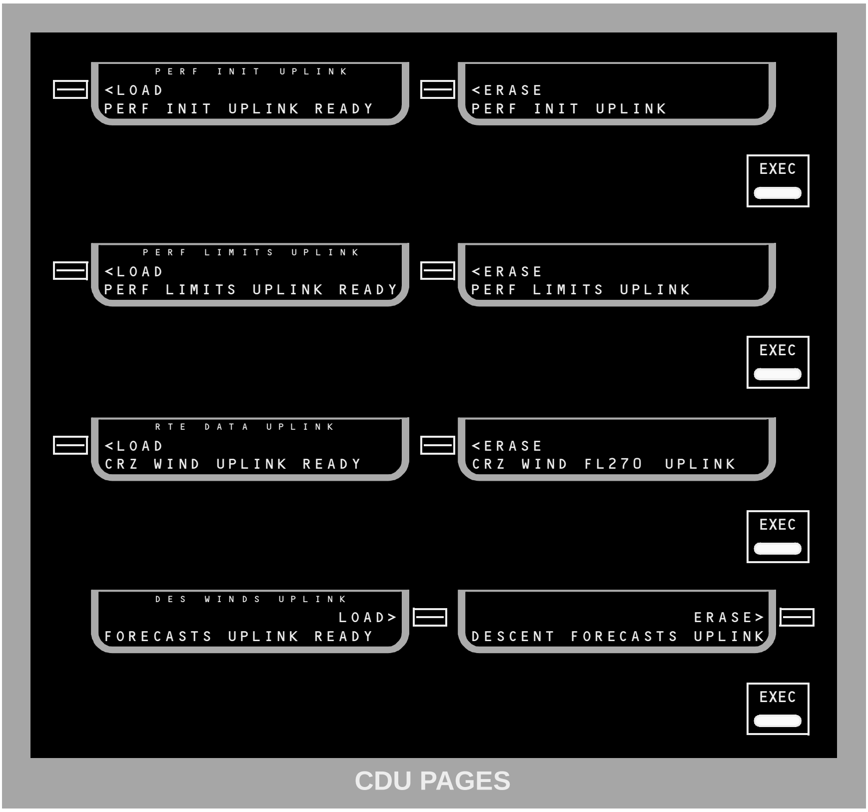
Pushing the EXEC key:

- incorporates modified data into active flight plan
- clears scratchpad message
- returns page display to normal (pre–uplink) format
- transmits a downlink accept message (if enabled) to acknowledge acceptance.

Selecting ERASE:

- removes modified data
- clears scratchpad message
- returns page display to normal (pre–uplink) format.
- transmits a downlink reject message (if enabled) to inform of rejection.

YA701 - YA704



```
PERF INIT UPLINK
<LOAD
PERF INIT UPLINK READY

<ERASE
PERF INIT UPLINK

PERF LIMITS UPLINK
<LOAD
PERF LIMITS UPLINK READY

<ERASE
PERF LIMITS UPLINK

RTE DATA UPLINK
<LOAD
CRZ WIND UPLINK READY

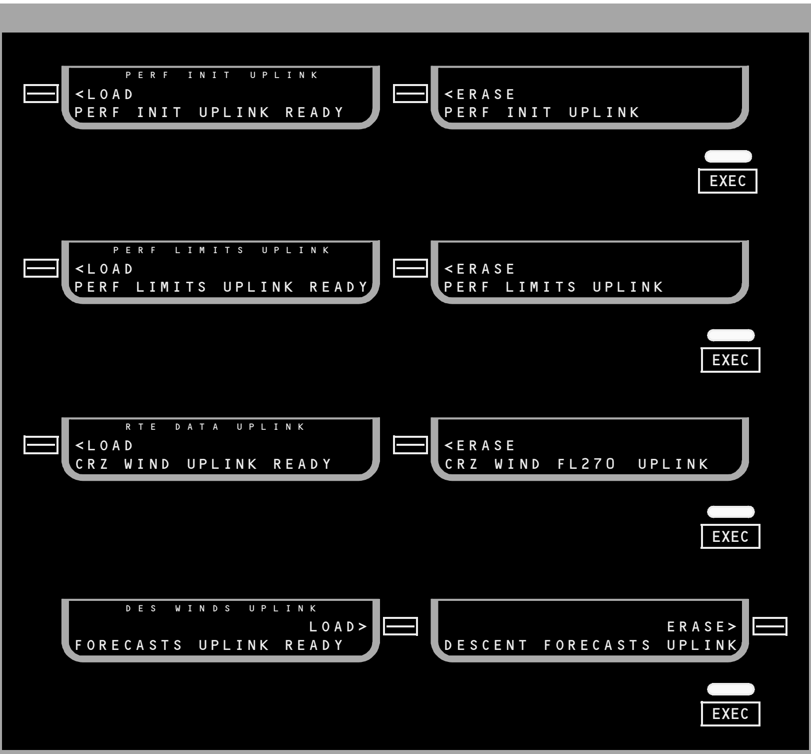
<ERASE
CRZ WIND FL270 UPLINK

DES WINDS UPLINK
LOAD>
FORECASTS UPLINK READY

ERASE>
DESCENT FORECASTS UPLINK
```

CDU PAGES

YA705 - YV754



CDU PAGES

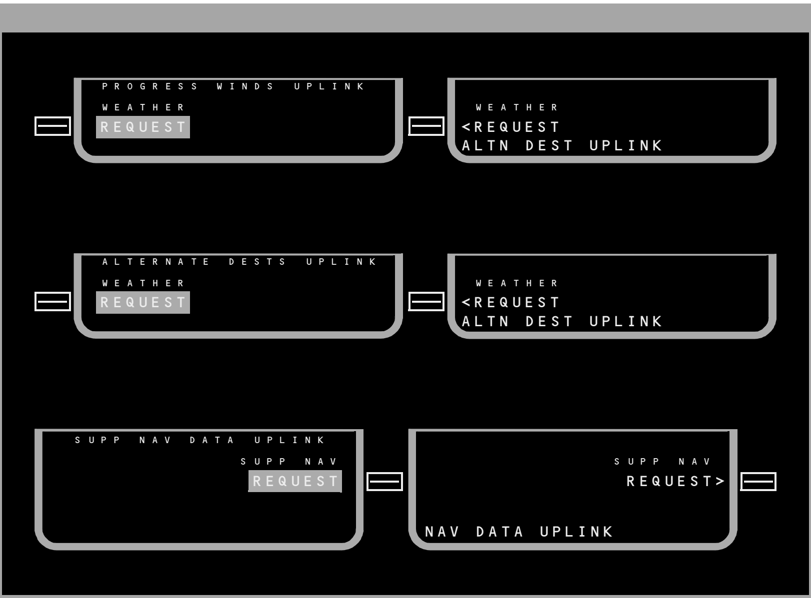
FMC Data Link Uplinks (Request)

Selecting the REQUEST prompt is the only action required to uplink data on the PROGRESS, ALTERNATE DEST, and SUPP NAV DATA pages.

After the uplinked data is loaded, an uplink message appears in the scratchpad.

Selecting REQUEST:

- loads uplinked data into FMC
- displays scratchpad message when uplink complete
- uplinked data modifies previous data.



CDU PAGES

FMC Data Link Uplinks (Automatic)

Data can be automatically uplinked.

The scratchpad message XXXXX UPLINK READY is displayed and the FMC alert light illuminates.

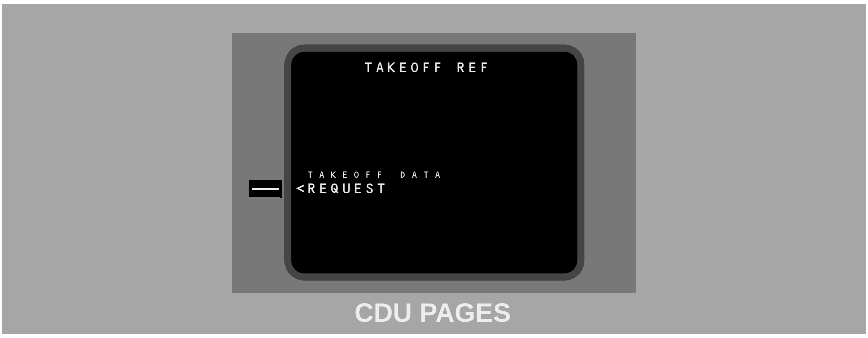
CDU PAGES

Data Link Management

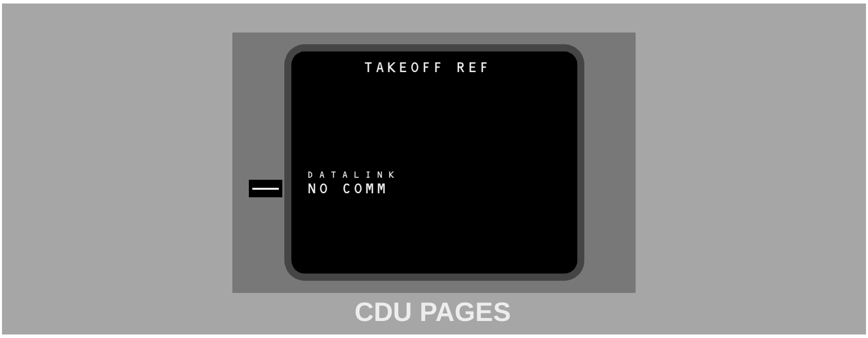
The flight crew should monitor system status of FMC data link by observing status displays on CDU pages.

CDU Data Link Status Displays

Data link operation is verified when the correct line title is above the related prompt. In the example below, the line title TAKEOFF DATA is above the REQUEST prompt on the TAKEOFF REF page.



When the data link system is not operating, CDU page prompts change to FAIL, VOICE, NO COMM or FULL and the headings change to DATALINK. A typical example is shown below.



This Section Applies to YS177 - YV754

MK2 AOA ACARS Communication

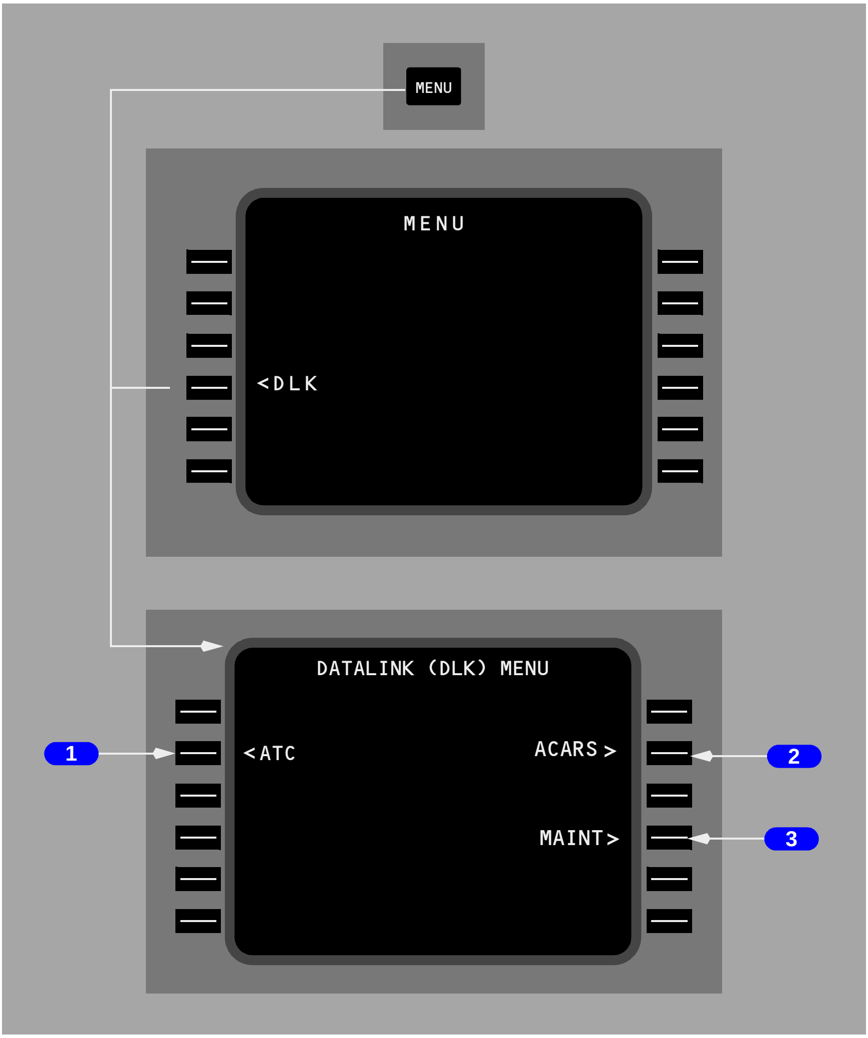
The MK2 Communication Management Unit (CMU) with AOA software, uses software programed to implement AOA communication to supplement VHF voice communication. AOA is an acronym for ACARS over AVLC (Aviation VHF Link Control). The AVLC protocol in the core software enables the

Airline Operational Command (AOC) and ATS data to be sent over a digital air/ground communications network.

Note: In the AOA/ACARS only configuration not all Line Select positions (LSK) are available even though they are depicted on the CDU screen. Only those positions with an appended "< or >" carrot are selectable.

Note: The following section describes the manufacturer provided ACARS system. Each customers airplanes can be equipped with a dedicated company ACARS system that may differ from the following pages.

Data Link (DLK) Main Menu



1 Air Traffic Control (ATC)

Push – selects DLK ATC MENU page as the system for which the MCDU will be active in providing control/display function.

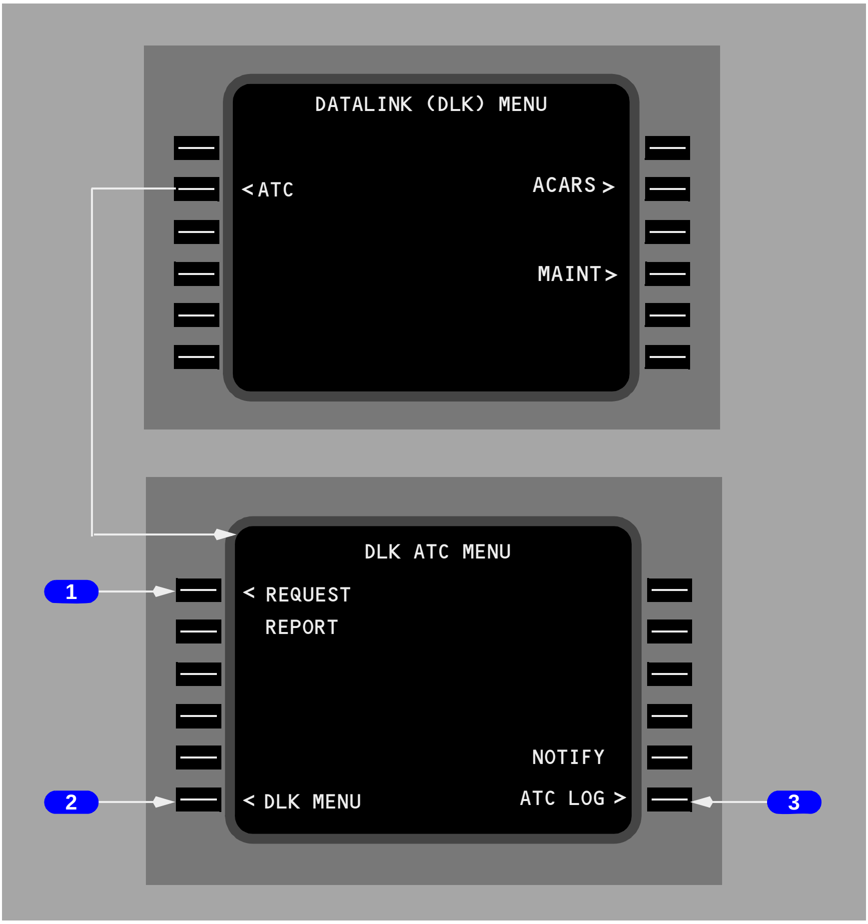
2 Aircraft Addressing Reporting System (ACARS)

Push – selects ACARS if activated. The ACARS menu is unique to each customer and is not covered.

3 **Maintenance (MAINT)**

Push – selects ACARS maintenance menu when ACARS option has been activated.

Data Link – DLK ATC MENU



1 **REQUEST**

Push – selects ATC REQUEST Menu page.

2 **DLK MENU**

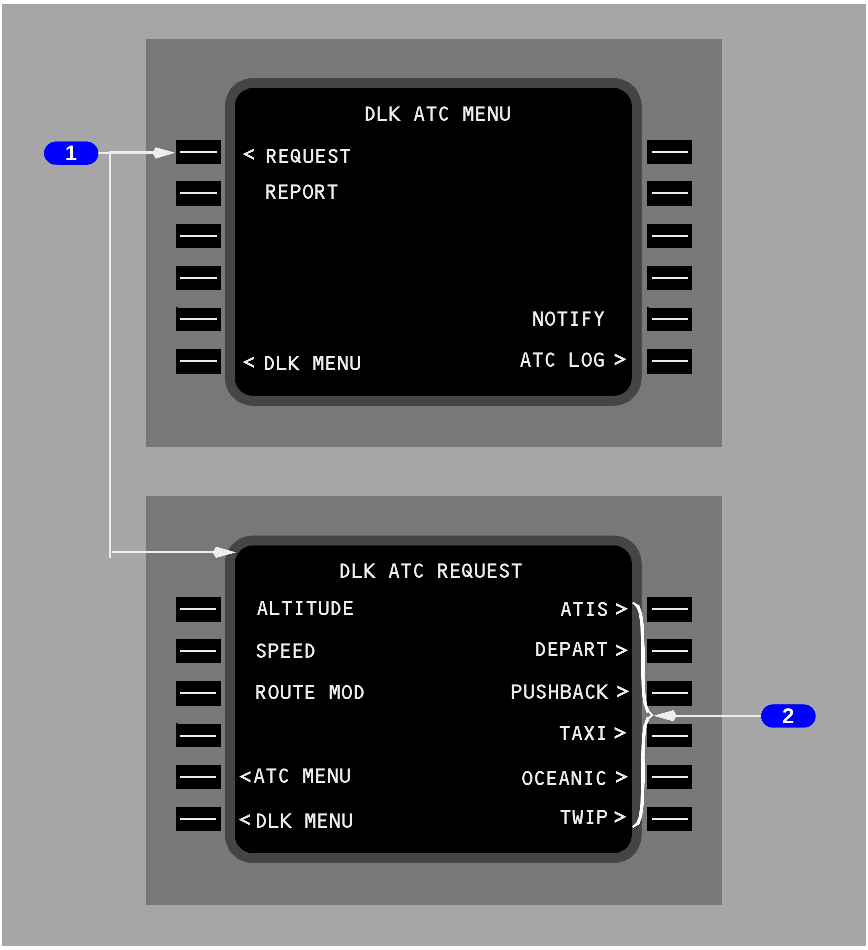
Push – returns crew member to DATALINK (DLK) MENU PAGE.

3 ATC LOG

Push – selects DLK ATC MSG LOG so ATC messages can be reviewed.

Datalink ATC Request – (DLK ATC REQUEST)

Access to screens for creating ATC request downlinks is provided by the ATC request menu. Requested downlinks are organized by the type of message and change requested. When a request message is sent, the system begins a dialogue record which inhibits creating any other request messages of that type until the dialogue is completed.



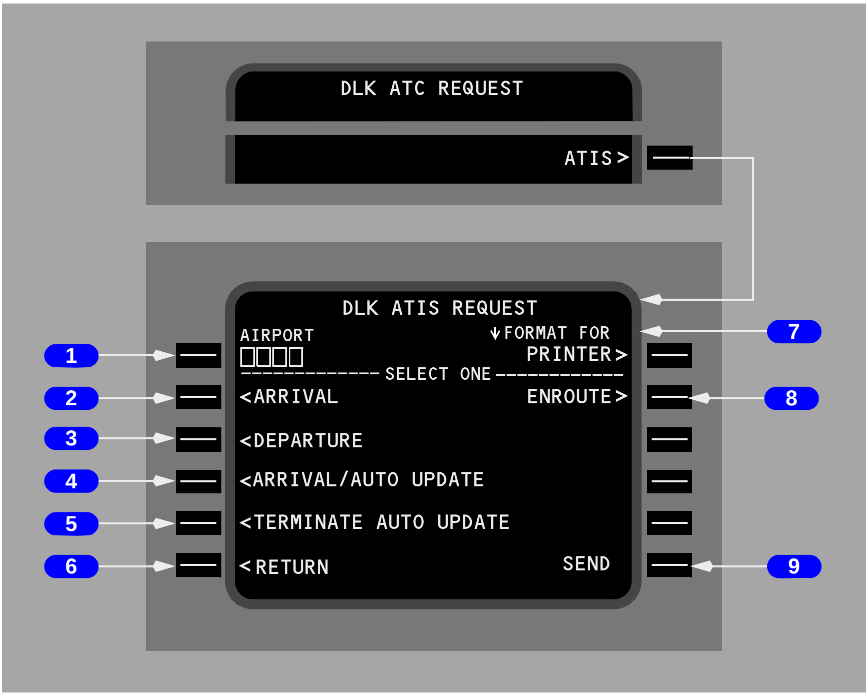
1 REQUEST

Push – selects DLK ATC REQUEST Menu page.

2 AOA/ACARS Function Selections

Push – selects requested page.

ATIS REQUEST



1 AIRPORT

Enter – airport code for requested ATIS information.

2 ARRIVAL

Push – selects arrival ATIS request.

3 DEPARTURE

Push – selects departure ATIS request information.

4 ARRIVAL/AUTO UPDATE

Push – selects automatically updated arrival ATIS information.

5 TERMINATE AUTO UPDATE

Push – terminates auto update feature.

6 RETURN

Push – returns crew member to previous screen.

7 FORMAT FOR

If the crew prefers that the uplink format be optimized for the MCDU then the crew toggles the prompt FORMAT FOR (LSK 1R) to display MCDU. If the crew prefers the uplink format to be optimized for the printer then the crew toggles the prompt FORMAT FOR (LSK 1R) to display PRINTER.

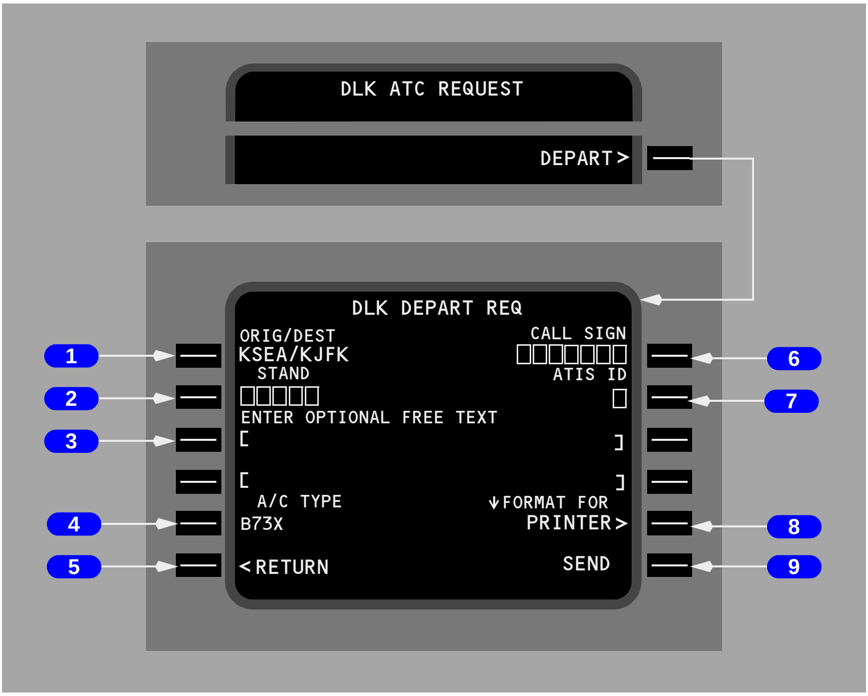
8 ENROUTE

Push – selects information request for enroute weather.

9 SEND

After a selection has been made, sends down link request.

Departure Clearance Request – (DLK DEPART REQ)



```
        DLK ATC REQUEST

                       DEPART>
```

```
        DLK DEPART REQ
ORIG/DEST              CALL SIGN
KSEA/KJFK               □□□□□□□
 STAND                   ATIS ID
□□□□□                          □
ENTER OPTIONAL FREE TEXT
[                              ]

[                              ]
 A/C TYPE            ↓FORMAT FOR
B73X                    PRINTER>

<RETURN                    SEND
```

1 Airport Origin and Destination – (ORIG/DEST)

Enter – “if needed” the Origin and Destination as shown on the ATC Flight Plan.

2 STAND

Enter – airplane STAND or Gate location at origination airport.

3 ENTER OPTIONAL FREE TEXT

Enter – optional free text to be sent with departure request.

4 Aircraft Type – A/C TYPE

Enter – “if needed” aircraft type.

5 RETURN

Push – returns crew member to previous screen.

6 CALL SIGN

Enter – ATS flight identifier call sign.

7 ATIS ID

Enter – latest ATIS ID identifier code.

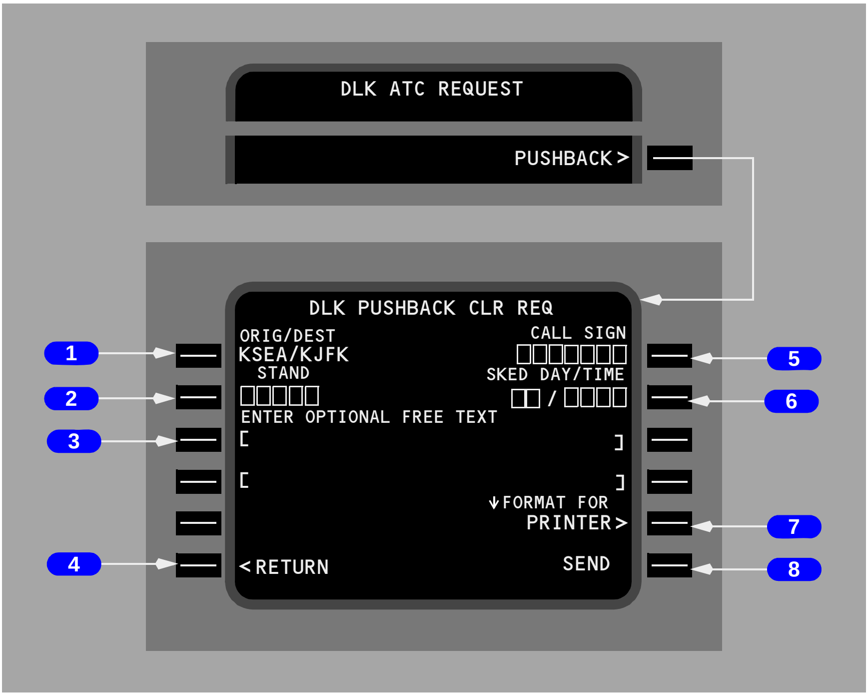
8 FORMAT FOR

If the crew prefers the uplink format to be optimized for the MCDU then the crew toggles the prompt FORMAT FOR (LSK 5R) to display MCDU. If the crew prefers the uplink format to be optimized for the printer then the crew toggles the prompt FORMAT FOR (LSK 5R) to display PRINTER.

9 SEND

After a selection has been made, sends down link request.

Pushback Clearance Request – (DLK PUSHBACK CLR REQ)



1 Airport Origin and Destination – (ORIG/DEST)

Enter – “if needed” the Origin and Destination as shown on the ATC Flight Plan.

2 STAND

Enter – airplane STAND or Gate location at origination airport.

3 ENTER OPTIONAL FREE TEXT

Enter – optional free text to be sent with departure request.

4 RETURN

Push – returns crew member to previous screen.

5 CALL SIGN

Enter – ATS flight identifier call sign.

6 Scheduled Day/Time of Departure – SKED DAY/TIME

Enter – scheduled day and time of departure.

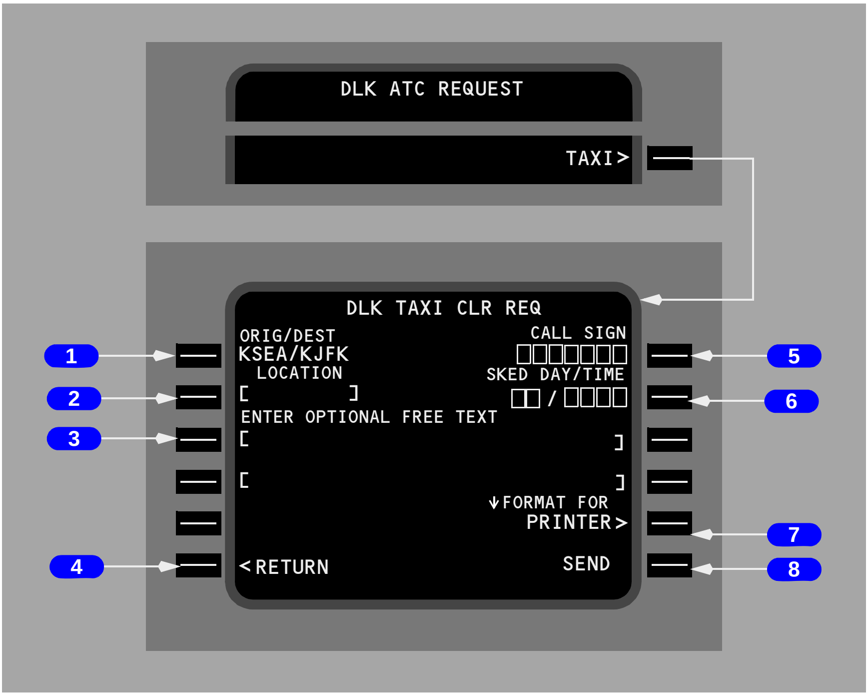
7 FORMAT FOR

If the crew prefers the uplink format to be optimized for the MCDU then the crew toggles the prompt FORMAT FOR (LSK 5R) to display MCDU. If the crew prefers the uplink format to be optimized for the printer then the crew toggles the prompt FORMAT FOR (LSK 5R) to display PRINTER.

8 SEND

Push – after all data fields have been entered, position becomes active and down link request is sent.

Taxi Clearance Request – (DLK TAXI CLR REQUEST)



1 Airport Origin and Destination – (ORIG/DEST)

Enter – “if needed” the Origin and Destination as shown on the ATC Flight Plan.

2 LOCATION

Enter – location on airport to begin taxi clearance from.

3 ENTER OPTIONAL FREE TEXT

Enter – optional free text to be sent with departure request.

4 RETURN

Push – returns crew member to previous screen.

5 CALL SIGN

Enter – ATS flight identifier call sign.

6 Scheduled Day/Time of Departure – SKED DAY/TIME

Enter – scheduled day and time of departure.

7 FORMAT FOR

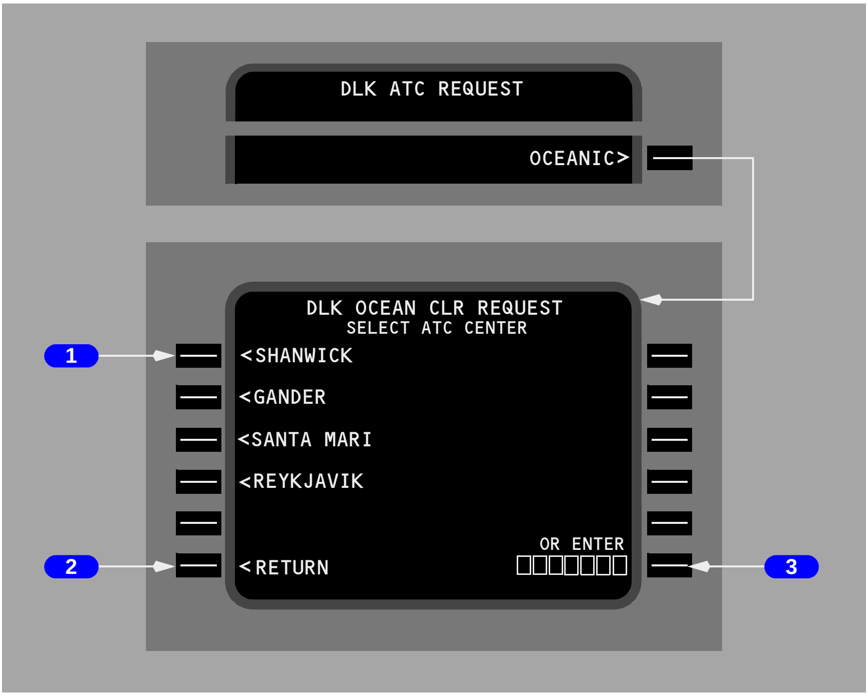
If the crew prefers the uplink format to be optimized for the MCDU then the crew toggles the prompt FORMAT FOR (LSK 5R) to display MCDU. If the crew prefers the uplink format to be optimized for the printer then the crew toggles the prompt FORMAT FOR (LSK 5R) to display PRINTER.

8 SEND

Push – after all data fields have been entered, position becomes active and down link request is sent.

Oceanic Clearance Request – (DLK OCEAN CLR REQUEST)

Select Oceanic ATC Center



1 ATC Center

Push – selects one of displayed ATC centers for oceanic clearance request.

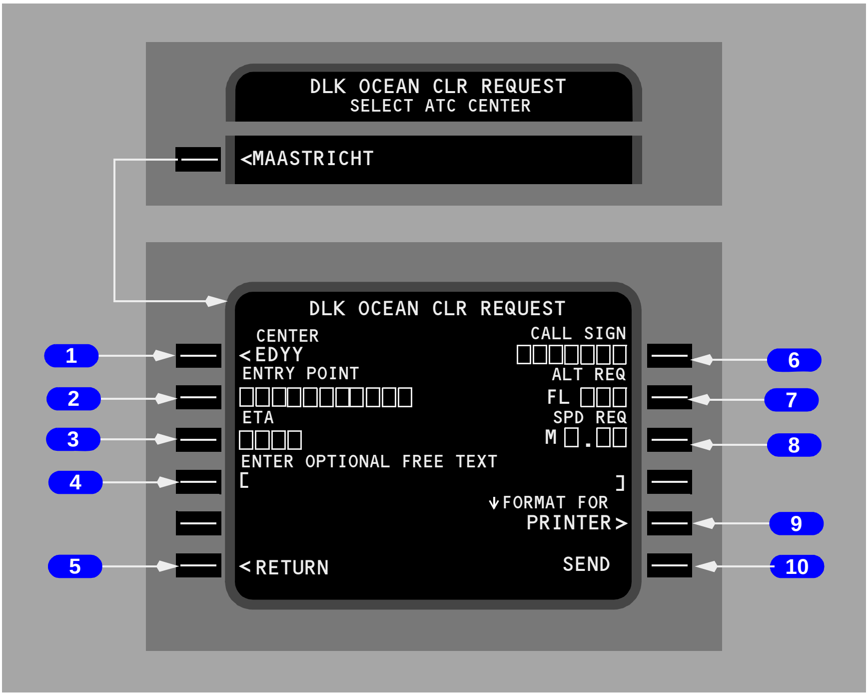
2 RETURN

Push – returns crew member to previous screen.

3 Entered ATC Center – OR ENTER

If the correct ATC Center is not displayed enter the correct ATC Center for the requested Oceanic clearance.

Oceanic Clearance Request – DLK OCEAN CLR REQUEST



1 CENTER

Selected or entered ATC Center.

2 ENTRY POINT

Enter – selected ATC Centers controlled airspace entry point.

3 Estimated Time of Arrival – ETA

Enter – the estimated time of arrival at the entry point.

4 ENTER OPTIONAL FREE TEXT

Enter – optional free text to be sent with departure request.

5 RETURN

Push – returns crew member to previous screen.

6 CALL SIGN

Enter – ATS flight identifier call sign.

7 Altitude Requested – ALT REQ

Enter – requested altitude at entry point.

8 Speed Request – SPD REQ

Enter – requested air speed at entry point.

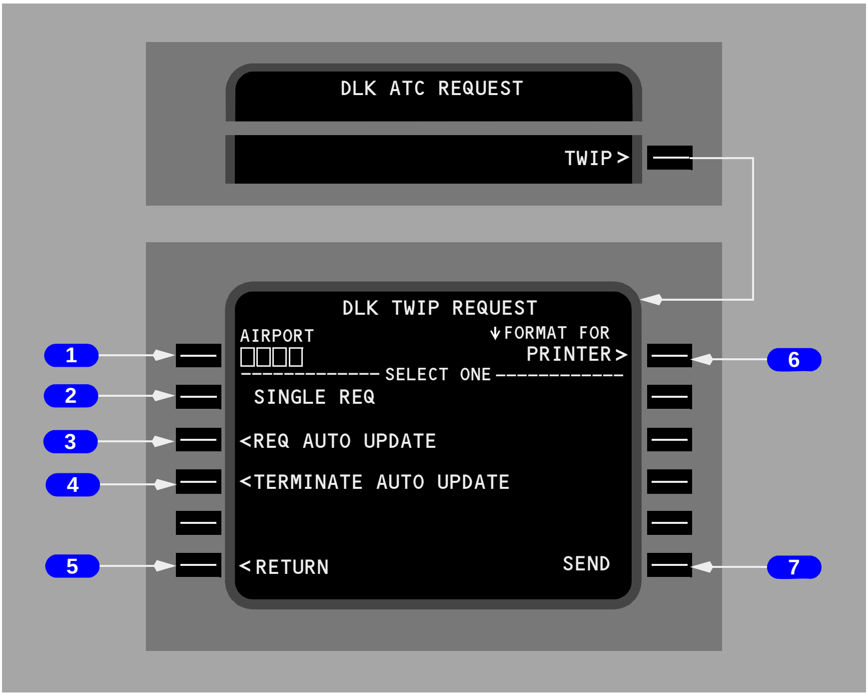
9 FORMAT FOR

If the crew prefers the uplink format to be optimized for the MCDU then the crew toggles the prompt FORMAT FOR (LSK 5R) to display MCDU. If the crew prefers the uplink format to be optimized for the printer then the crew toggles the prompt FORMAT FOR (LSK 5R) to display PRINTER.

10 SEND

Push – after all data fields have been entered, position becomes active and down link request is sent.

Terminal Weather Information for Pilots – (DLK TWIP REQUEST)



1 AIRPORT

Enter – airport for requested weather report.

2 Single Request – SINGLE REQ

Push – makes single TWIP request.

3 Request Automatic Updates – REQ AUTO UPDATE

Automatically updates the TWIP report.

4 Terminate Automatic Updates – TERMINATE AUTO UPDATE

Stops the automatic updating of the TWIP report.

5 RETURN

Push – returns crew member to previous screen.

6 FORMAT FOR

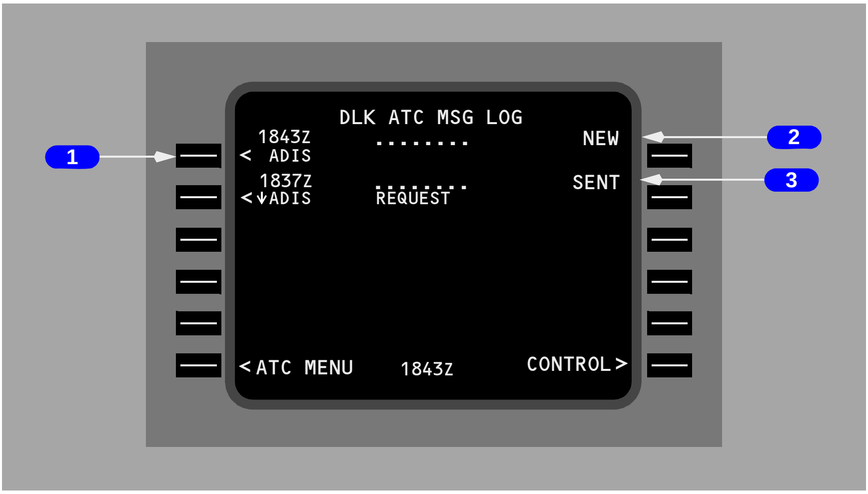
If the crew prefers the uplink format to be optimized for the MCDU then the crew toggles the prompt FORMAT FOR (LSK 1R) to display MCDU. If the crew prefers the uplink format to be optimized for the printer then the crew toggles the prompt FORMAT FOR (LSK 1R) to display PRINTER.

7 SEND

Push – after all data fields have been entered, position becomes active and down link request is sent.

ATC Message Log – (DLK ATC MSG LOG)

The ATC log contains all messages with special logic for prioritizing each messages. The ATC MSG LOG screen is able to display up to 100 message titles.



1 ATC Message

Push – expands message so entire content can be reviewed.

2 NEW or OPEN

The log will place the messages with a message status of NEW or OPEN

If the timer runs out before the Controller responds then the message status changes to EXPIRED.

3 SENT

The screen changes automatically to the DLK ATC MSG LOG after sending a request. A downlinked message is indicated by a downward arrow with a status of SENDING which changes (3 to 6 seconds) to SENT.

Intentionally
Blank

Flight Management, Navigation Chapter 11

FMC Preflight Section 40

Introduction

Completion of the FMC preflight requires data entry in all minimum required data locations. Completing all required and optional preflight data entries ensures the most accurate performance possible.

Data link can be used to load preflight data from airline ground stations. Using data link reduces the required crew actions. Manual crew entries replace existing data. Data link can also be used to load takeoff data onto the TAKEOFF REF pages.

Preflight Page Sequence

The normal preflight sequence follows paging prompts on each CDU page.

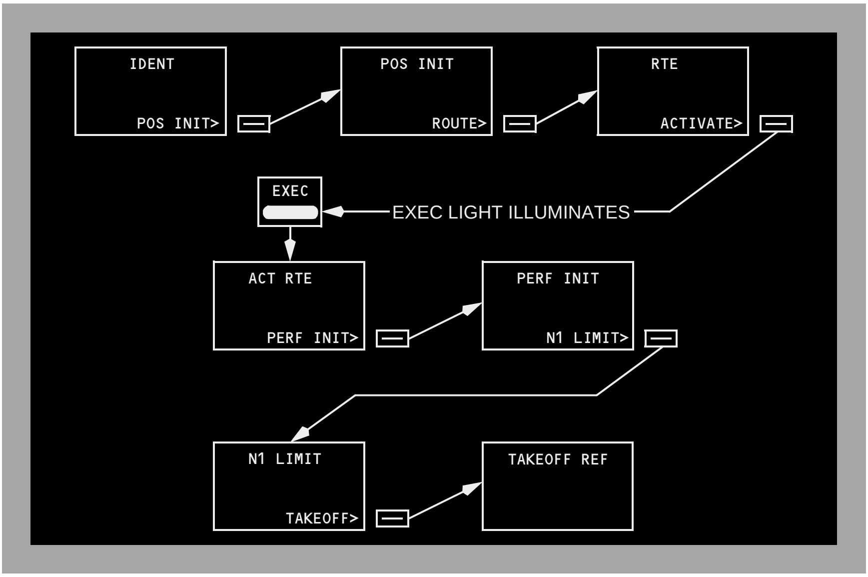
The normal FMC power–up page is the identification page. Preflight flow continues in this sequence:

- identification (IDENT) page
- position initialization (POS INIT) page
- route (RTE) page
- DEPARTURES page (no automatic prompt)
- performance initialization (PERF INIT) page
- with U10.1 or later installed:
  - N1 LIMIT page
  - takeoff reference (TAKEOFF REF) page.

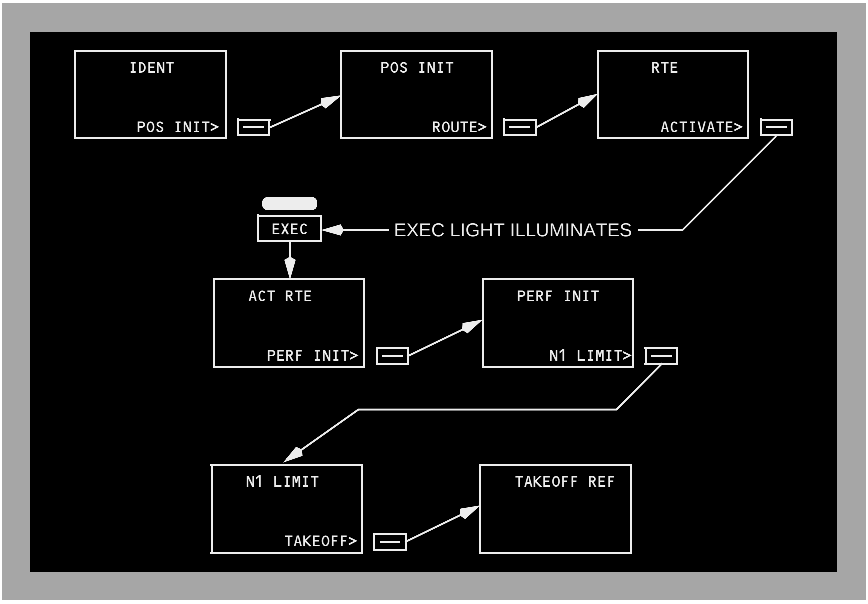
Some of these pages are also used in flight.

Minimum Preflight Sequence

YA701 - YA704



YA705 - YV754



During preflight, a prompt in the lower right of the CDU page automatically directs the crew through the minimum requirements for preflight completion. Pushing the prompt key for the next page in the flow presents new entry requirements. Additional entries are made on pages to refine the performance and route calculations. If a required entry is missed, a prompt on the TAKEOFF page leads the crew to the preflight page that is missing data.

The airplane inertial position is required for FMC preflight and flight instrument operation.

A route must be entered and activated. The minimum route information is origin and destination airports and a route leg.

Performance information requires the airplane weight and cruising altitude.

Supplementary Pages

Supplementary pages are sometimes required. These pages must be manually selected. Manual selection interrupts the normal automatic sequence. Discussions of each normal page include methods to display the page when the automatic sequence is interrupted.

When the route includes SIDs and STARs, they can be entered into the preflight using the DEPARTURES or ARRIVALS pages.

Route discontinuities are removed, the route is modified, and speed/altitude restrictions are entered on the RTE LEGS page. The RTE LEGS page is described in the FMC Takeoff and Climb and FMC Cruise sections of this chapter.

Waypoint, navigation, airport, and runway data is referenced on the REF NAV DATA page or the SUPP NAV DATA page. The REF NAV DATA page and SUPP NAV DATA page are described in the FMC Cruise section of this chapter.

VNAV performance is improved if the forecast winds and temperatures are entered during the preflight.

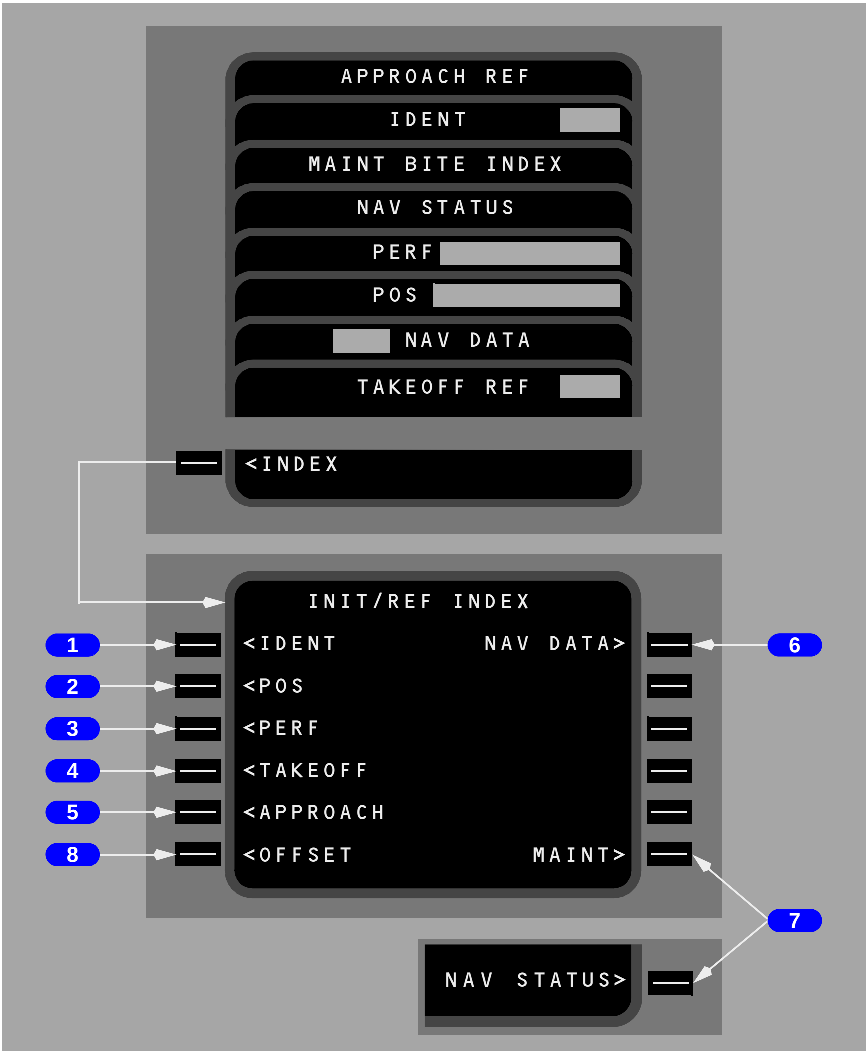
A single wind and temperature for cruise may be entered on the PERF INIT page. Wind and temperature data for specific cruise waypoints are entered on the RTE DATA page. The RTE DATA page is described in the FMC Cruise section. Wind and temperature for descent is entered on the DES FORECASTS page. The DES FORECASTS page is described in the FMC Descent section.

Preflight Pages

The preflight pages are presented in the sequence used during a typical preflight.

Initialization/Reference Index Page

The initialization/reference index page provides manual selection of FMC pages. It provides access to pages used during preflight and not normally used in flight.



1 IDENT

Push – displays the IDENT page, the first page in the automatic preflight sequence.

2 Position Initialization (POS)

- Push – displays the POS INIT page used for IRS initialization.
- POS INIT page is also used to enter/update magnetic heading for an IRS which is in the ATT mode.

3 Performance Initialization (PERF)

Push – displays the PERF INIT page for initialization of data required for VNAV operations and performance predictions.

4 Takeoff Reference (TAKEOFF)

Push – displays the TAKEOFF REF page to enter takeoff reference information and V speeds.

5 APPROACH

Push – displays the APPROACH REF page for entry of the approach VREF speed.

6 Navigation Data (NAV DATA)

Push – displays the REF NAV DATA page to display information about waypoints, navaids, airports, and runways. On the ground, displays the SUPP NAV DATA page if SUPP is entered in the scratchpad prior to selection.

7 Maintenance (MAINT) or Navigation Status (NAV STATUS)

- MAINT – On ground only.
  Push – displays maintenance pages for maintenance use.
- NAV STATUS – Replaces MAINT prompt when in air.
  Push – displays NAV STATUS page which shows status of navigation aids being tuned by the FMC. Replaces MAINT prompt when in air.

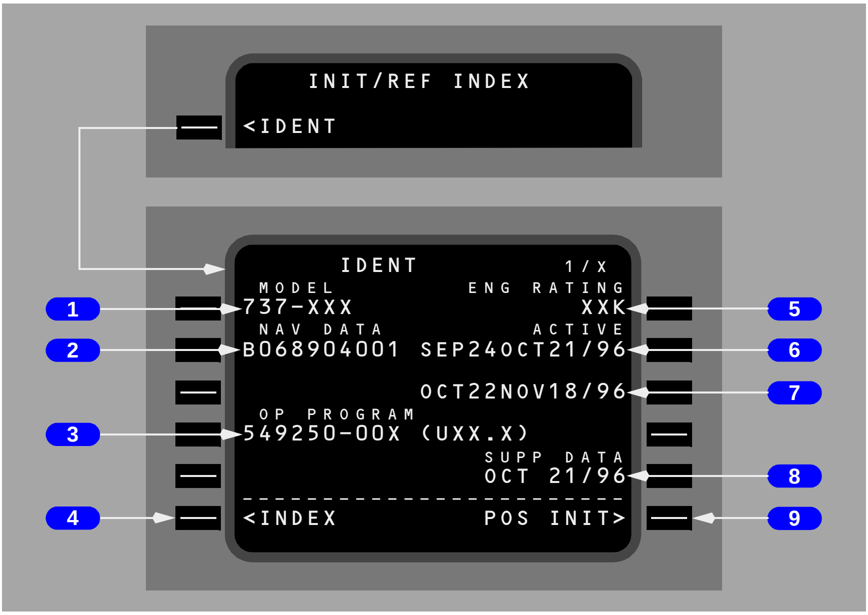
8 OFFSET

Push – displays the LATERAL OFFSET page for initiating a lateral offset.

Identification Page

Most of the data on this page is for crew verification. Active date accepts manual entries.

The crew verifies FMC data and selects a navigation database on the identification page.



1 MODEL

Displays the airplane model from the FMC performance database (e.g., 737–600, 737–700, 737–800 or 737-900).

YF048 - YV754
Airplanes with winglets will have a W appended to the model number (e.g. 737-600W, 737-700W, 737-800W or 737-900W).

YV604, YV605
Note: A model with a .1 appended to it indicates an airplane with a Short Field Performance package and a one-position tail skid (e.g. 737-800.1 or 737-800W.1).

2 Navigation Data (NAV DATA)

Displays the navigation database identifier.

3 Operational Program (OP PROGRAM)

Displays the Boeing software part number and update version. Update version installed at delivery:

YA701 - YT513, YV604, YV605
- Update 10.8A (U10.8A)

YT514 - YT521, YV741 - YV754
- Update 12.0 (U12.0)

4 INDEX

Push – displays the INIT/REF INDEX page.

5 Engine Rating (ENG RATING)

Displays the engine thrust stored in the FMC performance database (e.g., 20K, 22K, 24K, 26K or 27K).

YN531 - YN534
The engine thrust stored in the FMC performance database will show 24A as the full engine rating, in lieu of 24K.

6 ACTIVE Date Range

Displays the effectivity date range for the active navigation database.

Database activation is accomplished by pushing the proper date range prompt to copy that date into the scratchpad. The scratchpad date may then be transferred to the ACTIVE database line. The previous active date moves down to the inactive date line.

The ACTIVE label appears above the active navigation database date. No label appears above the inactive navigation database date. The navigation database date can be changed only on the ground. Changing the navigation database removes all previously entered route data.

When an active database expires in flight, the expired database continues to be used until the active date is changed after landing.

7 Inactive Date Range

Displays the effectivity date range for the inactive navigation database.

8 Supplemental Data (SUPP DATA)

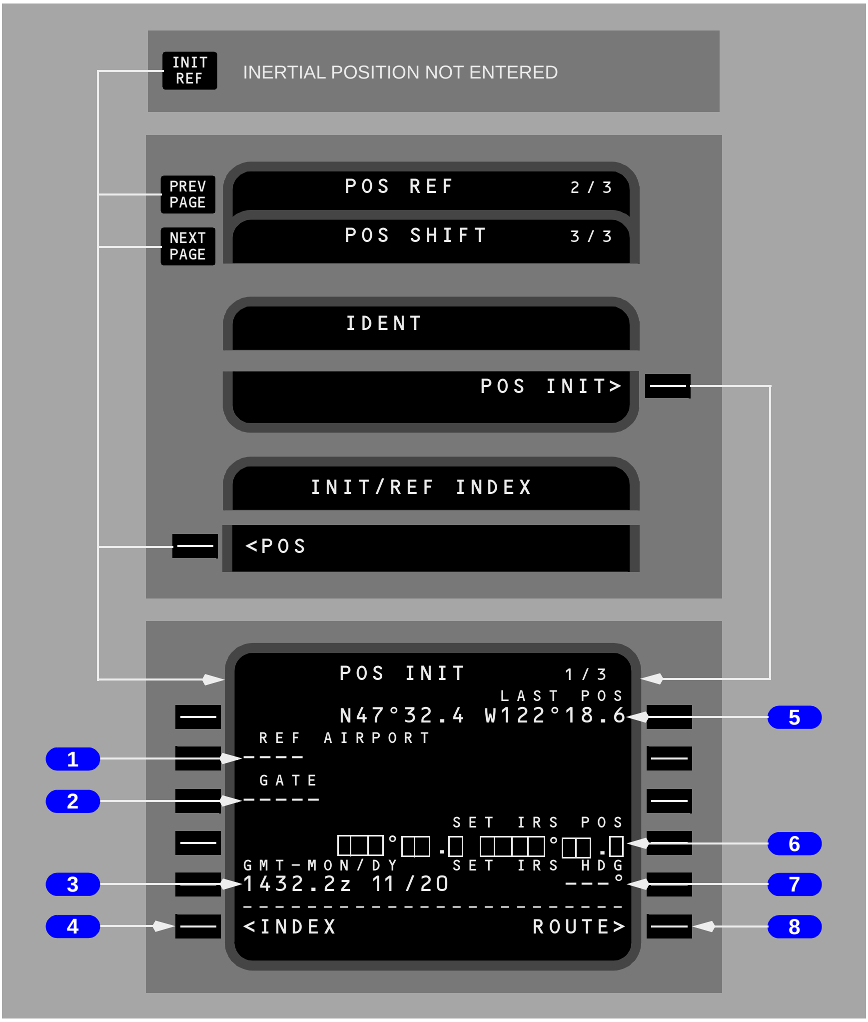
Displays the effective date of supplemental data. Blank if supplemental database is empty.

9 Position Initialization (POS INIT)

Push – displays the POS INIT page.

Position Initialization Page 1/3

The position initialization page 1/3 allows airplane present position entry for IRS alignment and FMC initialization. The same page is used to enter/update the magnetic heading for an IRS which is in the ATT mode. There are three POS pages.



① Reference Airport (REF AIRPORT)

The reference airport entry allows entry of the current airport for display of the airport latitude/longitude.

Optional entry.

Valid entries are ICAO four letter airport identifiers.

Displays the latitude and longitude of the reference airport.

Removes previous GATE entry.

Entry blanks at lift–off.

2 GATE

The gate entry allows further refinement of the latitude/longitude position.

Optional entry after the reference airport is entered.

Valid entry is a gate number at the reference airport.

Displays the latitude and longitude of the reference airport gate from the navigation database.

Changes to dashes when a new reference airport is entered.

Entry blanks at lift–off.

3 GMT – Month/Day (GMT – MON/DY)

Displays GPS time and date. If the GPS time is not valid, GMT starts at 0000.0Z when the FMC is first powered. MON/DY is blank. Manually enter the correct GMT.

4 INDEX

Push – displays the INIT/REF INDEX page.

5 Last Position (LAST POS)

Displays the last FMC computed position.

6 Set IRS Position (SET IRS POS)

The set inertial position entry is required to initialize the IRS. Select the most accurate latitude/longitude for the initialization. A displayed latitude/longitude can be selected or a manual entry can be used.

If an entry is not made before the IRS finishes the initial alignment, the scratchpad message ENTER IRS POS is displayed.

Failure of the manually entered position to pass the IRS internal check displays the scratchpad message ENTER IRS POS.

Enter airplane position latitude and longitude.

Box prompts are displayed when either IRS is in the ALIGN mode and IRS present position has not been entered.

Blanks when the IRS transitions from the alignment to the navigation mode.

7 Set IRS Heading (SET IRS HDG)

Enter/update magnetic heading for any IRS which is in ATT mode. Line blanks when IRS not in ATT mode.

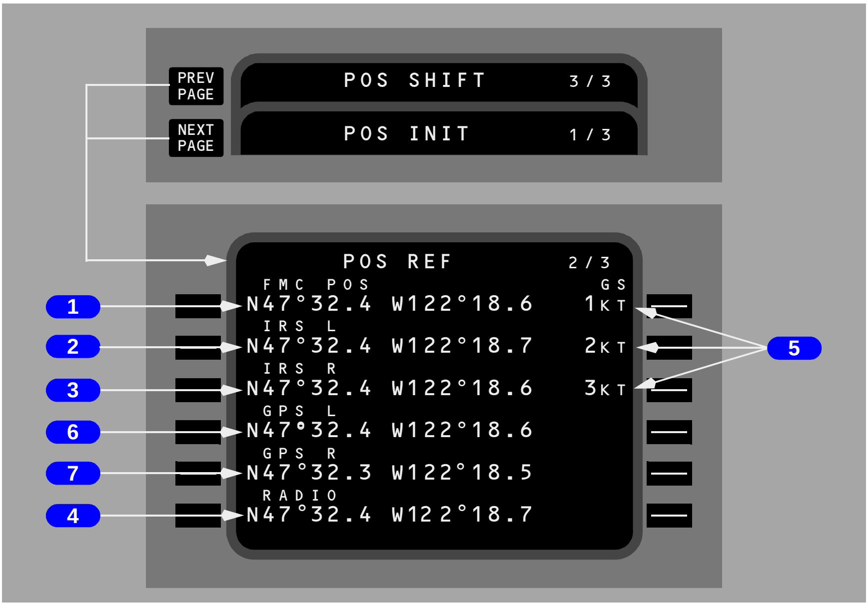
8 ROUTE

Push – displays the ROUTE page.

Position Reference Page 2/3

Position reference page 2 displays the airplane positions as calculated by the FMC, IRS, GPS, and radio navigation receivers.

This page displays latitude/longitude. All position displays are in actual latitude and longitude, as calculated by the respective system. Ground speed is displayed for the FMC and each IRS.



1 FMC Position (FMC POS)

Displays the FMC calculated latitude/longitude.

Blank if FMC position is invalid.

2 IRS L

Displays the latitude/longitude position as determined by the left IRS.

Blank if IRS position is invalid.

3 IRS R

Displays the latitude/longitude position as determined by the right IRS.

Blank if IRS position is invalid.

4 RADIO

Displays the latitude/longitude position as determined by the navigation radios.

Blank if on the ground or if radio position is invalid in flight.

5 Groundspeed (GS)

Displays the ground speed for FMC and IRS.

Blank if ground speed of related system is invalid.

6 GPS L

Displays the latitude/longitude position as determined by the left GPS.

Blank if GPS position is invalid.

7 GPS R

Displays the latitude/longitude position as determined by the right GPS.

Blank if GPS position is invalid.

Route Page 1/X

The route is entered and displayed in air traffic control format.

The first route page displays origin and destination data. Route segments are displayed on subsequent route pages.

Individual portions of the route may be manually entered by the flight crew. An pre–defined route may be loaded using the CO ROUTE line. CO ROUTE entries must correspond to a company defined route in the navigation database.

YA701 - YT513, YV604, YV605
The route may also be uplinked.

YT514 - YT521, YV741 - YV754
The route x (1 or 2) may also be uplinked.

Route 2 Feature

YT514 - YT521, YV741 - YV754
RTE 2 adds the capability of a second route to the existing FMC software and adds new prompts to the RTE and RTE LEGS pages that allows access to the second route. The DEP/ARR Index page is updated to access the Departures and Arrivals for the second route.

RTE 2 adds the capability to Activate, Predict and Erase a second route. The Active Route can also be copied "COPY" into the second route. All flight planning capabilities, are available for the second route with the exception of Lateral Offsets and Direct To processing. The RTE 2 Feature also adds the capability of entering a departure runway in the air. The ERASE capability allows the crew to deactivate an activated plan. This allows the crew to use the second route as a "what if" predictor

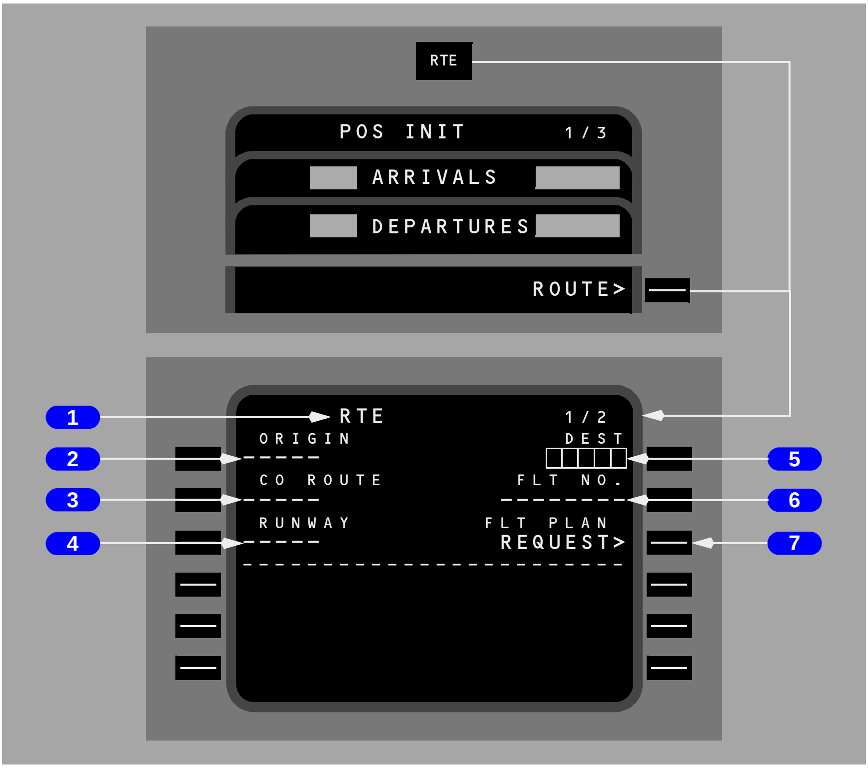
Messages that reference a route, have been update to reflect the route to which they apply (i.e., PARTIAL ROUTE LOADED has been changed to PARTIAL ROUTE X LOADED).

The ACARS functions are included with the second Route.

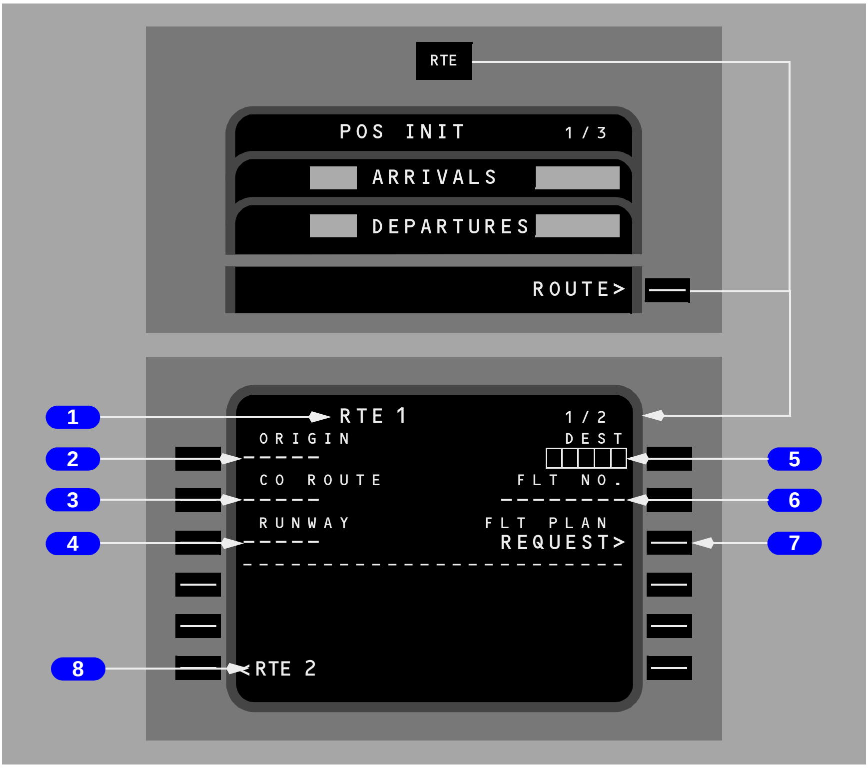
Adding the second Route requires a separate set of Inactive Performance Data for "what if" predictions. This is accomplished by adding an inactive state to the Perf Init page when the Inactive Plan is activated. When an Inactive Plan becomes activated, the ACT PERF INIT is demoted back to an INACT PERF INIT page. Demoting means that the ACT will no longer be displayed in the title and ERASE for the ACTIVATED plan will be displayed in 6L.

Perf Init Data can be entered (and completed) at any time; there is no change in this operation. The change is that the completed Perf Init data is not applied to any route until the route is ACTIVATED. Changes made to Perf Init data after the RTE is activated will be removed when the ACTIVATED route is ERASEd. If the ACTIVATED route is EXECd, the inactive Perf Init becomes part of the Active Route (no change from current requirements).

YA701 - YT513, YV604, YV605



YT514 - YT521, YV741 - YV754



1 Page Title

The word ACT appears to the left of the title when the route has been activated and executed.

The word MOD appears to the left of the normal title when the route is modified and the change is not executed.

Multiple route pages are indicated by the page sequence number to the right of the title.

2 ORIGIN

Enter the ICAO airport identifier for the origin.

An entry is required for route activation.

Valid entries must be in the navigation database.

Entry is allowed for all phases of flight. Entry of a new origin erases the previous route.

New entries on an active route display MOD in the route title.

Enables direct selection of departure and arrival procedures for the origin airport.

Automatically entered as part of a company route.

3 Company Route (CO ROUTE)

A company route can be called from the navigation database by entering the route identifier. The data provided with a company route can include origin and destination airports, departure runway, SID, and STAR, and the route of flight. All company route data is automatically entered when the route identifier is entered.

An entry is optional for activation of the route.

Enter a company route identifier.

Valid entry is any crew entered company route name. If the name is not contained in the NAV database, the scratchpad message NOT IN DATA BASE is displayed.

Entry of a new company route replaces the previous route.

4 RUNWAY

Line title does not display until after entry of origin airport.

Enter the desired runway for the origin airport.

An entry is optional for activation of the route.

Entries must be in the navigation database.

New entries on an active route display MOD in the route title.

Can be entered from the DEPARTURES page.

Entry is deleted upon takeoff.

5 Destination (DEST)

Enter the ICAO airport identifier for the destination of the route.

An entry is required for route activation.

Entries must be in the navigation database.

New entries on an active route display MOD in the route title.

Enables direct selection of arrival procedures for the destination airport.

Automatically entered as part of a company route.

Entry and execution of a new destination clears any runway and runway dependent approach procedure of the previous destination. If the active leg is part of the affected procedure, then all subsequent (inactive) legs are cleared.

6 Flight Number (FLT NO.)

Enter the company flight number.

Entry is optional for activation of the route.

Limited to 8 characters.

Crew entered.

Flight number is included in the PROGRESS page title.

YT514 - YT521, YV741 - YV754
The flight number entry is applied to both RTE 1 and RTE 2. The value of the flight number field will be the same for both routes. An entry into the flight number field on RTE 1 will propagate to the flight number field on RTE 2 and vice versa. The two flight number fields will always be the same.

As installed:
Transponder transmits flight number to ATC.

7 FLT PLAN REQUEST

YA701 - YT513, YV604, YV605
Push – transmits a data link request for a flight plan route uplink

YT514 - YT521, YV741 - YV754
Push – transmits a data link request for a flight plan route X uplink

YT514 - YT521, YV741 - YV754

8 Route 1 or 2 (RTE X)

Push - displays first or second route, depending on which route is currently being displayed at the Page Title position.

Route Pages 1/X and 2/X with Data Entries

YA701 - YT513, YV604, YV605

```
      RTE              1/3
 ORIGIN               DEST
KBFI                  KMWH
 CO ROUTE          FLT NO.
BFIMWH                 430
 RUNWAY          FLT PLAN
13R               REQUEST>
------------------------

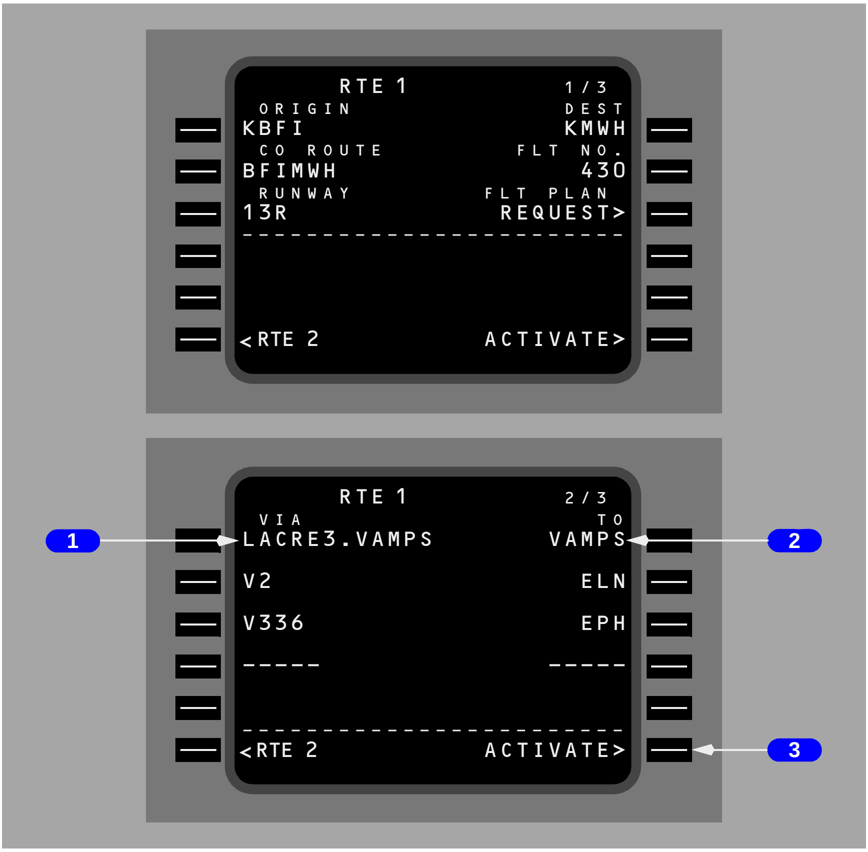


                 ACTIVATE>
```

```
      RTE              2/3
 VIA                    TO
LACRE3.VAMPS         VAMPS
V2                     ELN
V336                   EPH
-----                -----

------------------------
                 ACTIVATE>
```

YT514 - YT521, YV741 - YV754



```
          RTE 1            1/3
  ORIGIN                  DEST
KBFI                      KMWH
  CO ROUTE             FLT NO.
BFIMWH                     430
  RUNWAY              FLT PLAN
13R                   REQUEST>
------------------------------



<RTE 2               ACTIVATE>
```

```
          RTE 1            2/3
  VIA                       TO
LACRE3.VAMPS             VAMPS
V2                         ELN
V336                       EPH
-----                    -----

------------------------------
<RTE 2               ACTIVATE>
```

1 VIA

The VIA column displays the route segment to the waypoint or termination displayed in the TO column. Enter the path which describes the route segment between the previous waypoint and the segment termination.

Enter an airway in the VIA column and box prompts are displayed in the TO column if the previous TO line contains a waypoint on the airway.

Valid entries can also include procedures or DIRECT. Procedures are normally entered through selections on DEPARTURES and ARRIVALS pages. DIRECT is normally entered as a result of entering a TO waypoint first.

Valid airways must:

- contain the fix entered in the TO waypoint, and
- contain the previous TO waypoint, or

Dashed prompts change to DIRECT if the TO waypoint is entered first.

Dash prompts appear for the first VIA beyond the end of the route.

Invalid VIA entries display the scratchpad entry INVALID ENTRY.

Invalid VIA entries are:

- airways and company routes which do not contain the TO waypoint of the previous line
- airways or company routes that are not in the navigation database.

When entering airways, the beginning and ending waypoints determine if the entry is valid. The route segment must contain the waypoint entered in the TO position. The TO waypoint of the previous route segment must be the same as the beginning point of the current route segment, or a route discontinuity is created between the segments.

Entry of a SID or transition automatically enters the VIA and TO data for the route segments of the SID. A SID automatically links to the next route segment when the final SID waypoint is part of the route segment.

LACRE3.VAMPS is an example of a SID selection made on the DEPARTURES page.

V2 is an example of airway entry.

2 TO

Enter the end point of the route segment specified by the VIA entry.

Entry of a waypoint in the TO column without first entering a VIA airway displays DIRECT in the VIA column.

Box prompts indicate that an entry is required.

Valid waypoint entries for a DIRECT route segment are any valid waypoint, fix, navaid, airport, or runway.

Valid waypoint entries for airways are waypoints or fixes on the airway.

Dash prompts appear on the first TO waypoint following the end of the route.

YA701 - YT513, YV604, YV605

3 ACTIVATE

Pushing the ACTIVATE key arms the route for execution as the active route. When the EXEC key is pushed, the route becomes the active route and the ACTIVATE prompt is replaced with the next required preflight page prompt.

Push – prepares the selected route for execution as the active route.

Activation of a route is required for completion of the preflight.

Displayed on inactive route pages.

After route activation, the ACTIVATE prompt is replaced by:

- PERF INIT, when the required performance data is incomplete, or
- TAKEOFF when the required performance data is complete.

YT514 - YT521, YV741 - YV754

3 ACTIVATE

Pushing the ACTIVATE key arms RTE X for execution as the active route. When the EXEC key is pushed, RTE X becomes the active route and the ACTIVATE prompt is replaced with the next required preflight page prompt.

Push – prepares the selected route for execution as the active route.

Execution of a route is required for completion of the preflight.

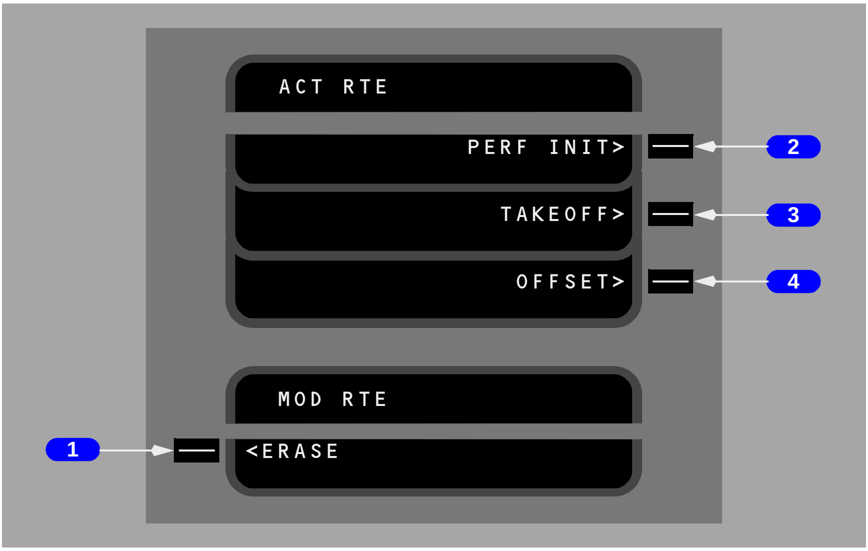
After RTE X activation the ACTIVATE prompt is blanked and the ERASE prompt replaces the RTE X prompt at LSK 6L.

After the EXEC key is selected the RTE COPY prompt becomes available at LSK 5R and LSK 6L displays the following prompts:

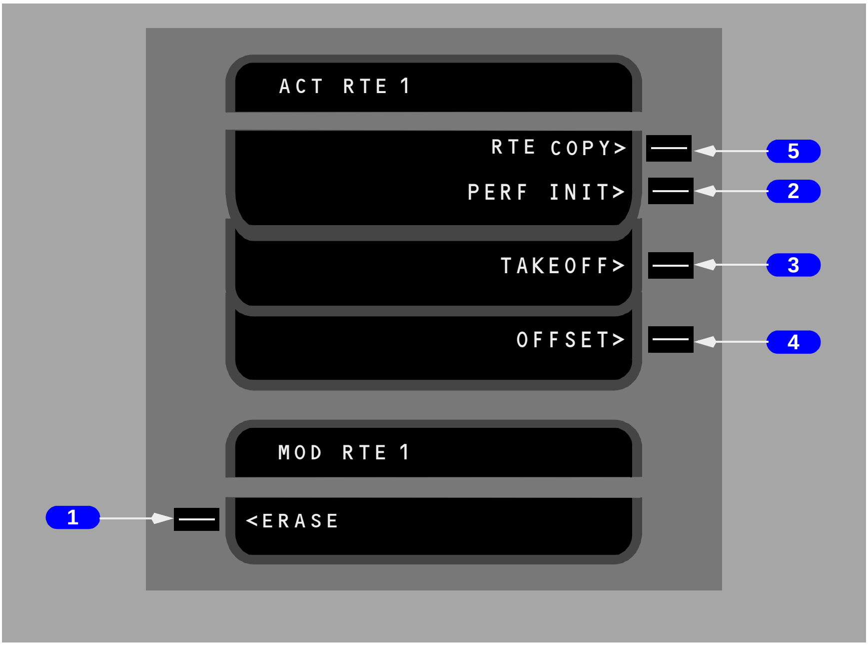
- PERF INIT, when the required performance data is incomplete, or
- TAKEOFF when the required performance data is complete.

Additional Route Page Prompts for an Activated Route

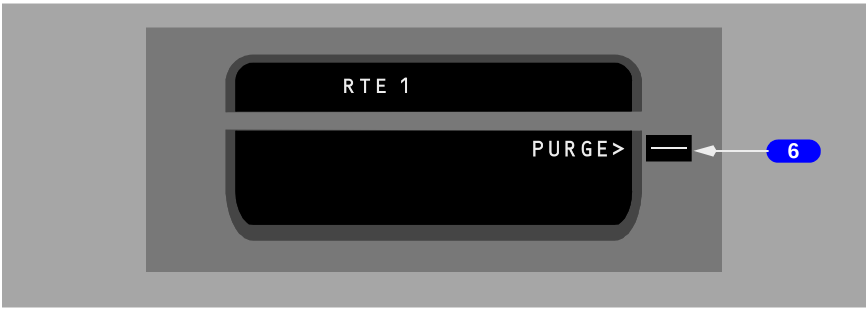
YA701 - YT513, YV604, YV605



YT514 - YT521, YV741 - YV754



YT514 - YT521, YV741 - YV754



1 **ERASE**

Push – removes all pending modifications.

Displayed only during modifications.

2 **Performance Initialization (PERF INIT)**

Push – displays PERF INIT page.

Displayed only on the ground when required entries on the PERF INIT page are incomplete.

3 TAKEOFF

Push – displays TAKEOFF REF page 1/2.

Displayed only on the ground when all required entries on the PERF INIT page are complete.

4 OFFSET

Push – displays LATERAL OFFSET page.

Displayed only in flight.

YT514 - YT521, YV741 - YV754

5 Route Copy (RTE COPY)

Push – results in the active route being copied into the alternate route, regardless of scratchpad contents.

After selection of the RTE COPY> prompt, COMPLETE is displayed in the data field in large font and RTE COPY is displayed in the header field in small font.

RTE COPY in the header and COMPLETE is cleared upon re-entering the RTE Page and the DIR/INTC RTE LEGS page on both CDUs, execution/ERASE of a flight plan, or the other flight plan entering a pending activation state.

YT514 - YT521, YV741 - YV754

6 PURGE

PURGE> is displayed in the data line in large font when the route displayed is inactive and a flight plan uplink load pending condition exists. If an inactive route becomes active, the purge prompt is removed from the new active route and is displayed on the new inactive route.

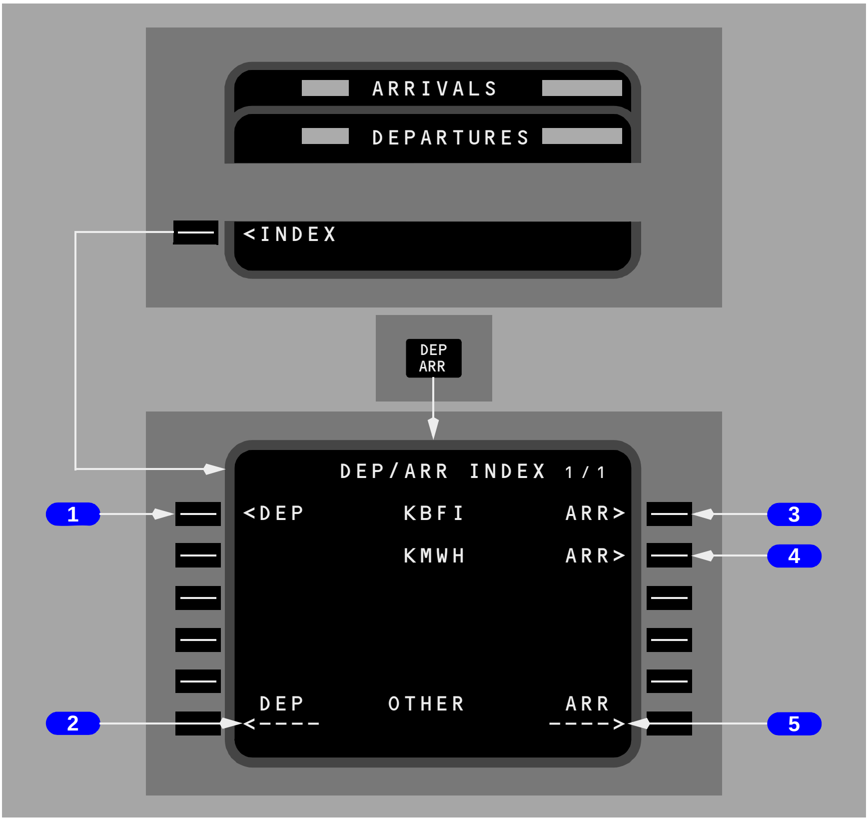
Push–results in the clearing of the route uplink, regardless of scratchpad contents.

Departure/Arrival Index Page

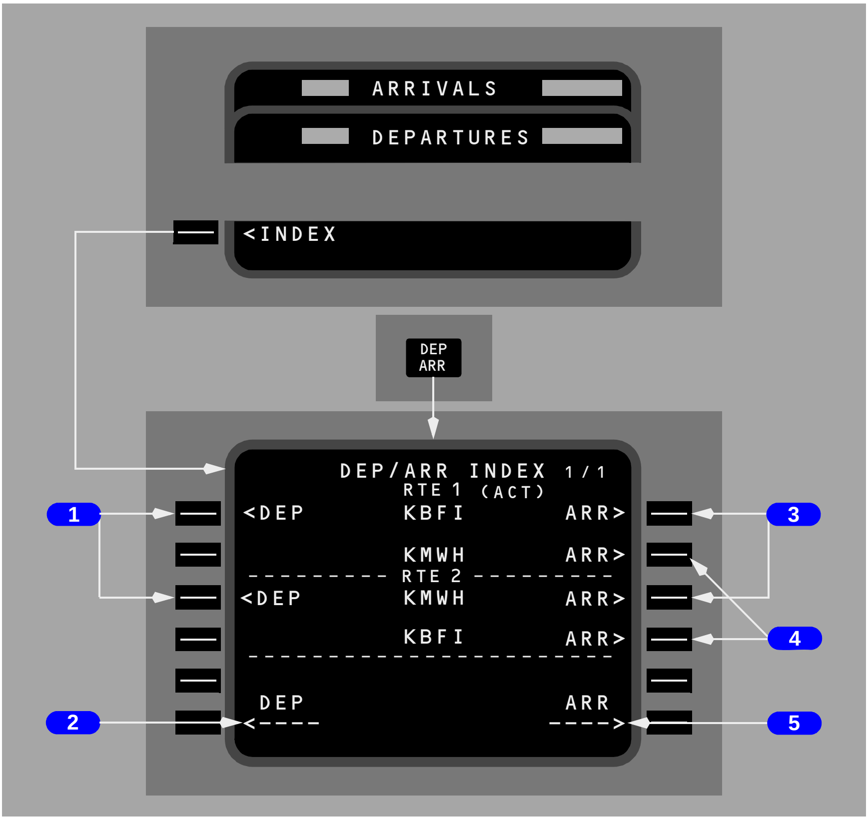
The departure and arrival index page is used to select the departure or arrival page for the origin and destination airports for each route. The index also allows reference to departure or arrival information for any other airport in the navigation database.

Departure and arrival prompts are available for the origin airport. Destination airports have only arrival prompts.

YA701 - YT513, YV604, YV605



YT514 - YT521, YV741 - YV754



YA701 - YT513, YV604, YV605

1 Departure (DEP) – Origin

Push – displays the departure page for origin airport.

YT514 - YT521, YV741 - YV754

1 Departure (DEP) – Origin

Push – displays the departure page for Route 1 origin airport.

Push – displays the departure page for Route 2 origin airport.

2 Departure (DEP) – OTHER

Displays the departure page for the airport entered into this line through the scratchpad.

DEP prompt for OTHER allows display of departure information about airports that are not an origin or destination. The displayed information can be viewed but cannot be selected, because the airport is not on the route.

YA701 - YT513, YV604, YV605

3 Arrival (ARR) – Origin

Push – displays the arrival page for origin airport. Origin airport arrivals selection is used during a turn–back situation.

YT514 - YT521, YV741 - YV754

3 Arrival (APR) – Origin

Push – displays the arrival page for Route 1 or Route 2 origin airport. Origin airport arrivals selection is used during a turn–back situation.

YA701 - YT513, YV604, YV605

4 Arrival (ARR) – Destination

Push – displays the arrival page for destination airport.

YT514 - YT521, YV741 - YV754

4 Arrival (ARR) – Destination

Push – displays the arrival page for Route 1 or Route 2 destination airport.

5 Arrival (ARR) – OTHER

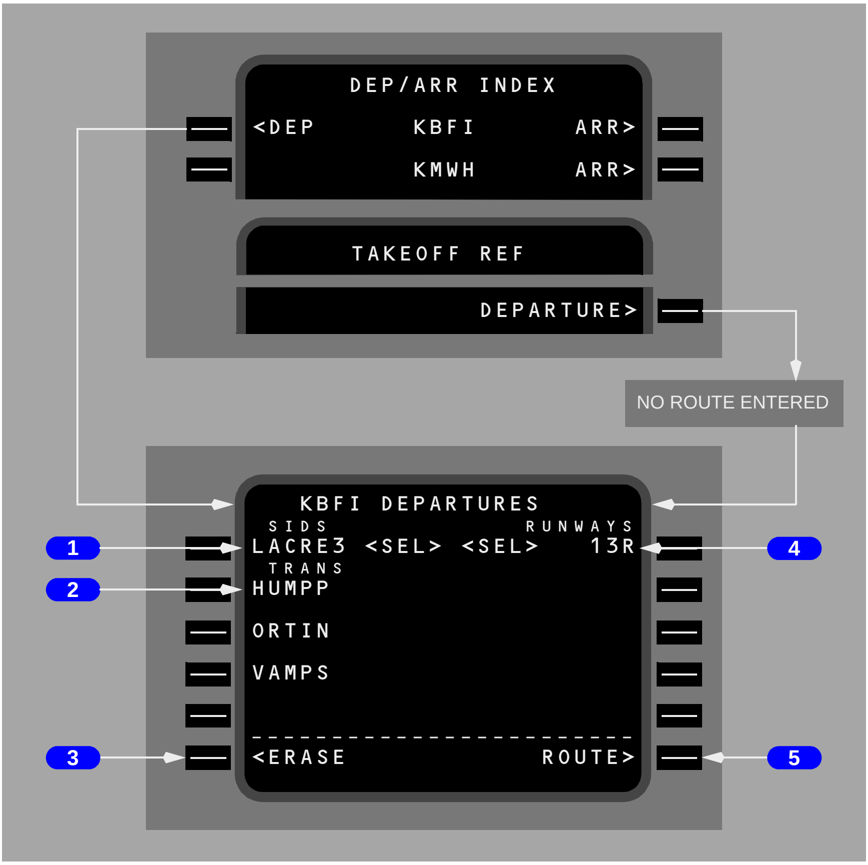
Displays the arrival page for the airport entered into this line through the scratchpad.

ARR prompt for OTHER allows display of arrival information about airports that are not an origin or destination. The displayed information can be viewed but cannot be selected, because the airport is not on the route.

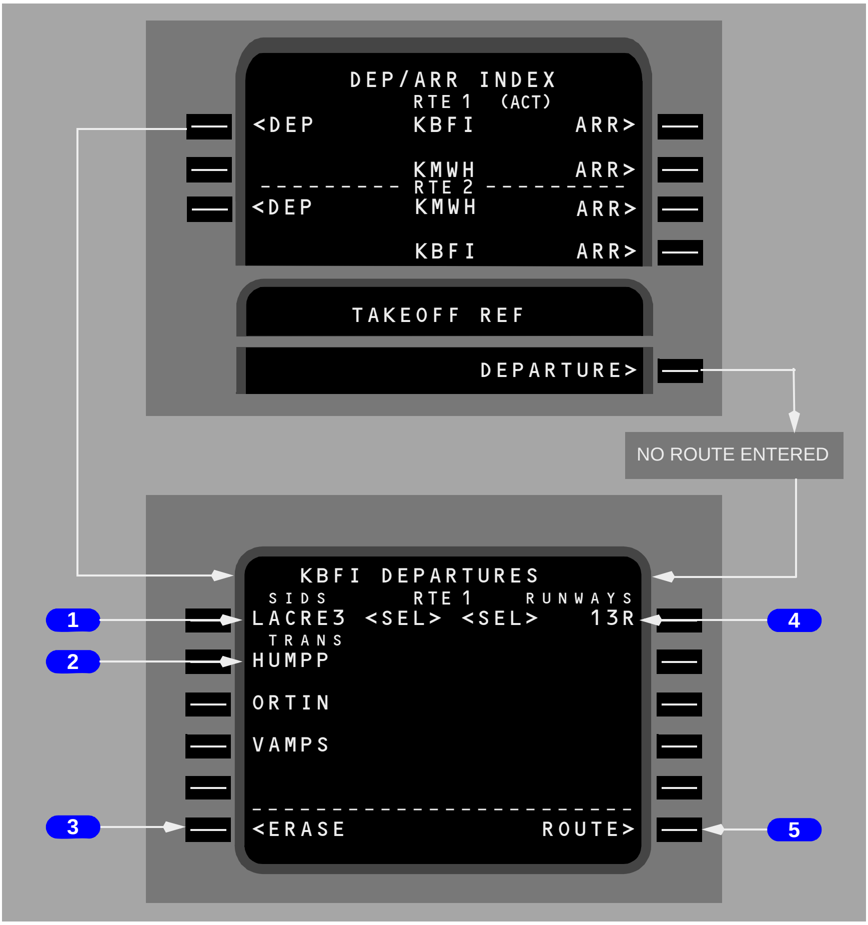
Departures Page

The departures page is used to select the departure runway, SID, and transition for the route origin airport.

YA701 - YT513, YV604, YV605



YT514 - YT521, YV741 - YV754



1 Standard Instrument Departures (SIDS)

Displays SIDS for the airport and runway selections.

Displays the engine–out SIDS for the airport and runway selections following the last SID display line or on the first line if there are no SIDS for the departure airport and runway.

Without the selection of a runway on the RTE page, the initial display contains all of the information for the airport runways and SIDS. As selections are made, incompatible options are removed. SID transitions are displayed after a SID is selected.

2 Transitions (TRANS)

Displays transitions compatible with the selected SID.

3 ERASE/INDEX

ERASE is displayed when a route modification is pending.

Push – removes route modifications that are not executed and restores the original route.

INDEX is displayed when no route modification is pending.

Push – displays the DEP/ARR INDEX page.

4 RUNWAYS

Displays a list of runways for the selected airport.

The runway selected on the RTE page is displayed as <SEL> or <ACT> when this page is displayed.

5 ROUTE

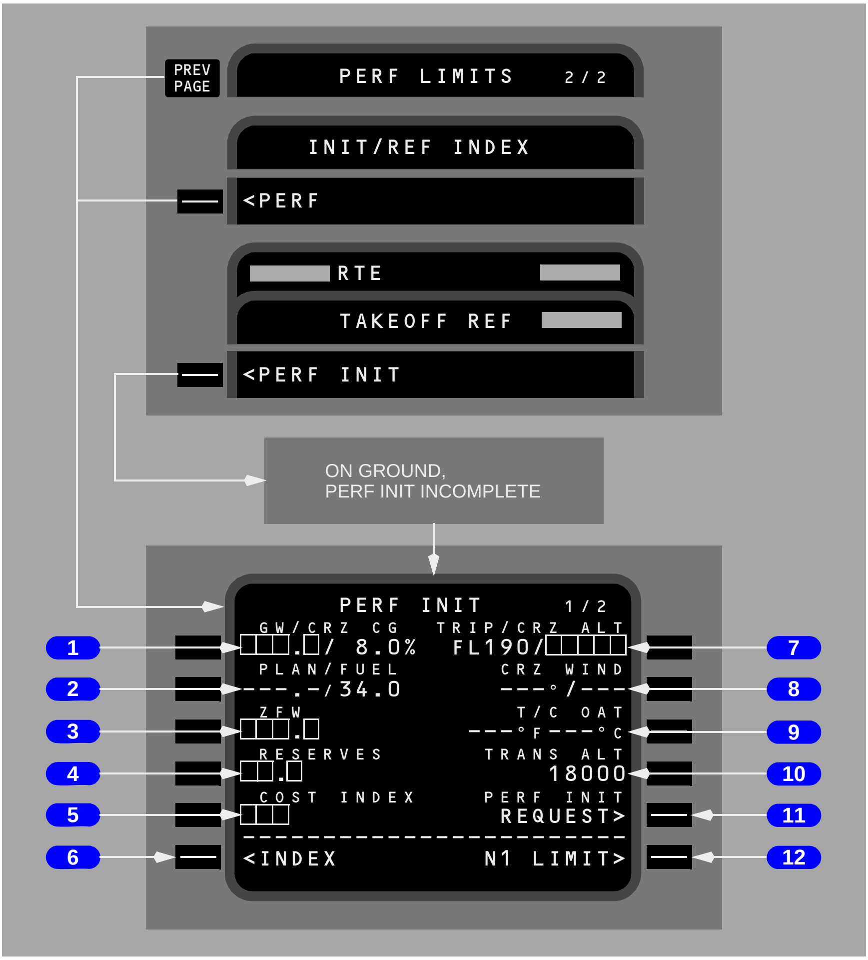
Push – displays the RTE page.

Selecting Options

Selecting an option displays <SEL> inboard of the option, and a route modification is created. When the modification is executed, the <SEL> becomes <ACT>. Leaving the page and returning displays all options and the <SEL> or <ACT> prompts.

Performance Initialization Page

The performance initialization page allows the entry of airplane and route data to initialize performance calculations. This information is required for VNAV calculations.



1 Gross Weight/Cruise Center of Gravity (GW/ CRZ CG)

Airplane gross weight is required. The entry can be made by the flight crew or automatically calculated by the FMC, following entry of zero fuel weight.

Enter airplane gross weight.

Valid entries are xxx or xxx.x.

Automatically displays calculated weight when zero fuel weight is entered first.

Displays default or manually entered cruise CG. Entry of actual cruise CG may revise maximum altitude capability.

2 PLAN/FUEL

Fuel on board is automatically displayed as received from the airplane fuel quantity indication system.

PLAN entry allows fuel predictions before actual fuel is known. Entry is blanked with flaps extended or in flight.

In flight, when the FMC is not receiving the required fuel data, the CDU displays dashes and allows manual entry of fuel weight. After manual entry, MAN (manual) appears next to the fuel weight. Manual entry of fuel weight should continue approximately every 30 minutes for the remainder of the flight to keep gross weight current.

3 Zero Fuel Weight (ZFW)

Airplane zero fuel weight is required. Normally the ZFW is entered from the airplane dispatch papers and the FMC calculates the airplane gross weight.

Enter the airplane zero fuel weight.

Valid entry is xxx or xxx.x.

Calculated zero fuel weight is automatically displayed if airplane gross weight is entered first and fuel on board is valid.

4 RESERVES

Enter fuel reserves for the route.

Entry is required to complete the preflight.

Valid entry is xx or xx.x.

5 COST INDEX

The cost index is used to calculate ECON climb and cruise speeds. The value reflects the relative impacts on overall trip cost of fuel cost as compared to other direct hourly operating costs.

Enter the cost index for ECON calculations.

Entry is required to enable use of VNAV mode.

Valid entries are 0 to 500. 0 causes the ECON speed to be MAX RANGE; 500 results in a minimum time flight.

Entry of a company route on RTE page causes any company stored value of cost index to be automatically displayed. A manual entry has priority.

6 INDEX

Push – displays the INIT/REF INDEX page.

7 Trip/Cruise Altitude (TRIP/CRZ ALT)

Trip altitude is automatically computed and displayed whenever entries have been made for the ORIGIN, DEST, GROSS WT, and COST INDEX. Otherwise, the field is blank.

Trip altitude is the predicted minimum cost altitude determined by operator constraints. Provides crew a reference for selecting a planned cruise altitude.

Cruise altitude is required.

Enter the cruise altitude for the route.

Automatically displays this cruise altitude on the CLB, CRZ, and RTE Legs pages.

8 Cruise Wind (CRZ WIND)

Cruise wind entry provides input to optimize FMC calculations.

Enter the forecast cruise wind.

Entry is propagated onto the RTE DATA page.

If no entry made, the FMC assumes zero wind for preflight predictions.

9 Top of Climb Outside Air Temperature (T/C OAT)

T/C OAT entry provides input to optimize FMC calculations.

Entry causes ISA DEV to be computed and displayed.

Enter top of climb OAT.

If no entry made, FMC assumes ISA value.

Note: FMC Update U10.7 and later takes advantage of sensed static air temperature (SAT) to automatically provide updating of the MAX altitude. The revised temperature model applies after climbing 5000 feet above the departure runway elevation. Calculation of MAX altitude uses the actual ISA deviation derived from the actual sensed SAT projected up to the MAX and OPT altitude solutions. The temperature model prior to U10.7 is still applied below 5000 feet. T/C OAT, if entered on the PERF INIT page, is used for the preflight planning forecast of MAX/OPT altitude.

10 Transition Altitude (TRANS ALT)

Displays 18,000 feet at FMC power up.

YA701 - YT513, YV604, YV605

Changes automatically after selecting a departure procedure with a different transition altitude.

YT514 - YT521, YV741 - YV754

Changes automatically when entering flight plan data based on the following criteria if a pilot entered value has not already been entered:

- the FMC will use the transition altitude from the NDB stored for the SID if the flight plan is active and a SID has been selected and a transition altitude exists for the SID.
- if an active flight plan exists and no transition altitude exists on the SID or a SID has not been selected, then the FMC will use the transition altitude from the NDB stored for the ORIGIN airport.
- if there is no transition altitude for the ORIGIN airport in the NDB for the conditions defined above, then the default transition altitude will default to the transition level from the NDB stored for the ORIGIN airport.
- if the transition altitude is not available from any of the sources above, then the FMC will default the transition level to 18000 feet or the value contained in a loaded custom performance defaults data base.

Manual entry has priority.

11 PERF INIT REQUEST

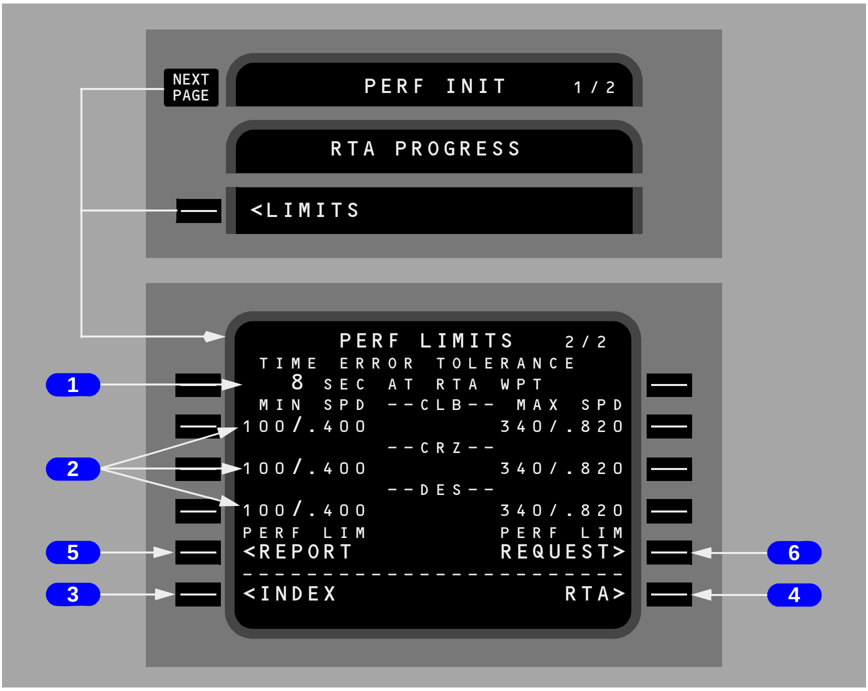
Push – transmits a data link request for a PERF INIT uplink

12 N1 LIMIT

Push – displays the N1 LIMIT page.

Performance Limits Page

The performance limits page allows the entry of performance limits affecting RTA and ECON calculations.



```
PERF INIT          1/2

RTA PROGRESS

<LIMITS
```

```
     PERF LIMITS     2/2
  TIME ERROR TOLERANCE
    8 SEC AT RTA WPT
  MIN SPD --CLB-- MAX SPD
100/.400         340/.820
         --CRZ--
100/.400         340/.820
         --DES--
100/.400         340/.820
PERF LIM         PERF LIM
<REPORT          REQUEST>
------------------------
<INDEX               RTA>
```

1 TIME ERROR TOLERANCE

Used during RTA calculations to establish a boundary on computed speeds.

Valid entry range is from 5 to 30 seconds.

Default value is 30 seconds and is displayed in small font.

2 Minimum Speed/Maximum Speed (MIN SPD/MAX SPD)

Establishes lower and upper speed limits for each phase of flight.

Default is 100/.400 for lower limit and 340/.820 for upper limit. Default values are displayed in small font and entered values are displayed in large font.

Either CAS or Mach can be entered.

Limits both RTA and ECON modes in flight.

3 INDEX

Push – selects INIT /REF INDEX page.

4 **Required Time of Arrival (RTA)**

Push – selects RTA PROGRESS page.

5 **PERF LIM REPORT**

Push – transmits displayed performance limits to ground station.

6 **PERF LIM REQUEST**

Push – transmits a data link request for a performance limits uplink.

N1 LIMIT Page - Preflight

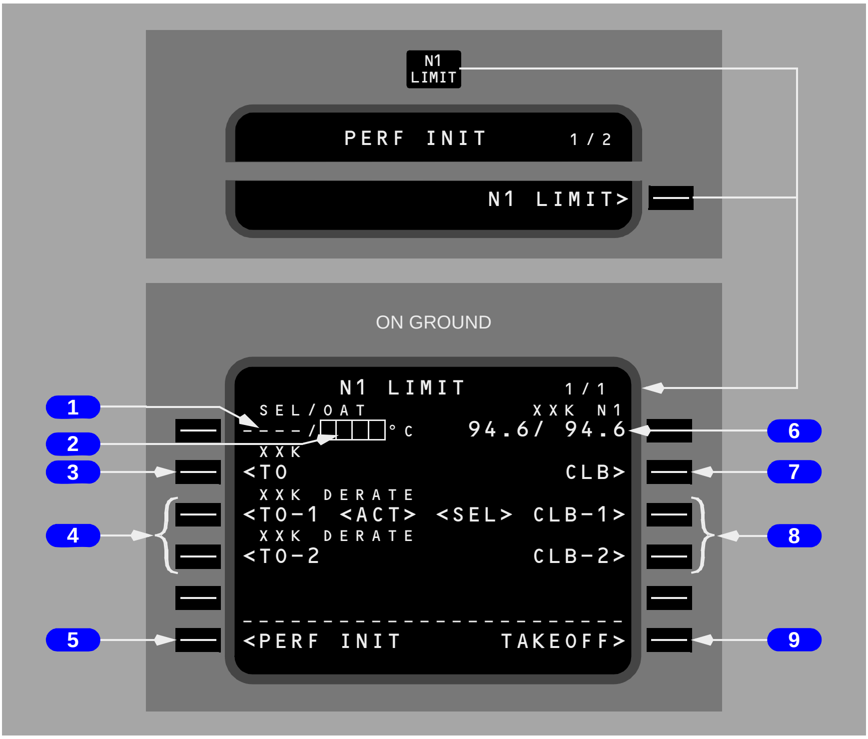
This section describes the preflight version of the N1 LIMIT page. See the FMC Takeoff and Climb section for a description of the in–flight version of the N1 LIMIT page.

The N1 LIMIT page is used during preflight to manage takeoff and climb thrust. Temperature data is entered, allowing the FMC to make N1 computations for normal or reduced thrust takeoff. Fixed takeoff and climb thrust derates may be selected.

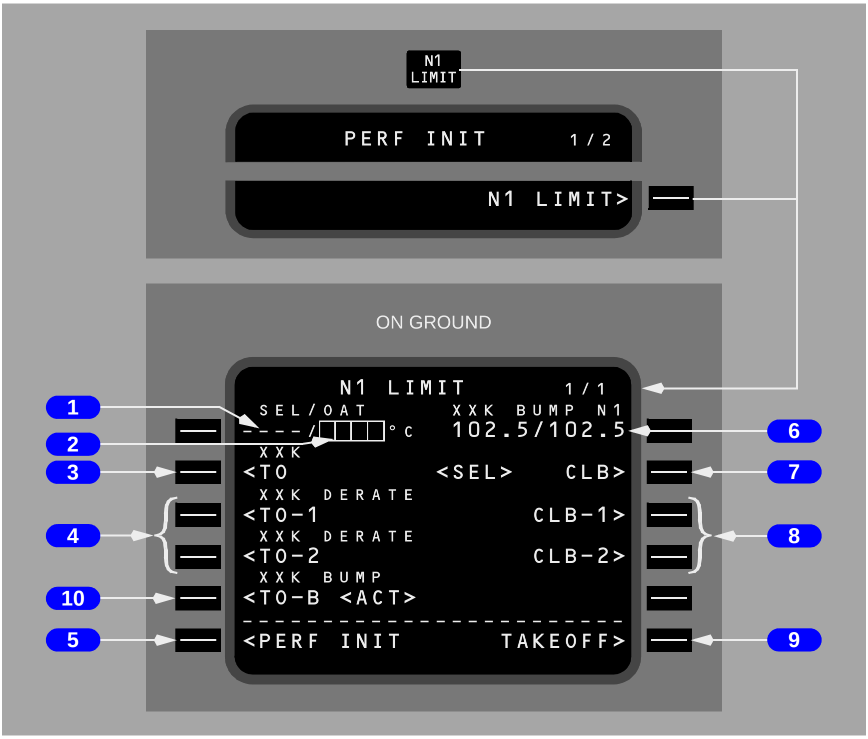
YN531 - YN534

The N1 LIMIT page is also used to select a takeoff bump thrust setting to meet extra thrust requirements for takeoff at certain airports.

YA701 - YM484, YS151 - YV754



YN531 - YN534



1 Selected Temperature (SEL)

Entry of an assumed temperature calculates a reduced thrust takeoff N1.

Entry can be made in degrees C or degrees F.

Maximum allowable entry is 70 degrees C (158 degrees F). The FMC, however, will limit the N1 to 25% takeoff reduction.

2 Outside Air Temperature (OAT)

Manual entry of actual takeoff OAT is displayed in large–sized characters and is used by the FMC to calculate the takeoff N1 limits.

Entry can be made in degrees C or degrees F.

3 Takeoff Thrust Limit (TO XXK)

Push – selects full rated takeoff thrust limit.

Selection of TO automatically selects CLB thrust.

Data line title displays full rated thrust. For example, typical line titles display as “24K” or “22K.”

YN531 - YN534
Data line title displays “24A” for full rated thrust.

Selection of a new rating after V speeds are selected on the TAKEOFF REF page causes the V speeds to display in small font, and the NO VSPD flag to show on the airspeed indication.

4 Takeoff Derates (TO–1 and TO–2)

Push – selects the associated takeoff thrust limit.

Takeoff data uplink may automatically select a thrust derate.

Data line title displays the associated reduced thrust rating. For example, typical line titles display as “22K DERATE” or “20K DERATE”

Normally, selecting TO–1 automatically arms CLB–1 and selecting TO–2 automatically arms CLB–2.

Note: If a reduced thrust takeoff has been specified, then either CLB–1 or CLB–2 may be automatically specified if required to avoid a climb N1 value greater than the specified reduced thrust takeoff N1.

Selection of a new rating after V speeds are selected on the TAKEOFF REF page causes the V speeds to display in small font, and the NO VSPD flag to show on the airspeed indication.

5 PERF INIT

Push – displays the PERF INIT page.

6 Takeoff N1 (XXK N1)

Displays the FMC computed N1 for takeoff

YA701 - YM484, YS151 - YV754
Data line title displays full rated thrust or selected takeoff derate thrust. Typical line titles display as “24K N1” or “22K N1”

YN531 - YN534
Data line title displays “24A N1” when full rated takeoff thrust is selected.

Data line title changes to RED XXK N1 when an assumed temperature (SEL TEMP) entry results in a reduced N1 value. If a SEL TEMP and a DERATE are both selected the data line title will change to “RED XXK N1,” and the effect on thrust will be additive.

YN531 - YN534
Data line title changes to 26B2 BUMP N1 when takeoff bump thrust is selected.

7 Climb (CLB)

Push – selects full rated climb thrust limit.

Climb thrust is automatically selected at the thrust reduction point on the TAKEOFF REF page 2.

8 **Reduced Climb (CLB–1 and CLB–2)**

Push – selects the associated reduced thrust climb mode.

CLB–1 provides a climb limit reduced by 3% N1 (approximately 10% thrust).
CLB–2 provides a climb limit reduced by 6% N1 (approximately 20% thrust).

Deletion results in the selection of CLB thrust.

Manual selection of a climb thrust rating overrides the automatic selection.

Takeoff data uplink may automatically select a thrust derate.

9 **TAKEOFF**

Push – displays the TAKEOFF REF page.

YN531 - YN534

10 **Takeoff Bump Thrust (TO–B)**

Push – selects takeoff bump thrust limit

Selection of TO–B automatically selects CLB thrust.

Data line title displays takeoff bump thrust. The line title will display "26B2 BUMP."

When takeoff bump thrust is selected, assumed temperature (SEL temperature) thrust reduction is not available.

Takeoff data uplink may automatically select takeoff bump thrust.

Selecting Takeoff Thrust

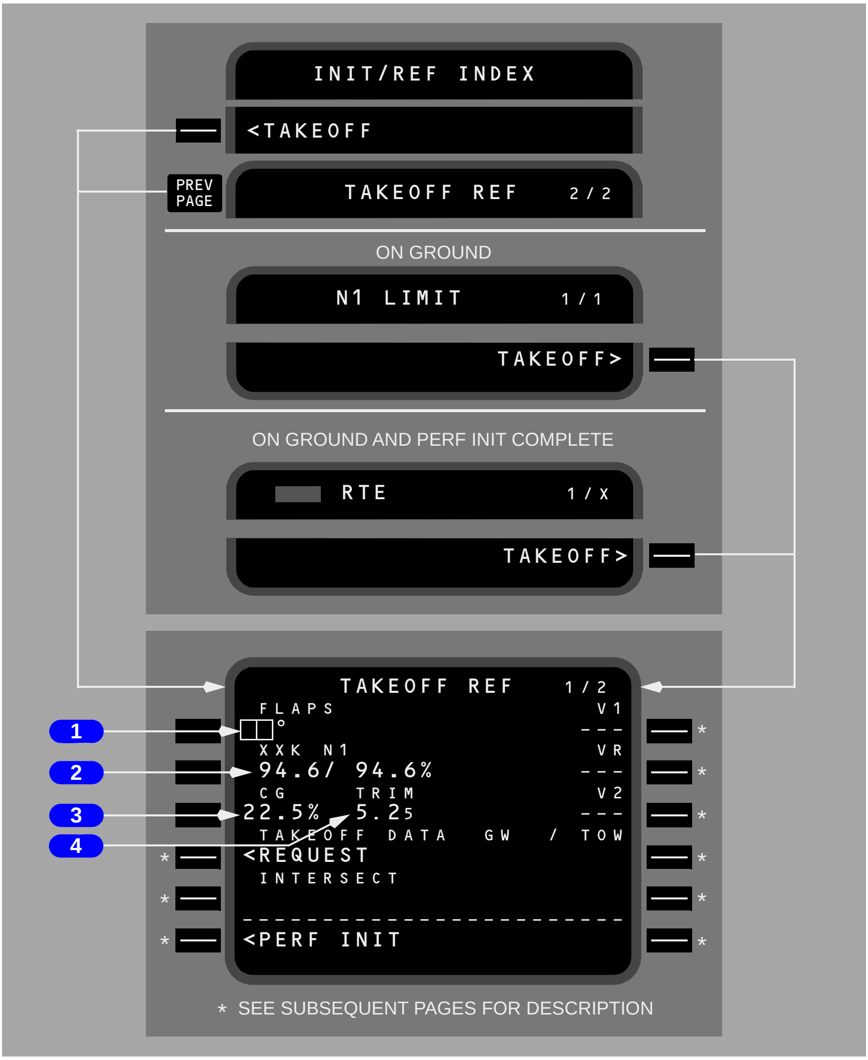
Selecting the maximum takeoff thrust or a derate (TO, TO-1, TO-2) displays <ACT> inboard of the option. The FMC automatically selects the highest climb thrust available (CLB, CLB-1, CLB-2) which would not result in a thrust lever push, when the aircraft transitions from takeoff to climb. <SEL> is displayed inboard of the selected climb N1 limit.

Takeoff Reference Page 1/2

The takeoff reference page allows the crew to manage takeoff performance.

Takeoff flap setting and V speeds are entered and verified. Thrust limits, takeoff position, CG, and trim can be verified or changed.

Preflight pages are selectively displayed to indicate preflight status whenever required entries on those pages are incomplete. Takeoff reference page entries finish the normal preflight. V speeds should be set before completion. FMC position can be updated prior to takeoff.



1 **FLAPS**

Enter takeoff flaps setting. Manual entry of 1, 5, 10, 15, or 25 allowed.

2 **Takeoff N1 (XXK N1)**

Displays the FMC computed N1 for takeoff.

Data line title displays full rated thrust or selected takeoff derate thrust. Typical line titles display as “24K N1” or “22K N1.”

YN531 - YN534

Data line title displays “24A N1” when full rated takeoff thrust is selected.

Data line title changes to RED XXK N1 when an assumed temperature (SEL TEMP) entry results in a reduced N1 value. If a SEL TEMP and a DERATE are both selected the data line title will change to "RED XXK N1," and the effect on thrust will be additive.

YN531 - YN534

Data line title changes to 26B2 BUMP N1 when takeoff bump thrust is selected.

3 Center of Gravity (CG)

Initial display is dashes.

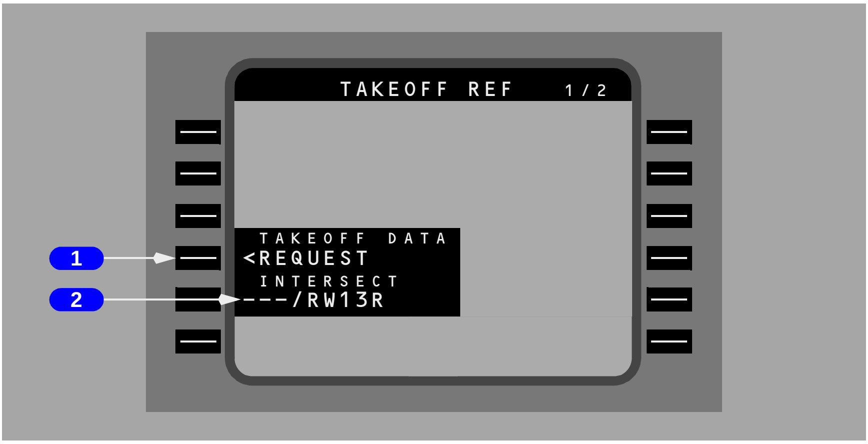
After CG is entered, the FMC calculates and displays stabilizer takeoff trim settings.

4 TRIM

Displays stabilizer takeoff trim setting.

Display is blank unless FLAPS and CG are entered.

Company Data Link



1 TAKEOFF DATA REQUEST

Push – transmits a data link request for a takeoff data uplink. Resulting TAKEOFF REF uplink may contain takeoff data for up to 6 runways, which are stored in FMC uplink memory.

2 Intersection (INTERSECT)

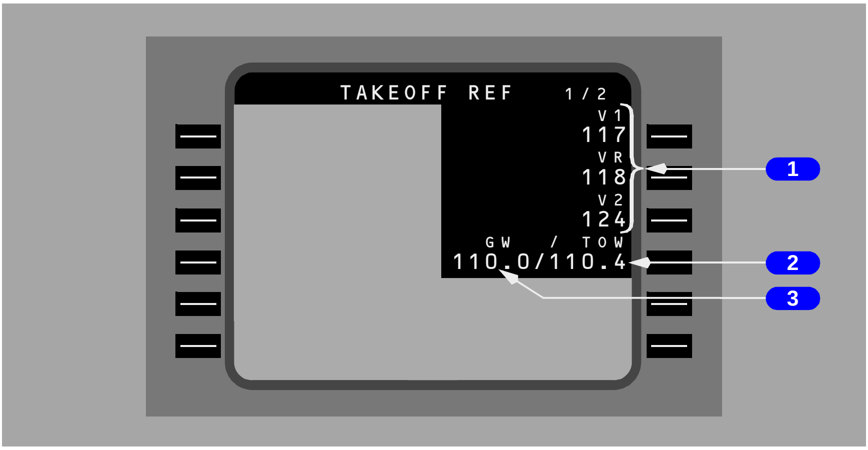
Displays active runway.

An intersection may be entered. Valid entries are 1 to 3 alphanumerics.

If an intersection is entered and TAKEOFF DATA REQUEST is made, the runway/intersection pair is included in the request downlink.

If the displayed runway or runway/intersection pair matches a runway or runway/intersection pair in FMC uplink memory, the associated TAKEOFF REF UPLINK is annunciated for flight crew ACCEPT/REJECT.

V Speed Data



1 V Speeds (V1, VR, and V2)

Crew calculated V speeds may be entered and displayed for reference.

V speeds may be uplinked.

Large font V speeds are displayed on the airspeed indication.

2 Takeoff Weight (TOW)

Displays gross weight the uplink V speeds are based on.

Blank if there are no uplinked V speeds in the column above.

3 Gross Weight (GW)

Displays current gross weight.

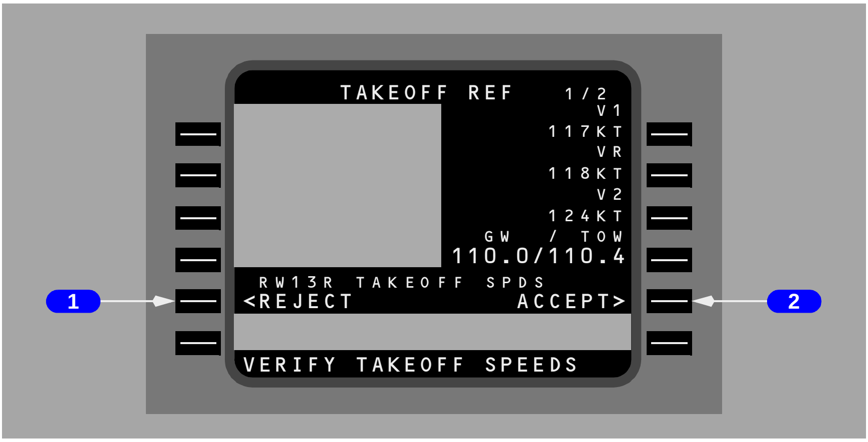
Change of Performance Data After V Speed Entry

V speeds should be entered on the TAKEOFF REF page as a final step of FMC preflight. If V speeds are entered and then performance data (for example, OAT or takeoff thrust) is subsequently changed, the FMC automatically removes the previously entered V speeds and the NO VSPD flag shows on the airspeed indication.

In addition, the scratchpad message VERIFY TAKEOFF SPEEDS displays if any of the following items are changed after V speeds have been entered:

- gross weight
- zero fuel weight
- plan fuel.

The previously entered V speeds are displayed in small font on the TAKEOFF REF page.



```
            TAKEOFF  REF      1/2
                               V1
                            117KT
                               VR
                            118KT
                               V2
                            124KT
                       GW  /  TOW
                      110.0/110.4
 RW13R  TAKEOFF  SPDS
<REJECT                   ACCEPT>

VERIFY  TAKEOFF  SPEEDS
```

1 REJECT

Displayed if V speeds have been entered and airplane gross weight, ZFW, or plan fuel has been changed.

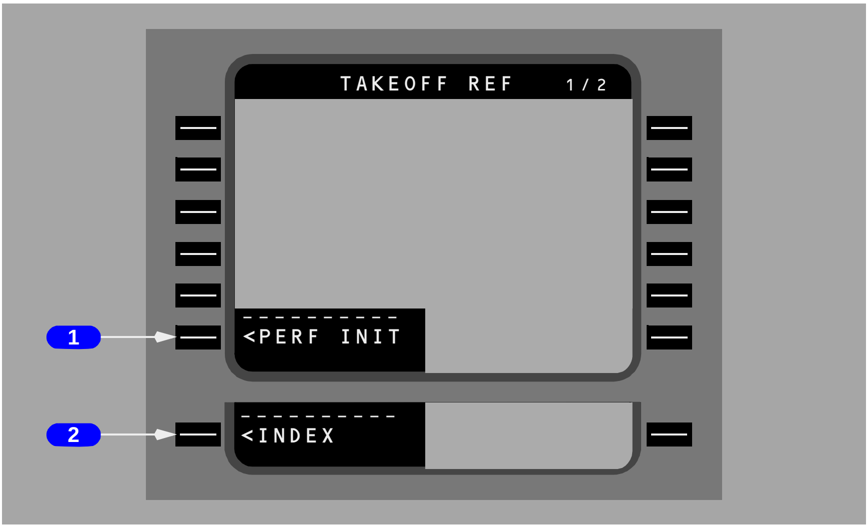
Push – causes the now small font takeoff speeds to disappear.

2 ACCEPT

Displayed if V speeds have been entered and airplane gross weight, ZFW, or plan fuel has been changed.

Push – changes the small font takeoff speeds to large font.

Preflight Status



1 Preflight Incomplete

When required preflight entries are not complete, the related page title displays

- POS INIT – IRS position not entered or invalid
- PERF INIT – required performance data not entered or executed
- ROUTE – required RTE page data not entered
- DEPARTURE – runway or route data not entered on the RTE page.
- N1 LIMIT – OAT not entered.

Push – Displays associated page.

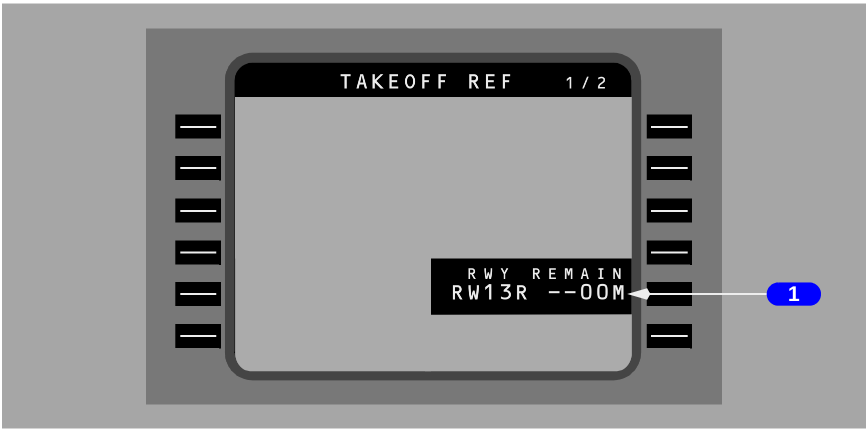
2 Preflight Complete (INDEX)

When the required preflight entries are complete, the index prompt is displayed below the takeoff reference page data. When required preflight entries are not complete, the related page title replaces the INDEX prompt.

Displayed following completion of required preflight entries on the POS INIT, RTE, and PERF INIT pages.

Push – Displays INIT REF INDEX page.

FMC Takeoff Position Update



1 Runway Remaining (RWY REMAIN)

Automatically displays the departure runway from the RTE page.

If a runway remaining distance is not entered and GPS UPDATE is OFF, the FMC updates to the runway threshold when TO/GA is pushed.

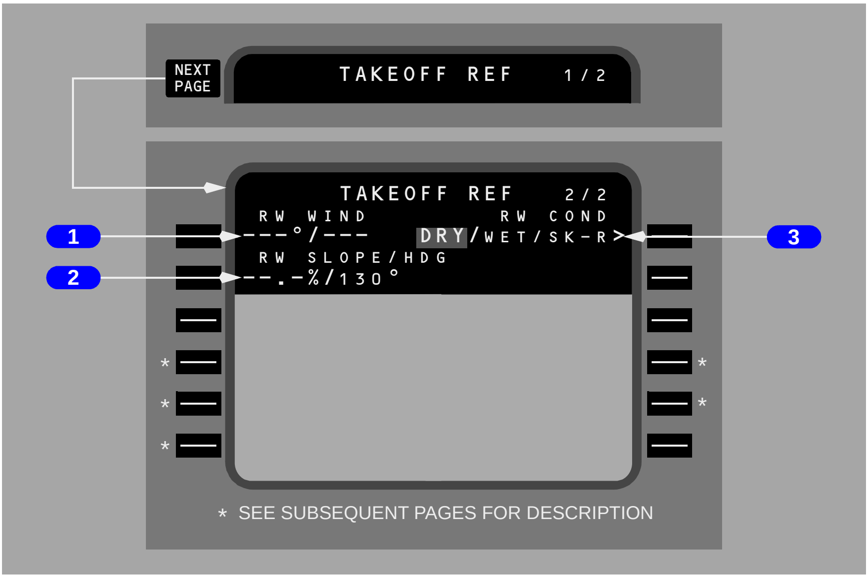
If a runway remaining distance is entered and GPS UPDATE is OFF, the FMC updates to the runway length remaining when the TO/GA switch is pushed.

TO/GA position update inhibited if GPS UPDATE is ON.

Following TO/GA update, the runway identifier and any entered shift value are highlighted in reverse video characters.

To remove a RWY REMAIN entry, reselect RWY on RTE page.

Takeoff Reference Page 2/2



* SEE SUBSEQUENT PAGES FOR DESCRIPTION

1 Runway Wind (RW WIND)

Enter surface wind direction and speed.

Entry is optional for preflight completion.

2 Runway Slope/Heading (RW SLOPE/HDG)

Enter runway slope.

Entry is optional for preflight completion.

Valid runway slope is U or + for up or D or – for down followed by slope in percent gradient.

HDG displays runway heading for origin airport.

3 Runway Condition (RWY COND)

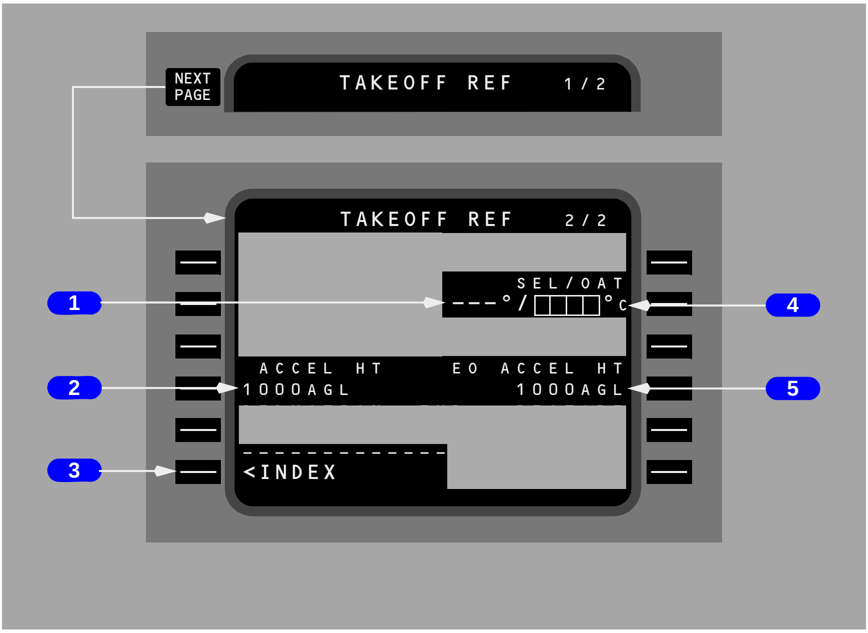
Active runway condition is highlighted:

- DRY – Dry runway computations
- WET – Wet runway computations
- SK–R – Skid resistant runway computations

Default condition is DRY.

The runway condition can be viewed by flight crew and shows under what conditions the uplinked V Speeds have been computed for. The runway condition is displayed for reference only and cannot be changed by the flight crew.

Takeoff Thrust



1 Selected Temperature (SEL)

Entry of an assumed temperature calculates a reduced thrust takeoff N1.

Entry can be made in degrees C or degrees F.

Maximum allowable entry is 70 degrees C (158 degrees F). The FMC, however, will limit the N1 to 25% takeoff reduction.

Repeats data shown on the preflight version of the N1 LIMIT page.

2 Acceleration Height (ACCEL HT)

Displays acceleration height altitude above origin airport elevation for flap retraction.

Default value is from the airline.

Entry is optional. Value is a height from 400 to 9999 feet.

3 INDEX

Push – displays the INIT/REF INDEX page.

4 Outside Air Temperature (OAT)

Manual entry of actual takeoff OAT is used by the FMC to calculate the takeoff N1 limits.

Entry can be made in degrees C or degrees F.

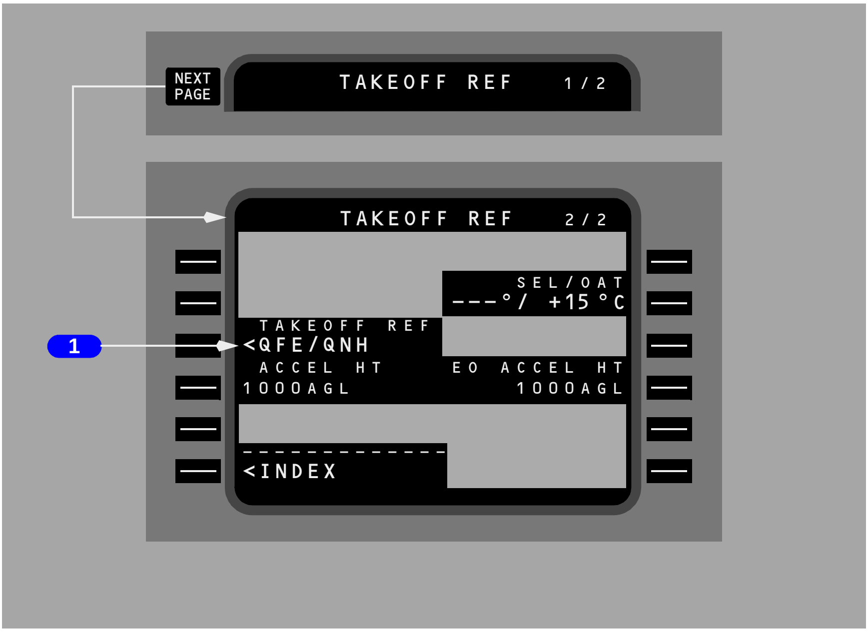
5 Engine Out Acceleration Height (EO ACCEL HT)

Displays acceleration height altitude above origin airport elevation for flap retraction with an engine out.

Default value is from the airline.

Entry is optional. Value is a height from 400 to 9999 feet.

Takeoff Reference



1 Takeoff Reference (TAKEOFF REF)

Push – Toggles altimeter reference between QFE and QNH.

Default is QNH.

Resets to QNH at flight complete.

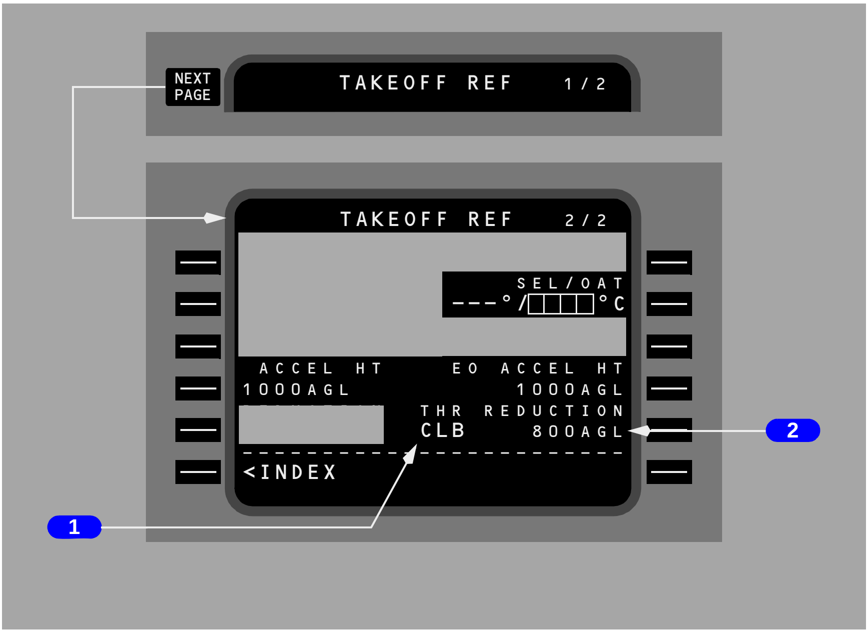
Reflects LANDING REF selection on APPROACH REF page.

Active altimeter reference is highlighted.

During preflight with QFE selected, the PFD altitude indications show zero feet at the departure runway threshold. The PFD altitude indication background colors change to green.

If QFE is the current altimeter reference, and the EFIS control panel STD switch is pushed, the takeoff reference automatically changes to QNH.

Automatic Thrust Reduction



1 **Selected Climb Rating**

Displays the climb rating that will be set at the THR REDUCTION altitude, as selected on the preflight version of the N1 LIMIT page.

2 **Thrust Reduction (THR REDUCTION)**

Altitude above origin airport elevation at which the autothrottle reduces from takeoff N1 to climb N1.

The default value is determined by the airline and is stored in the model/engine database. The default is displayed in small font.

Manual entries allowed on the ground. Entries must be between 800 to 9,999 feet and are displayed in large font.

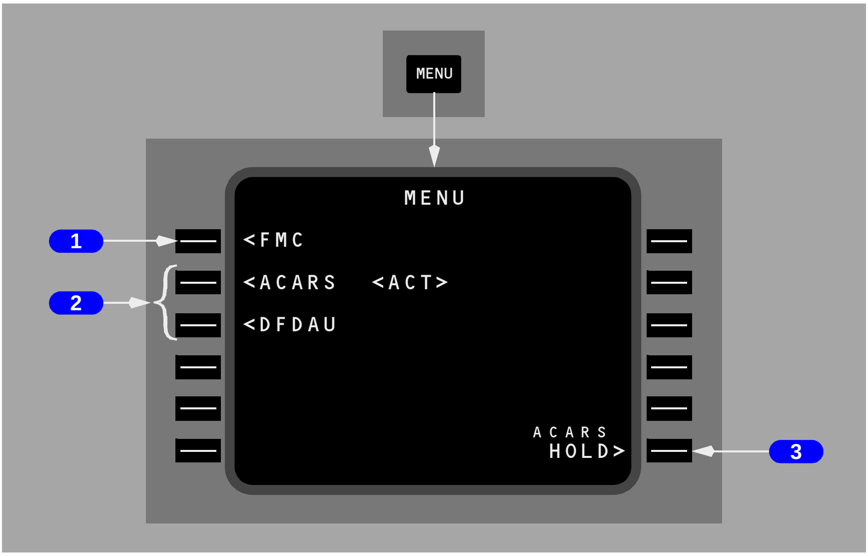
Deletion of a manual entry returns the display to the default value.

Menu Page

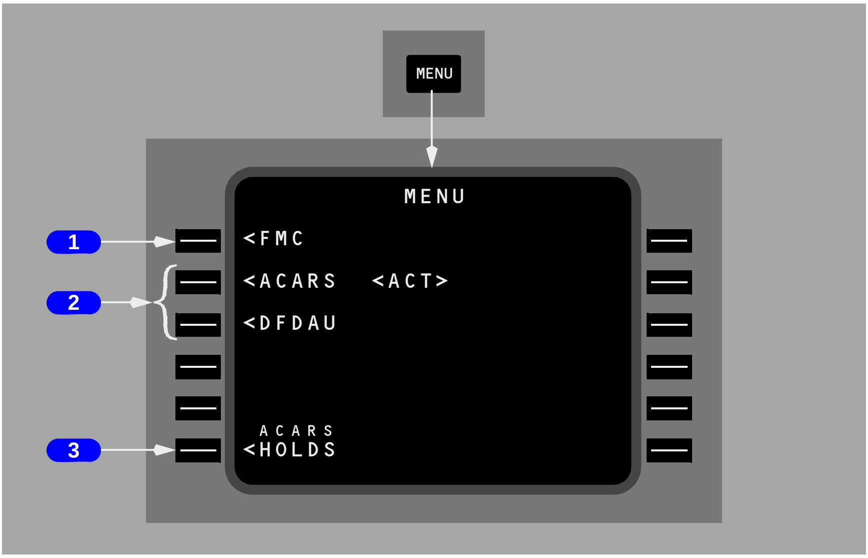
The menu page is selected with the MENU key or is automatically displayed when the currently active subsystem fails or on initial power up if the FMC system is not detected.

The menu page displays subsystems (ACARS, DFDAU, etc.) that require control/display functions through the MCDU and provides a means to temporarily access to these subsystems. The active system is indicated by <ACT> displayed next to the system title. A subsystem that requires use of the CDU displays a request message <REQ> next to the subsystem title. The FMC system or a requesting subsystem is accessed by using the line select key next to the title. The FMC can be reselected by selecting the FMC prompt on the MENU page or selecting any mode key (INIT/REF, RTE, etc.). A subsystem can be temporarily placed on hold <HLD> by selecting the subsystem XXXXXX HOLD> line select key returning the CDU display to the currently active FMC page (XXXXXX represents the system name). While the subsystem is on hold the MCDU CALL light is illuminated. To reselect the subsystem on hold, push the subsystem line select key again. When a subsystem is placed on hold a XXXXXX LOGOFF prompt appears to allow for release of the subsystem being held. No more than one subsystem can be selected at a time. If an attempt is made to select more than one subsystem, a FIRST LOGOFF XXXXXX prompt is displayed as a reminder to logoff the currently active subsystem.

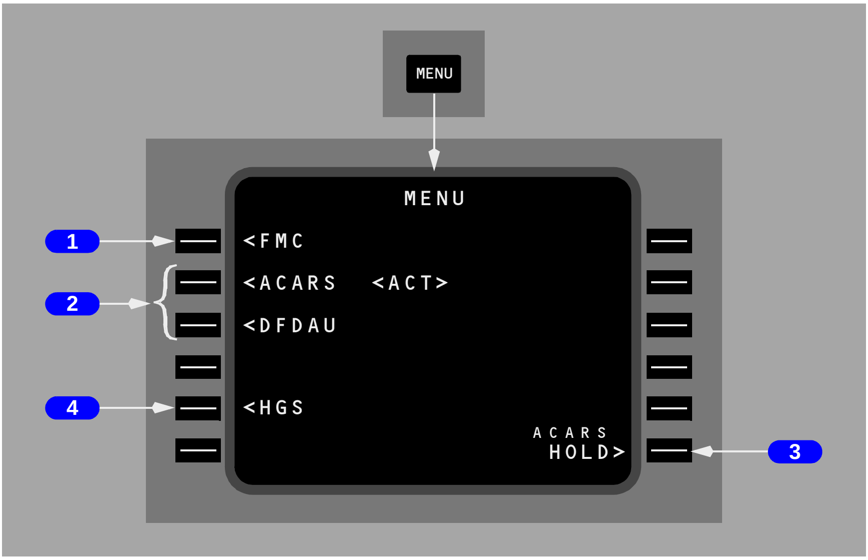
YA705 - YS178, YS191 - YV754



YA701 - YA704



YS179 - YS190



1 FMC

Push – selects FMC as the system for which the MCDU will be active in providing control/display function.

2 Other Aircraft Subsystems (typical)

Push – selects the subsystem for which the MCDU will be active in providing control/display function.

YS177 - YV754
Note: This line selection position will display "DLK" instead of "ACARS" in some configurations. Selecting "DLK" will provide access to the "DATALINK (DLK) MENU" page.

3 XXXXXX HOLD/LOGOFF

Push - places active subsystem on hold or logs off subsystem and returns control to the FMC.

YS177 - YV754
Note: This line selection position will display "DLK HOLD" instead of "ACARS HOLD" in some configurations.

YS179 - YS190

4 Head Up Guidance System (HGS)

Push - selects HGS DATA page.

Refer to Chapter 10, Flight Instruments for system description.

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Flight Management, Navigation — Chapter 11

FMC Takeoff and Climb — Section 41

Introduction

The FMC takeoff phase begins with the selection of takeoff/go–around (TO/GA). Preparation for this phase begins in the preflight phase and includes entry of the TAKEOFF REF page data.

The takeoff phase automatically changes to the climb phase when climb thrust is selected. The climb phase continues to the top of climb point, where the cruise phase begins.

During these phases, the following pages are normally used:

- TAKEOFF REF page – to make last minute changes to the departure runway
- DEPARTURES page – to make last minute changes to the SID
- CLIMB page – to modify climb parameters and monitor airplane climb performance
- RTE LEGS page – to modify the route and monitor route progress
- PROGRESS page – to monitor the overall progress of the flight
- N1 LIMIT page – to select alternate climb thrust limits
- DEP/ARR INDEX page – to select an approach during a turn–back.

Takeoff Phase

When last minute changes are made to the departure runway and SID, the TAKEOFF REF and DEPARTURES pages must be modified to agree. The modifications are performed the same as during preflight.

With correct takeoff parameters, the FMC commands the selected takeoff thrust when the TO/GA switch is pushed. During the takeoff roll, the autothrottle commands the thrust and the FMC commands acceleration to between V2+15 and V2+25 knots.

LNAV can be armed prior to takeoff. Prior to 50 feet radio altitude, roll command is wings level. At 50 feet radio altitude, if within engagement criteria, LNAV engages and provides roll commands to fly the route leg. VNAV may be engaged to control the climb profile.

Note: For LNAV to be armed on the ground, the departure runway must be selected and the course, to the first waypoint, must be within 5 degrees of the runway heading.

VNAV Armed for Takeoff

YA709 - YV754

VNAV may be armed on the MCP prior to takeoff provided the following requirements have been met:

- a valid flight plan has been entered
- performance data has been entered and executed
- both flight director switches have been switched on
- NG aircraft equipped with Collins P4 FCC or later; or Honeywell -710 FCC or later; and CDS BP06 software.

Note: If an older version of FCC or CDS software is installed, VNAV will not engage nor arm on the ground.

Target Speeds will follow the profile listed in the Climb Phase.

The CDS will annunciate VNAV armed on the FMA when VNAV is selected prior to takeoff and it is capable of being armed. On takeoff and after reaching 400 feet above the runway, the FCC will automatically engage VNAV if armed.

To prevent the FCC from engaging on-ground in VNAV SPD mode, if the FCC engages on-ground, the FMC will clear its VNAV valid discrete, which will force the FCC to disengage. The FMC will retain the last valid MCP speed that was above 60 knots that existed prior to the FCC engaging, and will output that as the FMC speed.

VNAV Takeoff -One Engine Out

During the all engine takeoff flight phase, VNAV will be enabled to automatically adjust the target airspeed profile upon engine out detection.

If a single engine failure is detected while in the VNAV takeoff flight phase (for all engines) and below the engine out takeoff acceleration height, the FMC will calculate and issue a target speed equal to the greater of current airspeed or V2 limited to be less than or equal to V2 + 20 KCAS.

This speed will continue to be updated until an engine failure is detected, at which point the target speed will be frozen at the present value.

VNAV will continue to generate this target speed until reaching the engine out acceleration height or when VNAV guidance initiates a level-off prior to reaching the engine out acceleration height, at which point the VNAV target speed will be changed to VREF + 70 KCAS (flaps up maneuver speed) subject to the applicable speed limits for the current airplane configuration.

VNAV will continue to issue the VREF + 70 KCAS target speed through flap retraction and thrust reduction, and retains this target for obstacle clearance until the pilot selects and executes the ALL ENG prompt on the CDU or VNAV transitions to the cruise flight phase to complete the engine-out takeoff flight phase.

The FMC engine-out mode will not be set when the groundspeed is less than 60 knots. If the engine-out mode is set while on the ground, the FMC will exit the mode when the speed drops below 60 knots. Engine-out speeds will be available if an engine fails on takeoff after 60 knots.

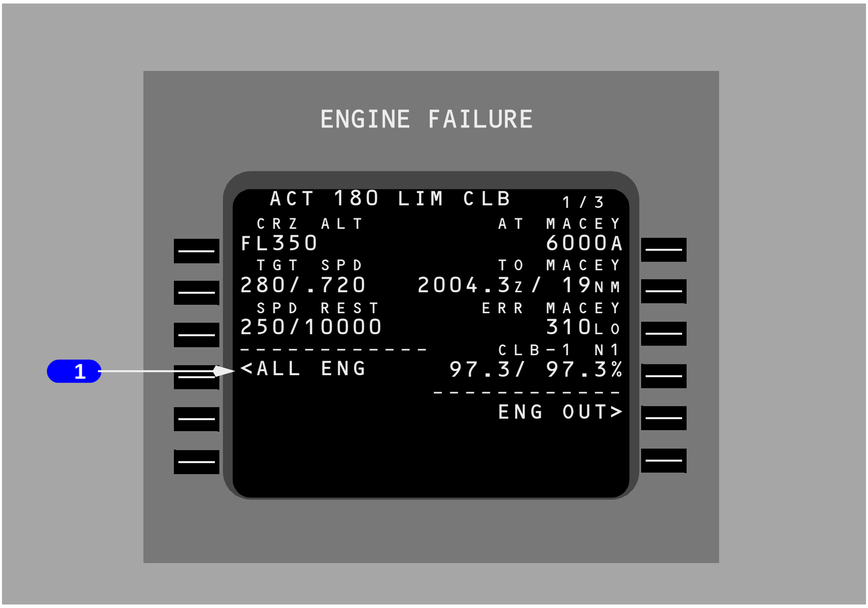
Prediction displays will be blanked on the MCDU pages when engine failure is detected and airspeed is over 60 knots of ground speed. Route (RTE) data, estimated time of arrival (ETA) data and top of climb (TOC) data displayed on the CDS Navigation Display will be blanked when an engine-out condition has been detected by the FMC. Engine-out will be cleared and the target speed and predictions will return to normal two engine values when the crew selects and EXECutes the ALL ENGINE prompt on the CLB page, or the CRZ or DES phase is entered, or a Flight Complete occurs, regardless of how many engines are running.

A new FMC CDU message (ENTER EO CRZ SPD AND ALT) will be displayed when the engine-out operation is terminated due to reaching cruise altitude or the pilot depresses the ALL ENGINE prompt button on the climb page.

When an engine failure has been detected, the thrust reduction height and the all engine acceleration height specified on TAKEOFF REF page two will be ignored. All waypoint fuel, ETA, Progress page and LEGS page performance predictions will be blanked. Upon exiting the engine out takeoff flight phase, the performance predictions will be displayed.

If an engine failure is detected after the all engine takeoff flight phase is complete, there will be no automatic engine out VNAV function as well as no modification of the Climb page.

Note: Prior to the all engine flight phase completion, with an engine failure detected, the Climb page is modified as depicted in the following illustration.



ENGINE FAILURE

```
 ACT 180 LIM CLB     1/3
  CRZ ALT        AT MACEY
FL350               6000A
  TGT SPD        TO MACEY
280/.720    2004.3z/ 19NM
  SPD REST      ERR MACEY
250/10000           310LO
-----------      CLB-1 N1
<ALL ENG      97.3/ 97.3%
            -------------
                 ENG OUT>
```

1 **All Engines**

Line select key 4L terminates the engine out takeoff mode and activates the normal climb mode.

Climb Phase

YA709 - YV754

During the takeoff flight phase prior to the flap acceleration height the FMC calculates and issues a speed target equal to V2 + 20 KCAS. V2 will be obtained from the MCP speed window. The V2 speed set in the MCP speed window cannot be changed after reaching 60 knots. VNAV continues to generate this speed target until reaching the all engine acceleration height indicated on the TAKEOFF REF page. The speed target then changes to the pre-planned climb speed profile subject to applicable speed limits for the current configuration.

Climb Profile Speed Targets

With VNAV armed for the climb phase, VNAV commands acceleration to:

- last MCP speed (V2) + 20 kts until acceleration height
- the flap placard speed minus 5 kts
- 230 kts or less when leading edge flaps are not fully retracted
- 250 knots with flaps retracted
- the active target speed

- waypoint speed constraints, or
- the speed restriction associated with the origin airport, whichever is more restrictive.

Climb Profile Speed Target Exceptions

An exception to the standard climb speed profile is flown:

- if VNAV initiates a level off prior to reaching the acceleration height for either of the following reasons, then the speed target changes at the level off initiation as though the airplane had reached the planned acceleration height.
  - profile altitude constraint or MCP altitude capture.
  - cruise altitude capture.
- if an engine failure is detected, target speed will be last MCP speed (V2) + 20 kts if the airplane is at that speed or greater, or the existing speed if the airplane is between V2 and V2 + 20 kts
- if an engine failure is detected and the engine out acceleration height is reached or VNAV guidance initiates a level-off prior to engine out acceleration height the VNAV target speed will change to VREF + 70 KCAS (flaps up maneuver speed)

YA701 - YA708

VNAV commands acceleration to:

- the active target speed
- 250 knots
- waypoint speed constraints, or
- the speed restriction associated with the origin airport, whichever is more restrictive.

At the climb thrust reduction point, the FMC commands a reduction to the selected climb thrust. Passing 10,000 feet, VNAV commands an acceleration to the economy climb speed, which is maintained until entering the cruise phase. Waypoint speed constraints take priority if slower than target speed.

During the climb, VNAV complies with the LEGS page waypoint altitude and speed constraints. A temporary level–off for a crossing altitude restriction is accomplished at the current commanded speed.

When the climb speed profile causes an anticipated violation of a waypoint altitude constraint, the FMC displays the CDU scratchpad message UNABLE NEXT ALTITUDE. A different speed profile that provides a steeper climb angle must be manually selected.

When the speed profile causes an anticipated violation of a waypoint speed constraint, the FMC displays the CDU scratchpad message UNABLE YYY KNOTS AT XXXXX, where speed is YYY and waypoint is XXXXX. When a waypoint speed constraint greater than 10 kts above the predicted speed at the waypoint exists, the FMC displays the CDU scratchpad message DRAG REQUIRED AFTER XXXXX where waypoint is XXXXX.

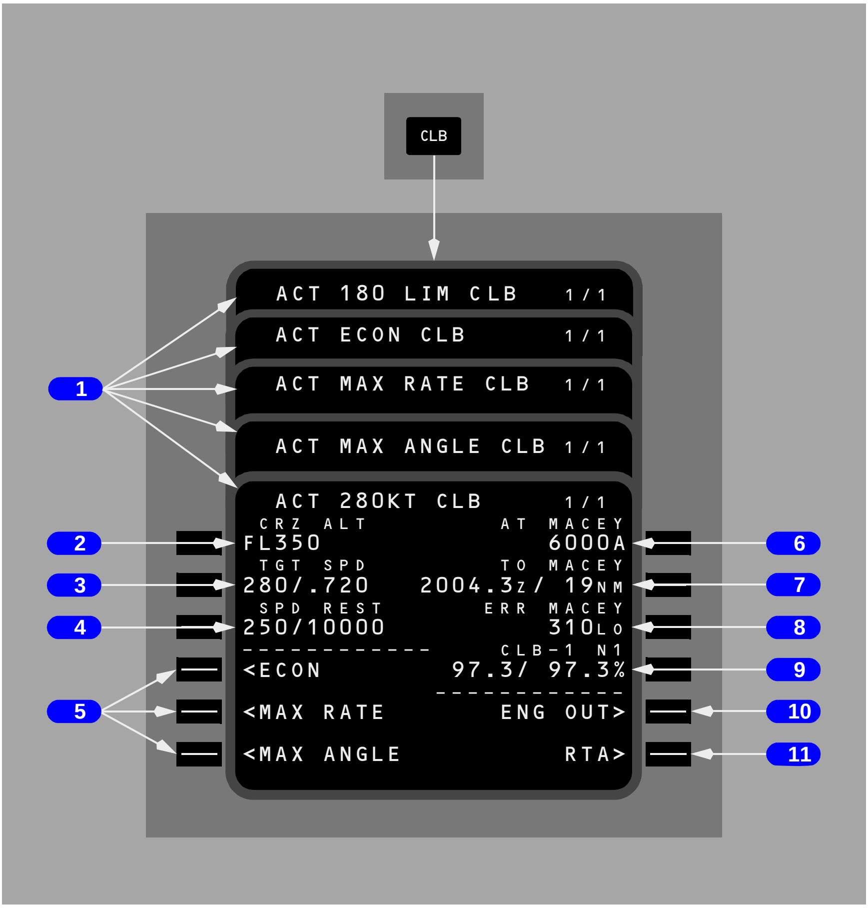
If a CLB 1 or CLB 2 derate is selected, the derate is maintained for the initial part of the climb. Thrust eventually increases to maximum climb thrust by 15,000 feet.

Climb Page

The climb page is used to evaluate, monitor, and modify the climb path. The data on the climb page comes from preflight entries made on the route and performance pages.

The climb page is automatically selected by pushing the CLB function key on the ground and during takeoff and climb. The TAKEOFF REF page automatically transitions to the climb page after takeoff.

The FMC climb mode can be economy or fixed speed. In either mode, similar data is displayed on the page.



1 Page Title

The page title displays the type of climb. Normally, the title displays ECON for the economy climb mode. Fixed speed climbs modify the title.

XXX LIM CLB indicates the limit speed, XXX, is based on leading or trailing edge flaps:

- target speed is 5 knots below trailing edge flap placard speed
- speed is limited to 230 kts if leading edge devices are not completely retracted

ECON indicates the speed is based on a cost index.

MAX RATE indicates the speed is based on the maximum altitude over the shortest period of time.

MAX ANGLE indicates the speed is based on the maximum altitude over the shortest horizontal distance.

Fixed climb speeds display XXXKT for a fixed CAS climb speed or M.XXX for a fixed Mach climb speed profile. Reasons for fixed speeds are:

- takeoff/climb acceleration segment constraints
- waypoint speed constraints
- an altitude constraint associated with a speed constraint
- a speed restriction
- a crew entered speed.

Displays ACT when the climb phase is active.

② Cruise Altitude (CRZ ALT)

YA701 - YA710

The cruise altitude from the PERF INIT page is displayed. A new altitude can be manually entered.

YF048 - YV754

The cruise altitude from the PERF INIT page is displayed. The altitude can be changed by two methods:

- a new altitude can be manually entered from the CDU at any time. Changing the altitude in this manner creates a modification.
- setting the MCP altitude above the current FMC CRZ altitude, provided no intermediate altitude constraints exist between the current airplane altitude and the MCP target altitude. Selecting the new altitude on the MCP and pushing the altitude intervention button places the new altitude in the CRZ ALT data line. Entering a new cruise altitude in this manner does not create a modification.

③ Target Speed (TGT SPD)

Displays computed values or manually entered values for the selected mode.

YF048 - YV754

Displays XXX/MCP when speed intervention is active and plan is active.

Airspeed and/or Mach may be entered using the keyboard. Title will display manually entered value.

The active controlling speed is highlighted in reverse video.

4 Speed Restriction (SPD REST)

The speed restriction line displays the speed restriction/altitude from one of the following sources:

- the navigation database value for the origin airport (dashes displayed when no speed restriction exists for the listed airport)
- waypoint related restriction from the RTE LEGS page if restriction limits climb speed
- a default speed of 250 knots and 10,000 feet for airports not listed in the navigation database (example 250/10000)
- displays XXX/FLAPS if the active speed restriction is lower than the minimum speed for the selected flap setting
- displays XXX/HOLD when decelerating to hold speed prior to hold entry fix.

Dashes displayed if no active speed restriction exists.

Manual crew entries or deletions may be made. HOLD or FLAPS speed may not be deleted or modified.

Note: If the FMC default speed restriction is overwritten, it will be deleted and not return after the overwrite condition passes (e.g. the default of 250/10000 is overwritten to 230/3000, after 3000 feet is passed there will be no speed restriction and VNAV will accelerate to the unrestricted climb speed).

The active controlling speed is highlighted in reverse video.

5 Climb Page Prompts

Push – selects various CLB pages.

Following line selection, the prompt for that page blanks.

YA701 - YT513, YV604, YV605

6 AT XXXXX

The waypoint constraint line displays the next waypoint having an altitude constraint. Constraints are entered on the RTE LEGS page or by departure procedure selection. The constraints can be deleted on this page or the RTE LEGS page. The waypoint may be a HOLD AT point.

Display is blank if no restriction exists.

YT514 - YT521, YV741 - YV754

6 AT XXXXX

The waypoint constraint line displays the waypoint and constraining altitude of the current VNAV altitude target. Constraints are entered on the RTE LEGS page or by departure procedure selection. The constraints can be deleted on this page or the RTE LEGS page. The waypoint may be a HOLD AT point.

Display is blank if no restriction exists.

7 TO XXXXXX

Displays ETA and distance to go to waypoint on AT XXXXXX line.

If no waypoint constraint exists, values are for CRZ ALT.

8 Error (ERR XXXXX)

Displays predicted altitude undershoot for the waypoint on AT XXXXXX line.

During VNAV operation, the FMC commands a level off if an overshoot is predicted.

Display is blank, including the label, if no error exists.

9 Climb N1 (CLB N1, CLB – X N1)

Displays the computed climb N1 value.

10 Engine Out (ENG OUT)

Push – displays RT ENG OUT and LT ENG OUT prompts. See ENG OUT CLB page description.

Selection will also load the engine–out SID if the following conditions are true:

- an engine–out SID exists for the ACTIVE departure runway
- an engine–out SID is not already selected for the active route

YA701 - YT513, YV604, YV605

- the flaps are not up and have not been up since the takeoff was started

YT514 - YT521, YV741 - YV754

- the EO SID disarm waypoint has not been reached if designated in the active route, regardless of flap position

YT514 - YT521, YV741 - YV754

- if no disarm waypoint exists for the SID, and flaps are not up and have not been up since takeoff was started
- flight phase is takeoff or climb
- the airspeed is greater than 80 kts (airborne).

When the above conditions are met and there is a loss of thrust or split between the thrust levers, the FMC will automatically load the engine-out SID upon detection of the engine-out condition.

YT514 - YT521, YV741 - YV754
An EO SID disarm waypoint may be coded into the EO SID. When a flight plan is executed, it will be searched to see if the disarm waypoint exists in the active plan. The EO SID will remain armed until that waypoint is sequenced regardless of flap position. If no disarm waypoint exists in the flight plan the EO SID auto-loading will revert to a flap based loading.

11 Required Time of Arrival (RTA)

Push – displays the RTA PROGRESS page.

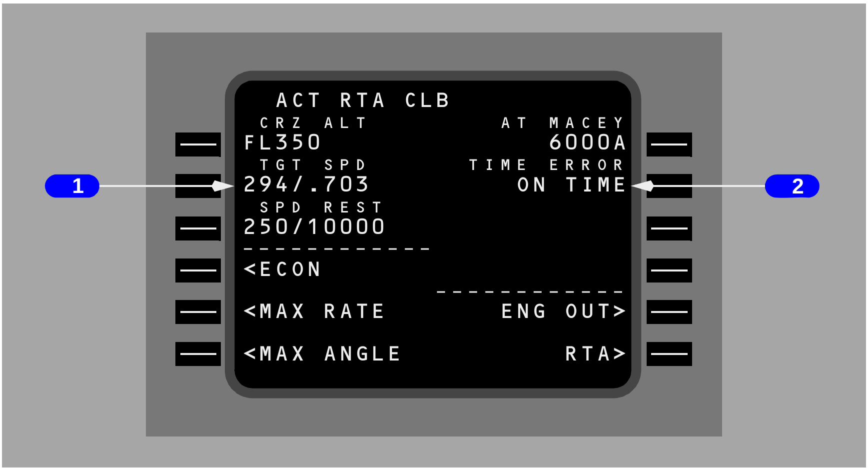
ERASE prompt replaces RTA during a page modification.

RTA Climb Page

The RTA climb page is displayed when a required time of arrival is active.

The RTA climb page is automatically selected by pushing the CLB function key when RTA is active.

Displays on this page are the same as other climb pages except as noted.



```
  ACT RTA CLB
   CRZ ALT               AT MACEY
FL350                       6000A
   TGT SPD           TIME ERROR
294/.703                  ON TIME
   SPD REST
250/10000
-----------
<ECON
                      -----------
<MAX RATE                ENG OUT>

<MAX ANGLE                   RTA>
```

1 Target Speed (TGT SPD)

Displays computed speed required to meet entered RTA.

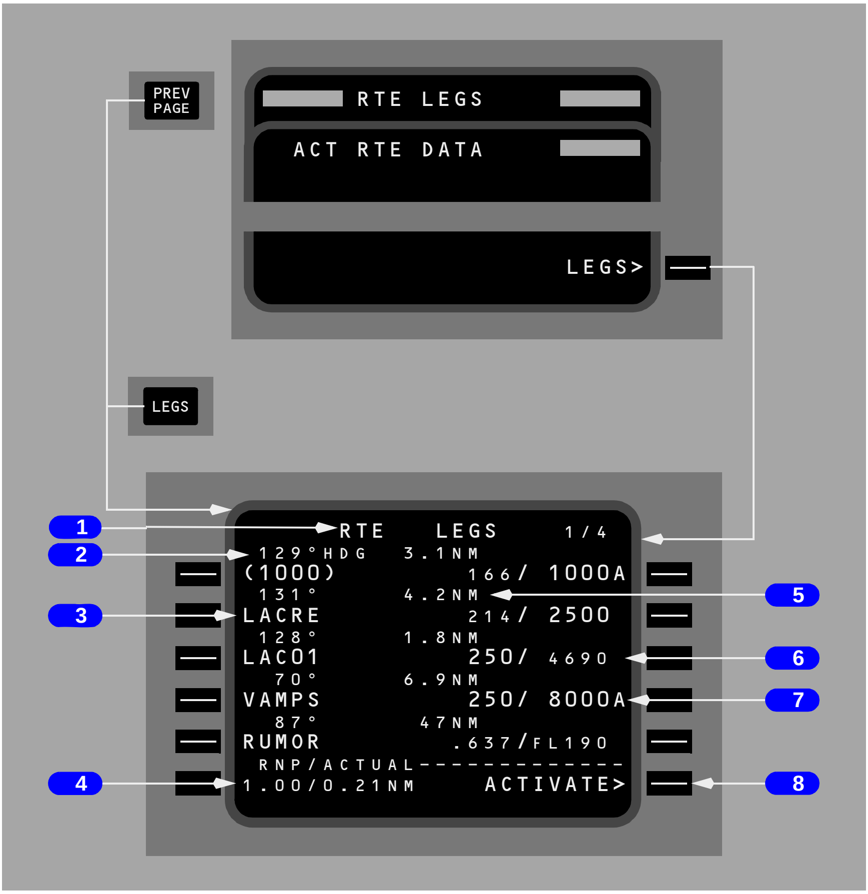
When RTA is exited by waypoint sequence or deletion, this speed changes to FMC target speed.

2 TIME ERROR

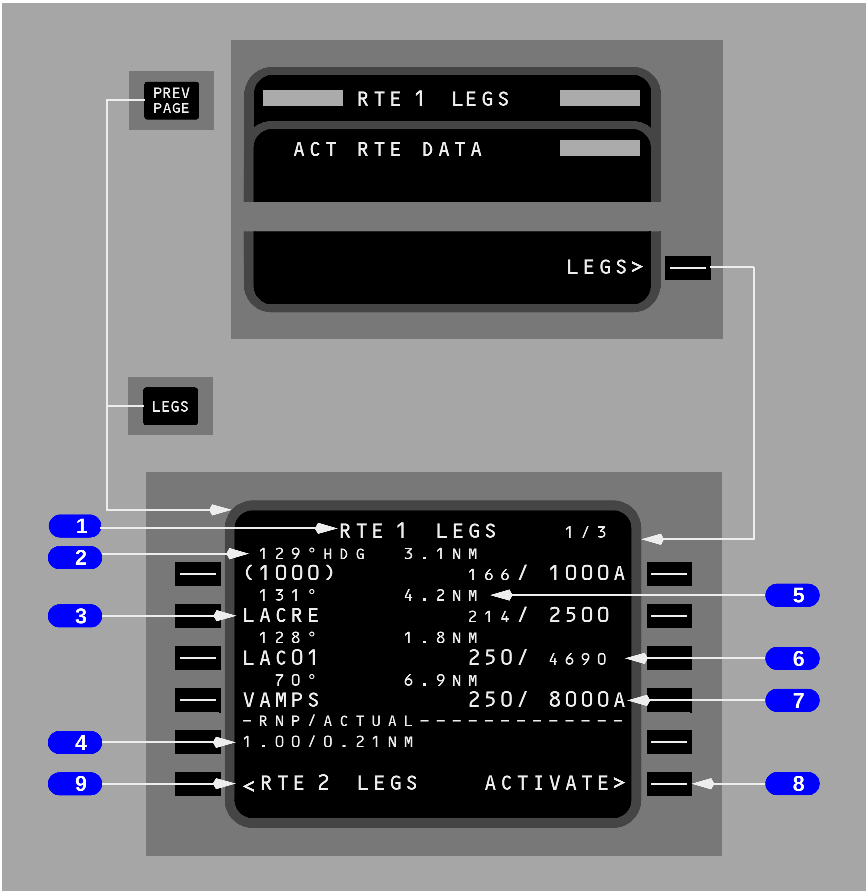
Displays computed time error at RTA waypoint. Same as RTA PROGRESS page.

RTE LEGS Page

YA701 - YT513, YV604, YV605



YT514 - YT521, YV741 - YV754



1 Page Title

YA701 - YT513, YV604, YV605

An active route legs page title is displayed with ACT as part of the title. A modified page title displays a reverse video MOD.

YT514 - YT521, YV741 - YV754

An active route legs page title is displayed with ACT as part of the title it can be either RTE 1 LEGS or RTE 2 LEGS that is ACT. When an inactive RTE 1 LEGS or RTE 2 LEGS is selected for display, the title (RTE 1 LEGS or RTE 2 LEGS) will be in cyan color.

2 Leg Direction

The leg segment direction is displayed as the title of the waypoint line. Courses are displayed in magnetic (xxx°) or true (xxx° T). Directions to maintain an arc display the arc distance, the word ARC followed by the direction, and left or right (24 ARC L). The computed great circle route leg directions may be different than chart values. Heading leg segments to conditional waypoints are displayed as (xxx° HDG) and track leg segments are displayed as (xxx° TRK). Directions may be displayed as special procedural instructions, such as HOLD AT or PROC TURN.

Display is blank for an undefined course.

3 Waypoint Identifier

The current active leg is always displayed at the top of the first active RTE LEGS page.

All route waypoints are displayed. Waypoints on an airway are included on the route legs page. Waypoints appear in flight sequence.

Waypoints can be entered and moved. This includes:

- adding new waypoints
- removing existing waypoints
- resequencing existing waypoints
- linking route discontinuities.

Displays the waypoint by name or condition.

Box prompts are displayed for route discontinuities.

Dashes are displayed for the next line beyond the end of the route.

4 Required Navigational Position/Actual (RNP/ACTUAL)

Displays the required navigation accuracy compared to actual navigation accuracy.

Manual entry is allowed.

5 Distance to Waypoint

Displays the distance from the airplane or the waypoint to the next waypoint.

6 Calculated Waypoint Speed/Altitude

Displays the calculated speed or altitude at the waypoint in small font.

7 Specified Waypoint Speed/Altitude

Displays any waypoint speed or altitude constraint in large font.

Manual entry is allowed.

8 ACTIVATE, RTE DATA

The activate prompt is displayed on the legs page when the route is not active.

Push –

- ACTIVATE arms the execute function. Pushing the EXEC key activates the route and changes the ACTIVATE prompt to RTE DATA
- RTE DATA displays the route data page. The RTE DATA prompt is used to review or modify additional information about the route.

YT514 - YT521, YV741 - YV754

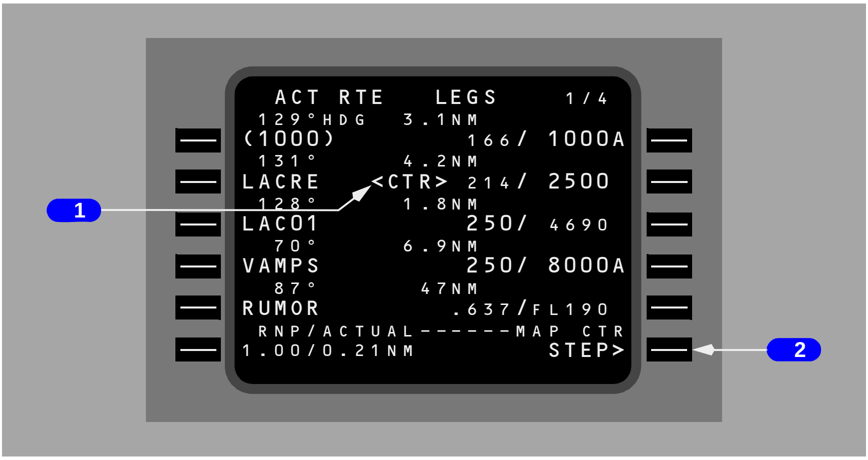
9 RTE (1 or 2) LEGS

Push – Displays RTE LEGS page that is at LSK 6L, either RTE 1 LEGS or RTE 2 LEGS.

Map Center Step Display

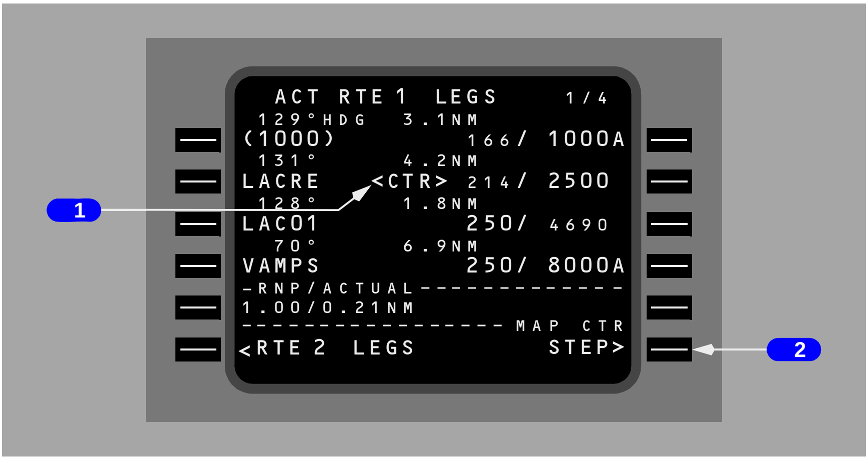
The map center step prompt replaces ACTIVATE or RTE DATA when the EFIS control panel mode selector is placed in the PLAN position. Pushing the prompt key advances the waypoint that is displayed in the center of the navigation display. The label <CTR> is displayed to the right of the corresponding waypoint on the RTE LEGS page.

YA701 - YT513, YV604, YV605



```
  ACT RTE    LEGS      1/4
  129°HDG   3.1NM
(1000)          166/ 1000A
  131°      4.2NM
LACRE      <CTR> 214/ 2500
  128°      1.8NM
LAC01           250/ 4690
   70°      6.9NM
VAMPS           250/ 8000A
   87°       47NM
RUMOR         .637/FL190
  RNP/ACTUAL------MAP  CTR
1.00/0.21NM          STEP>
```

YT514 - YT521, YV741 - YV754



```
    ACT RTE 1  LEGS        1/4
  129°HDG    3.1NM
(1000)            166/ 1000A
  131°       4.2NM
LACRE     <CTR> 214/ 2500
  128°       1.8NM
LAC01             250/ 4690
   70°       6.9NM
VAMPS             250/ 8000A
-RNP/ACTUAL-------------
1.00/0.21NM
----------------  MAP CTR
<RTE 2  LEGS          STEP>
```

1 Map Center Label (<CTR>)

Identifies the waypoint around which the map display is centered.

Whenever the EFIS Mode selector is positioned to PLAN, the label is automatically displayed for the first geographically fixed waypoint on the displayed page.

2 STEP

Displayed on a CDU when PLAN is selected on the associated EFIS control panel. Replaces the RTE DATA or ACTIVATE prompt.

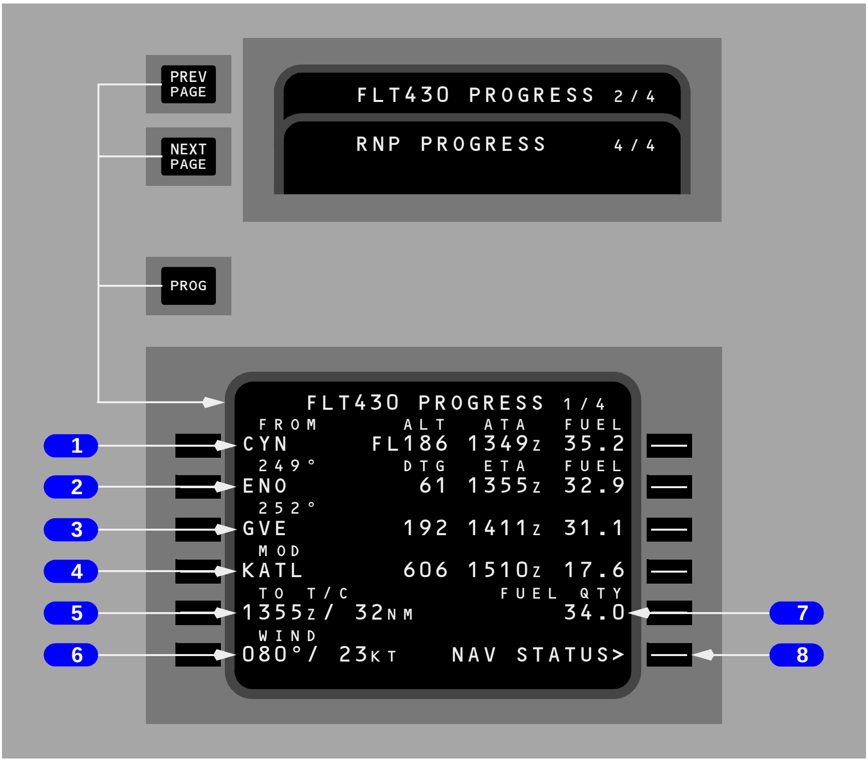
Push – moves the map center label to the next geographically fixed waypoint in the route.

Progress Page 1/X

The progress page provides general flight progress information along the route of flight such as:

- waypoints (last, active and next)
- waypoint ETA
- waypoint ATA
- distance to go information
- destination information
- altitude change points
- current wind
- fuel quantity

The page title displays the company flight number from the RTE page.



```
FLT430 PROGRESS      2/4
RNP PROGRESS         4/4
```

```
    FLT430 PROGRESS 1/4
 FROM         ALT   ATA    FUEL
CYN         FL186 1349Z    35.2
 249°         DTG   ETA    FUEL
ENO            61 1355Z    32.9
 252°
GVE           192 1411Z    31.1
 MOD
KATL          606 1510Z    17.6
 TO  T/C             FUEL  QTY
1355Z/ 32NM                34.0
 WIND
080°/ 23KT      NAV STATUS>
```

1 FROM

Displays the identifier of the last (FROM) waypoint, the altitude (ALT), the actual time of arrival (ATA), and the fuel at that waypoint.

2 Active Waypoint

Displays the identifier of the active waypoint, the flight plan course to the active waypoint, and distance–to–go (DTG) from present position to the active waypoint. Also displays the estimated time of arrival (ETA) and predicted fuel remaining at the active waypoint. The active waypoint is highlighted by reverse video.

3 Next Waypoint

Displays the identifier of the next waypoint which follows the active waypoint, the flight plan course for that leg, and flight plan distance–to–go (DTG) from present position to the next waypoint. Also displays the estimated time of arrival (ETA) and predicted fuel remaining at the next waypoint.

4 Destination

Displays the identifier of the destination airport (DEST) and flight plan distance–to–go (DTG) from present position to the destination. Also displays estimated time of arrival (ETA) and predicted fuel remaining at the destination.

When a route modification is in progress, the destination line label displays MOD. Performance predictions include the modification.

YT514 - YT521, YV741 - YV754
Highlighting is used to identify the MOD or INACT destination field.

5 Altitude Change Point (TO XXXXX)

Displays ETA and distance to go to the following altitude change points as appropriate to phase of flight:

- TO T/C: to top of climb for the active climb
- TO STEP POINT: to the step point if a STEP TO entry is made on CRZ page
- TO T/D: to top of descent, if no STEP TO entry is made on CRZ page
- TO E/D: to the end of descent waypoint for an active path descent; blank if a path descent is not available.

6 WIND

Displays current true wind direction and speed.

7 Fuel Quantity (FUEL QTY)

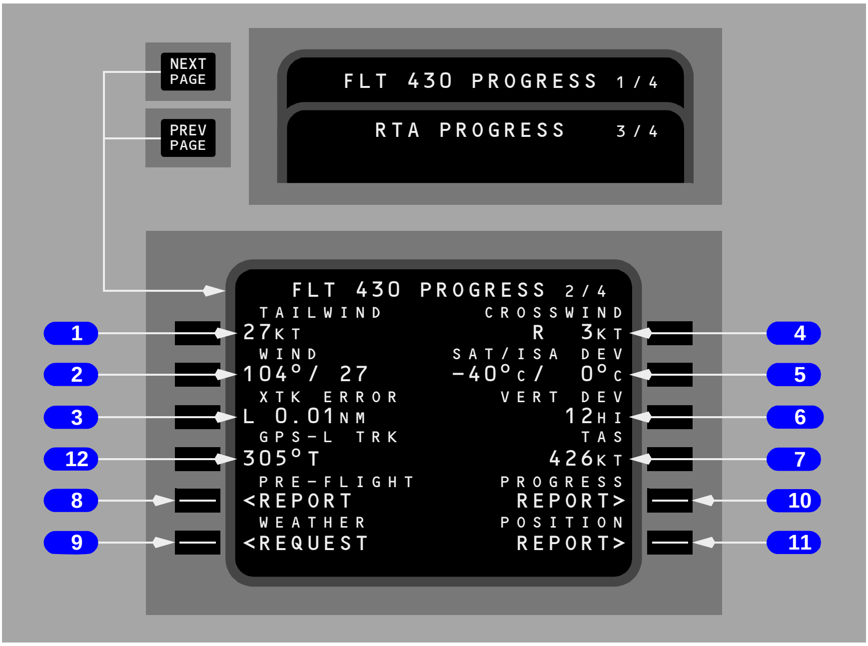
Displays the present total fuel quantity remaining as obtained from the airplane fuel quantity indication system.

8 **NAV STATUS**

Push – displays the navigation status page.

Progress Page 2/4

The progress page 2/4 displays wind, track, path, temperature, and speed data.



```
FLT 430 PROGRESS 1/4
RTA PROGRESS     3/4
```

```
      FLT 430 PROGRESS 2/4
 TAILWIND           CROSSWIND
27KT                   R  3KT
 WIND             SAT/ISA DEV
104°/ 27           -40°C/  0°C
 XTK ERROR           VERT DEV
L 0.01NM                 12HI
 GPS-L TRK                TAS
305°T                   426KT
 PRE-FLIGHT          PROGRESS
<REPORT               REPORT>
 WEATHER             POSITION
<REQUEST              REPORT>
```

1 HEADWIND or TAILWIND

Displays the present headwind or tailwind component.

2 WIND

Displays the present true wind direction/speed.

3 Crosstrack Error (XTK ERROR)

Displays present cross–track error from the desired LNAV course.

Blank if error is greater than 99.9 nm.

4 CROSSWIND

Displays present crosswind component (left or right).

5 Static Air Temperature/ISA Deviation (SAT/ISA DEV)

Displays present SAT and the equivalent ISA deviation.

6 **Vertical Descent Path Deviation (VERT DEV)**

Displays present computed deviation (HI or LO) from the FMC vertical path.

Blank if descent not active or path not available.

7 **TAS**

Displays present TAS.

8 **PRE–FLIGHT REPORT**

Push – transmits downlink report of preflight data.

9 **WEATHER REQUEST**

Push – transmits a data link request for a weather uplink.

10 **PROGRESS REPORT**

Push – transmits a downlink report of progress data.

11 **POSITION REPORT**

Push – transmits a downlink report of position data.

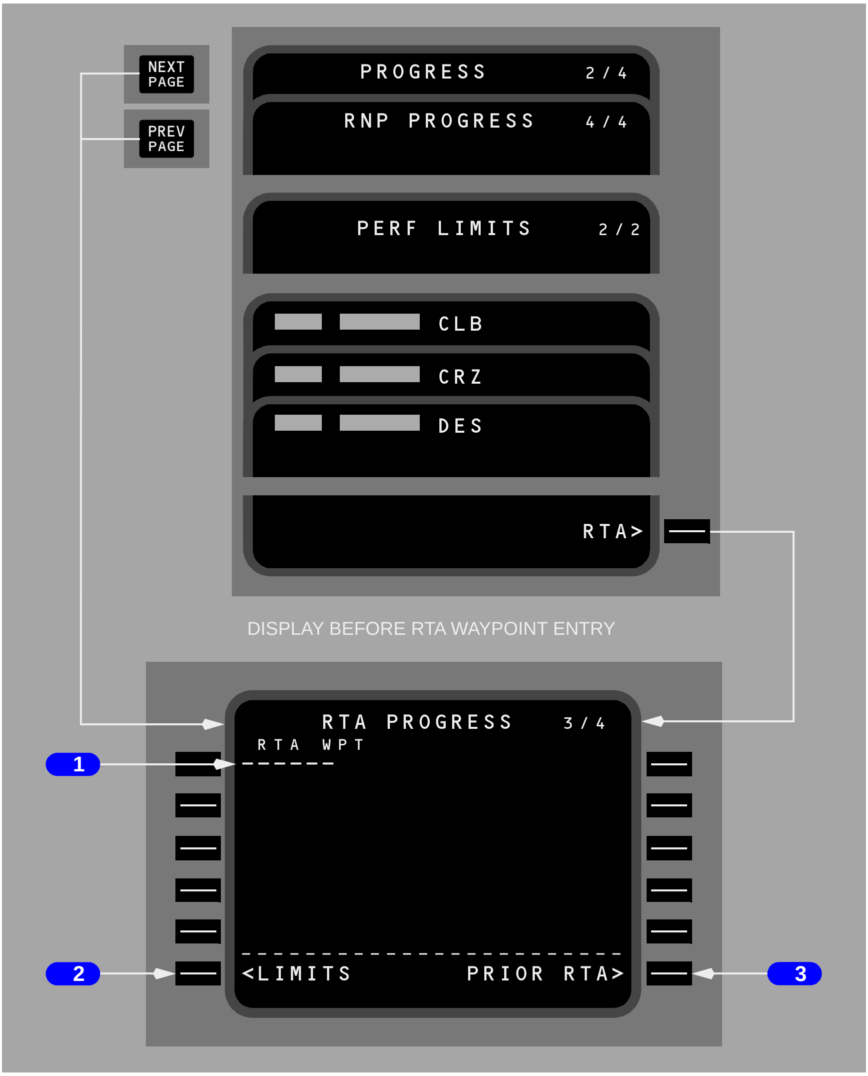
12 **GPS–L TRK**

Displays GPS track.

RTA Progress Page 3/4

RTA Progress page is used to initiate the required time of arrival (RTA) mode.

The RTA page provides advisory data on flight progress in the RTA mode and advises of control times such as recommended takeoff time to meet RTA.



① Required Time of Arrival Waypoint (RTA WPT)

Displays dashes when entry allowed.

2 LIMITS

Push – displays the PERF LIMITS page.

3 Prior RTA Waypoint (PRIOR RTA)

Prompt displayed when the RTA waypoint field contains dashes and a previous RTA waypoint is still in the flight plan; otherwise blank.

Push – displays last active RTA waypoint data.

RTA Progress on Ground and in Flight

```
 ACT RTA PROGRESS      3/4
 RTA WPT                 RTA
EPH               1100:00zB
                  TIME ERROR
                     ON TIME
RECMD T/O                GMT
1040:02z           1003:00z
DIST--TO EPH      --ALT/ETA
 126NM        FL250/1022:29z
-------T/O WINDOW---LAST
                   1041:44z
------------------------
<LIMITS
```

GROUND DISPLAY

```
 ACT RTA PROGRESS      3/4
 RTA WPT                 RTA
EPH               1012:00zA
 RTA SPD          TIME ERROR
250/.633       EARLY   01:30
SPD REST                 GMT
250/10000          1000:30z
DIST--TO EPH      --ALT/ETA
  25NM        FL250/1010:30z
FIRST--RTA WINDOW---LAST
1008:23z           1010:30z
------------------------
<LIMITS
```

IN FLIGHT DISPLAY

1 Required Time of Arrival Waypoint (RTA WPT)

Waypoint entry must be in flight plan or the CDU message NOT IN FLIGHT PLAN will be displayed.

Entering a valid waypoint will generate a MOD RTA PROGRESS page and illuminate the EXEC light.

Deletion of the RTA waypoint will create a MOD RTA PROGRESS page with all data blanked and EXEC light illuminated. Execution will exit the RTA mode.

Deletion of the RTA waypoint does not remove the waypoint from the flight plan.

Automatically clears the RTA waypoint and exits the RTA waypoint after sequencing the RTA waypoint out of the flight plan.

2 Recommended Takeoff Time (RECMD T/O)

Displays the recommended takeoff time (brake release time) to meet the planned RTA.

Time is based on entered Cost Index as well as the earliest and latest times to achieve RTA.

3 Distance To, Altitude, and ETA at the RTA Waypoint (DIST – – TO XXX – – ALT/ETA)

Displays the distance to the RTA waypoint.

Displays the predicted altitude at the RTA waypoint.

Displays ETA to the RTA waypoint based on:

- immediate takeoff
- MIN/MAX speeds on PERF LIMITS page
- entered forecast winds.

4 Required Time of Arrival (RTA)

After RTA waypoint entry, initially displays current ETA based on the active flight plan and performance parameters at time of waypoint entry.

Desired RTA may be entered by overwriting displayed data.

Entry must be in one of the following forms:

- XXXXXX (hr/min/sec)
- XXXX (hr/min)
- XXXX.X (hr/min/tenths of min).

Entry of “A” after RTA specifies arrival time of at or after.

Entry of “B” after RTA specifies arrival time of at or before.

5 TIME ERROR

Displays the most recent time error in minutes and seconds up to a maximum of 59:59 minutes.

Displays ON TIME if GMT is within current T/O WINDOW.

Displays EARLY or LATE as appropriate if GMT is not within current T/O WINDOW.

6 GMT

Displays the actual GMT.

7 Takeoff Window (– – – – – – – T/O WINDOW – – – LAST) or (FIRST – – T/O WINDOW – – – – – – –)

Displays latest takeoff time to meet the planned RTA.

If the entered RTA time is “At or After” time, only the FIRST field will be displayed.

If the entered RTA time is “At or Before” time, only the LAST field will be displayed.

Time is based on minimum and maximum speeds on the PERF LIMITS page.

8 Required Time of Arrival Speed (RTA SPD)

Displays the target speed required to meet the planned RTA.

Same as speed displayed on RTA CLB, CRZ, or DES page.

Limited by MIN/MAX speeds on the PERF LIMITS page and the SPD REST line.

During cruise, displays XXX/HOLD when decelerating to hold speed prior to hold entry fix.

9 Speed Restriction (SPD REST)

Displays the current speed restriction affecting RTA progress.

When not in cruise, displays XXX/HOLD when decelerating to hold speed prior to hold entry fix.

10 Arrival Time Window (FIRST – – RTA WINDOW – – – LAST)

Displays earliest and latest achievable arrival times at the RTA waypoint.

Times based on MIN/MAX speeds on PERF LIMITS page, existing winds, and entered forecast winds.

11 LIMITS

Push – displays PERF LIMITS page.

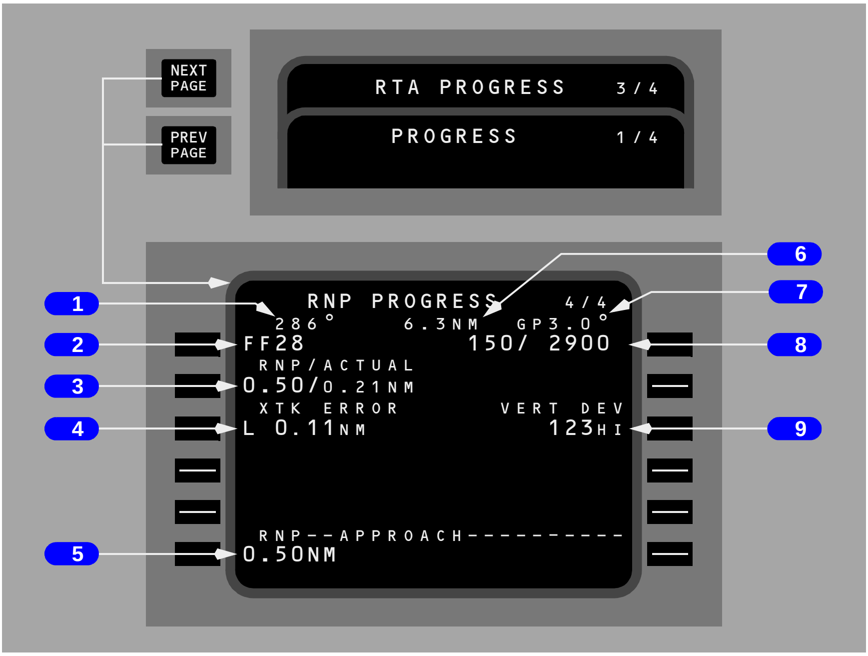
12 TIME ERROR

In flight, displays difference between the ETA and the RTA plus the TIME ERROR TOLERANCE on the PERF LIMITS page.

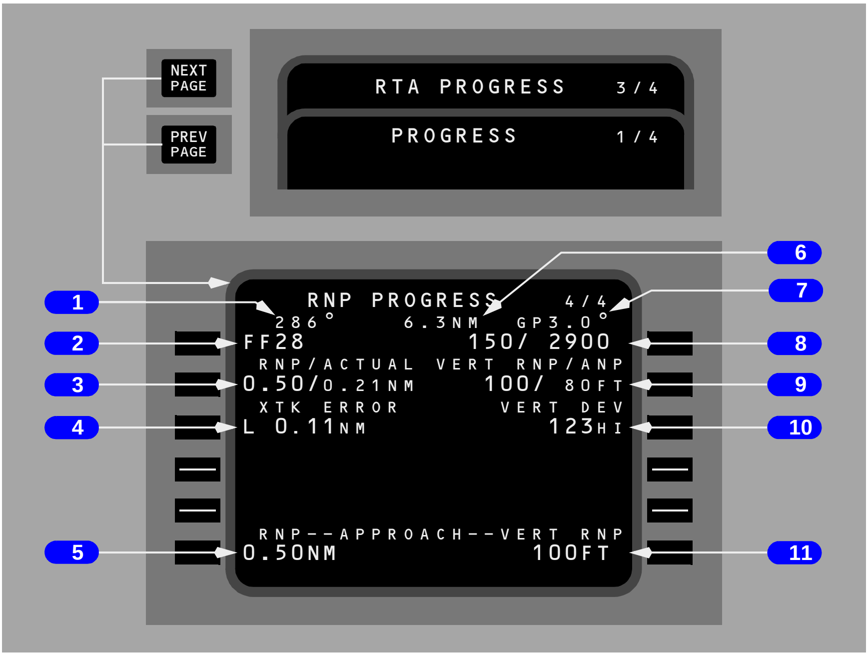
RNP Progress Page 4/4

Progress page 4/4 displays essential Required Navigation Performance (RNP) information. The items displayed include waypoint identifier, RNP and ANP values, course, distance, glide path, cross track error, speeds, altitudes and vertical deviation.

YA701 - YL544, YM482 - YM484



YL545 - YL551, YN531 - YV754



1 Leg Direction

The leg segment direction is displayed as the title of the waypoint line. Courses are displayed in magnetic (xxx°) or true (xxx° T). Directions to maintain an arc display the arc distance, the word ARC followed by the direction, and left or right (24 ARC L). The computed great circle route leg directions may be different than chart values. Heading leg segments to conditional waypoints are displayed as (xxx° HDG) and track leg segments are displayed as (xxx° TRK). Directions may be displayed as special procedural instructions, such as HOLD AT or PROC TURN.

Display is blank for an undefined course.

2 Waypoint Identifier

Displays the next waypoint.

Same as displayed on the RTE LEGS page.

3 RNP / ACTUAL

Displays the current FMC RNP / ANP values. The RNP may be overwritten (manual entries are displayed in large font) and affects the approach RNP 6L value. The RNP value displayed is selected from the performance defaults database if not specified in the navigation database.

Same as displayed on the POS SHIFT page.

4 Crosstrack Error (XTK ERROR)

Displays present cross–track error from the desired LNAV course.

L or R indicates left or right of course.

Blank if error is greater than 99.9 nm.

5 Lateral RNP (Approach)

Displays the lowest RNP (initial, intermediate or final segment) for the selected approach

Displays in large font for 3L manually entered RNP values.

Displays in small font for values provided by the navigation database.

6 Distance To Go

Displays the distance remaining to the next waypoint.

7 Glide Path

Displays the FMC computed glide path for the approach.

8 Waypoint Speed/Altitude

Displays waypoint speed or altitude constraints in large font.

Displays FMC predicted values in small font when no restrictions have been specified.

YA701 - YL544, YM482 - YM484

9 Vertical Deviation

Displays present vertical deviation from the FMC computed glide path.

YL545 - YL551, YN531 - YV754

9 Vertical Navigation Performance

Displays both the vertical RNP (Required Navigation Performance) and the vertical ANP (Actual Navigation Performance) for the current leg.

Valid display range for vertical ANP is 0 to 999 feet.

Manual entries are allowed and are displayed in large font.

Valid entries are 10 to 999 feet and may be suffixed with an optional “/“

Entries are cleared at flight completion.

Values from the navigation database are displayed in small font.

YL545 - YL551, YN531 - YV754

10 Vertical Deviation

Displays present vertical deviation from the FMC computed glide path.

YL545 - YL551, YN531 - YV754

11 Vertical RNP (Approach)

Displays the lowest applicable vertical RNP for the approach.

Manual entries (entered in 2R) are displayed in large font.

Values from the navigation database are displayed in small font.

N1 Limit Page

This section describes the in–flight version of the N1 LIMIT page. See the FMC Preflight section for a description of the preflight version of the N1 LIMIT page.

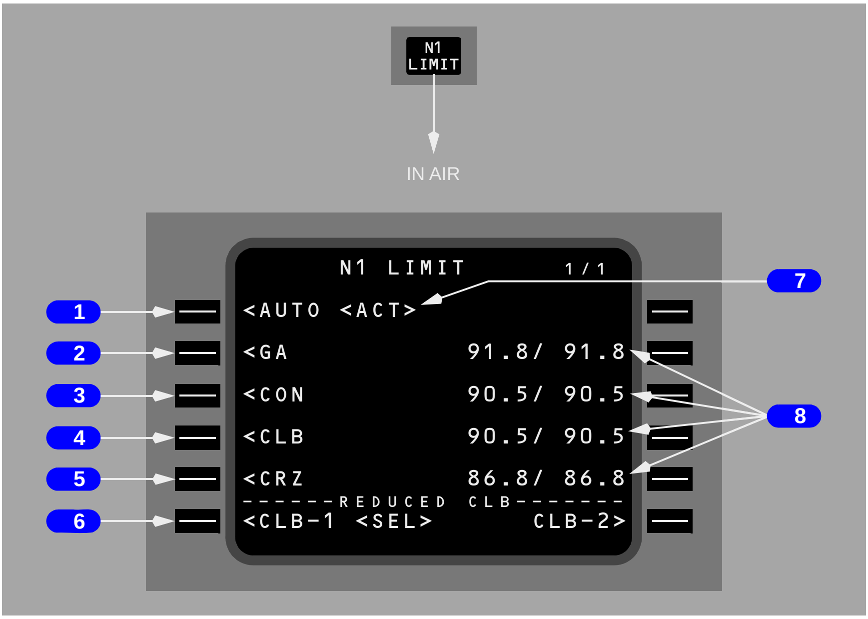
Normally, N1 limits are automatically specified. Pilot selection of other limits is allowed.

Pilot selection of a reduced climb mode does not change the automatic selection for other phases of flight.

Pilot selected mode is automatically replaced by AUTO selection when the autopilot next changes vertical mode.

The active thrust limit is used by the autopilot and is displayed on the thrust mode display.

YT514 - YT521, YV741 - YV754
An optional increase in available cruise thrust limits is available via a custom Loadable Defaults Database (LDDB). The default cruise N1 thrust rating is CRZ where cruise N1 limits are used as the default cruise thrust rating. The optional setting is CLB where climb N1 limits are used as the default cruise thrust rating.



```
         N1  LIMIT          1/1
<AUTO  <ACT>
<GA                  91.8/ 91.8
<CON                 90.5/ 90.5
<CLB                 90.5/ 90.5
<CRZ                 86.8/ 86.8
------REDUCED CLB-------
<CLB-1  <SEL>            CLB-2>
```

1 AUTO

Push – selects automatic computation of N1 limits for all phases of flight.

2 Go Around (GA)

Push – selects the go–around thrust limit.

3 Continuous (CON)

Push – selects the maximum continuous thrust limit.

4 Climb (CLB)

Push – changes the thrust mode from AUTO to the active climb thrust, i.e. CLB, CLB–1, or CLB–2.

5 Cruise (CRZ)

Push – selects the cruise thrust limit.

6 Reduced Climb (REDUCED–CLB)

Push – selects either of two reduced climb thrust modes.

CLB–1 provides a climb limit reduced by 3% N1 (approximately 10% thrust).

CLB–2 provides a climb limit reduced by 6% N1 (approximately 20% thrust).

The reduced climb N1 value is displayed on the CLB pages.

If either mode is <SEL>, deletion allows return to full rated climb thrust.

Any reduced climb selection is automatically deleted above 15,000 feet.

Note: If a reduced thrust takeoff has been specified on the TAKEOFF REF page, the FMC will re-compute CLB–1 and CLB–2 values as required to avoid a climb N1 value greater than the reduced thrust takeoff N1 value.

7 <ACT> STATUS LABEL

Identifies the active N1 thrust limit.

8 N1

Displays the N1 for individual thrust limits based on present conditions and bleed air configuration.

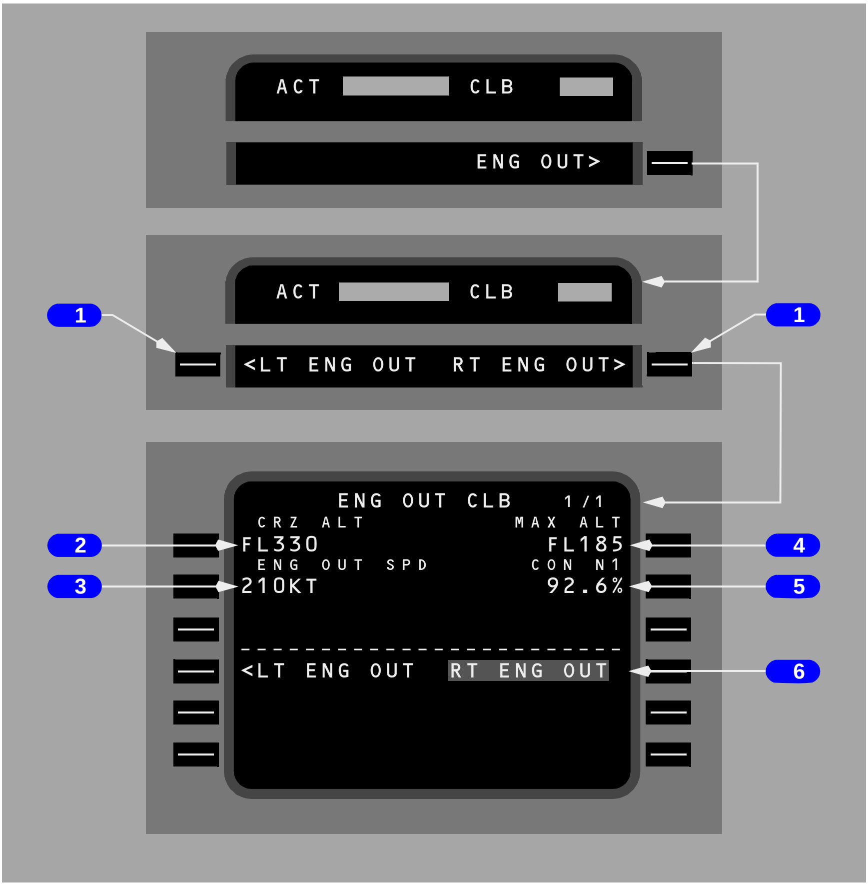
If CLB–1 or CLB–2 is selected, the N1% for CLB and the N1 cursors still display values for full rated climb.

Engine Out Climb

Engine out climb advisory data is available on the CLB page. Engine out data is also available with both engines operating. The engine out climb phase automatically transitions to the engine out cruise phase when reaching the cruise altitude.

Engine Out Climb Page

Displays advisory information for an engine inoperative condition. Once the page is selected, it cannot be executed.



1 Left/Right Engine Out (LT ENG OUT/RT ENG OUT)

Displayed after selection of ENG OUT prompt.

2 Cruise Altitude (CRZ ALT)

Displays the current active cruise altitude. Value is forwarded from either the PERF INIT, CRZ, CRZ CLB, or CRZ DES pages. Manual entry not allowed.

3 Engine Out Speed (ENG OUT SPD)

Displays the minimum drag engine out climb speed.

4 Maximum Altitude (MAX ALT)

Displays the maximum altitude at which company specified rate of climb can be achieved using one engine at maximum continuous thrust.

After page selection, the FMC accounts for wing and engine anti–ice, air conditioning and engine bleed of the operating engine.

5 Continuous N1 (CON N1)

Displays the N1 for maximum continuous thrust.

6 LT ENG OUT/RT ENG OUT

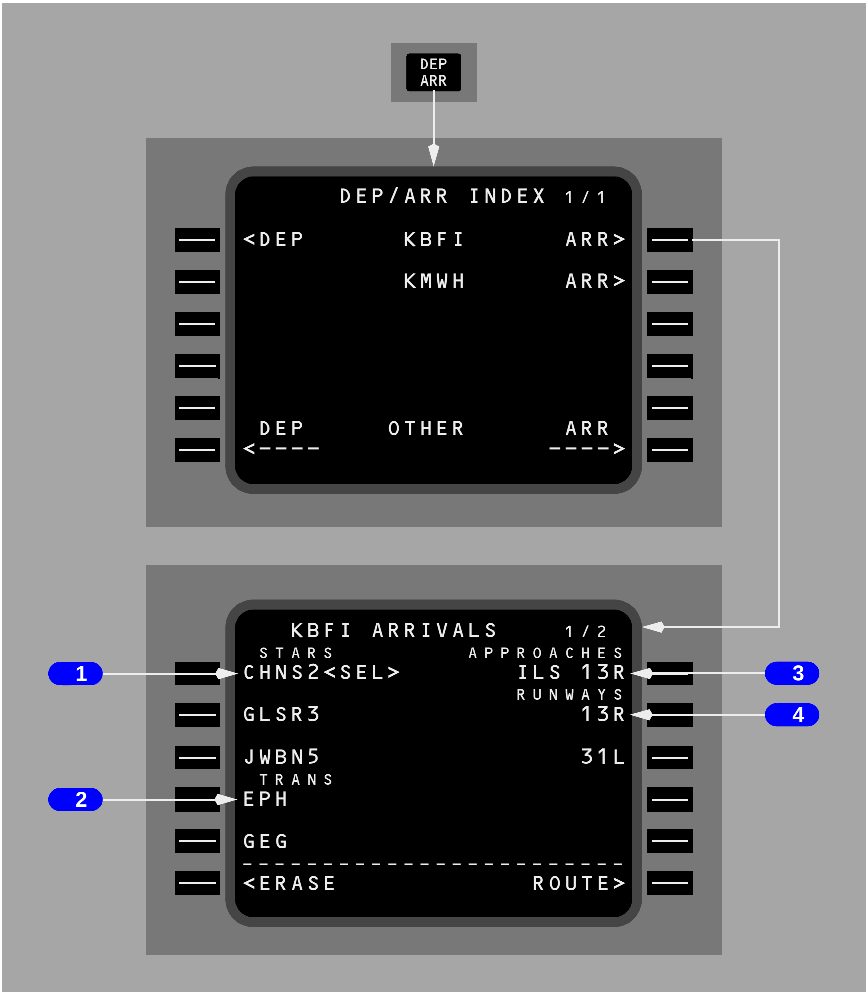
Selected engine is shown in reverse highlighting.

Air Turnback

Arrivals Page

During a turn–back situation, the crew requires quick access to the arrivals information for the origin airport. The departure/arrivals index and arrivals page provide access without changing the destination on the route page. See Chapter 11, Section 43 for additional information on the arrivals page.

YA701 - YT513, YV604, YV605



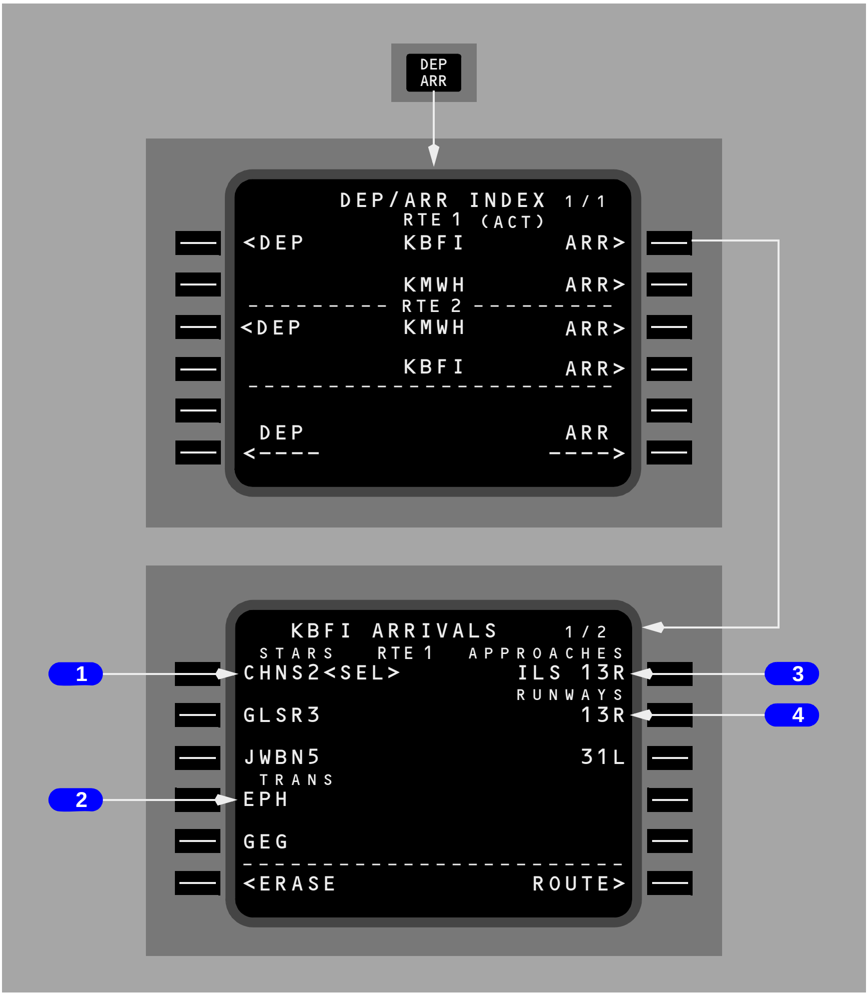
```
     DEP/ARR INDEX 1/1
<DEP       KBFI       ARR>
           KMWH       ARR>




 DEP       OTHER      ARR
<----                ---->
```

```
   KBFI ARRIVALS      1/2
 STARS        APPROACHES
CHNS2<SEL>        ILS 13R
                  RUNWAYS
GLSR3                 13R
JWBN5                 31L
 TRANS
EPH
GEG
-------------------------
<ERASE             ROUTE>
```

YT514 - YT521, YV741 - YV754



1 Standard Terminal Arrival Routes (STARS)

Displays STARS for the origin airport.

2 Transitions (TRANS)

Displays transitions for the origin airport.

3 APPROACHES

Displays approaches for the origin airport.

4 RUNWAYS

Displays runways for the origin airport.

Introduction

The cruise phase automatically begins when the top of climb is reached.

During cruise, the primary FMC pages are:

- RTE LEGS
- PROGRESS
- CRZ.

The RTE LEGS pages are used to manage route restrictions and modify the route. The PROGRESS pages display flight progress information. RTA requirements are also specified on the PROGRESS pages. The CRZ pages display VNAV related information. Other pages include:

- POS REF page – verifies the FMC position (refer to Section 40 of this chapter)
- POS SHIFT page – permits selection of preferred position from list of references
- RTE DATA page – displays progress data for each waypoint on the RTE LEGS page. Displays wind data for cruise waypoints.
- REF NAV DATA page – displays information about waypoints, navaids, airports, or runways
- LATERAL OFFSET page – permits selection of a route offset
- FIX INFO page – displays information about waypoints, and can be used to create new waypoints and fixes
- SELECT DESIRED WAYPOINT page – permits selection of the desired waypoint from a list of duplicate named waypoints
- NAV STATUS page – displays information about available navigation aids.

The only cruise mode automatic page changes are the transition from climb to cruise at the top of climb point and from cruise to descent at the top of descent point.

LNAV Modifications

This section presents the normal techniques for modifying the route. The modifications include:

- adding and deleting waypoints
- resequencing waypoints
- linking discontinuities
- intercepting a course.

RTE LEGS Page Modifications

When modifications are made to the RTE LEGS page, several automatic prompt or identifying features assist in managing and executing the modifications, such as:

- ERASE
- INTC CRS.

Adding Waypoints

A waypoint can be added to the route whenever necessary.

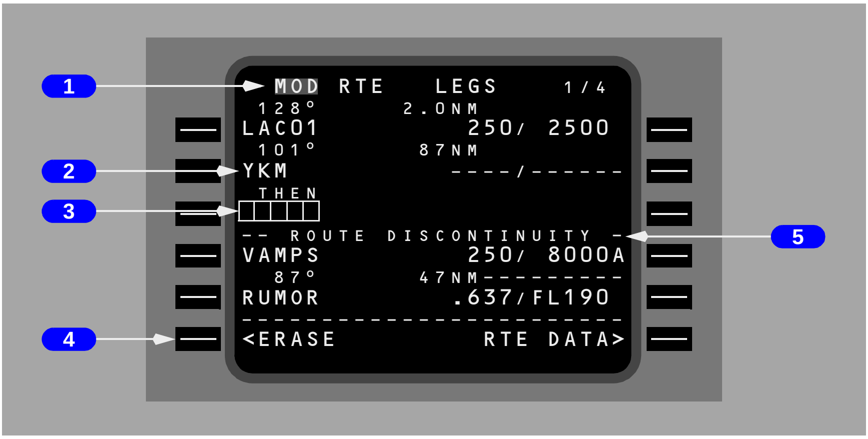
The new waypoint must first be placed into the CDU scratchpad. Existing waypoints can be copied from a RTE LEGS page into the scratchpad by pushing the line select key adjacent to the desired waypoint.

The new waypoint is then inserted into the route at the desired sequence point by pushing the line select key adjacent to the desired location for the new waypoint. Using the NEXT PAGE/PREV PAGE function keys to select the desired location does not alter the CDU scratchpad. The new entry automatically links to the preceding waypoint via a direct route. Placing the new waypoint into the active waypoint line is a special case and is discussed under Intercept Course in this section.

All new waypoints, except along track waypoints, cause a route discontinuity between the new waypoint and the following waypoint.

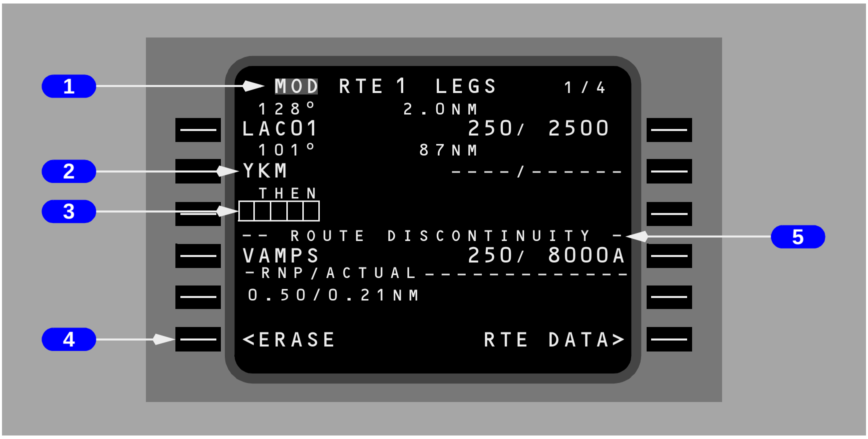
Note: If the FMC NAV database contains a HOLD pattern at the FAF, executing a database approach with a procedure turn and then executing a HOLD at the same FAF, using any inbound course, may cause a discontinuity between the FAF and the procedure turn. If the discontinuity is removed, LNAV guidance is available to fly the approach from the published holding pattern. LNAV guidance is not available to fly the published procedure turn.

YA701 - YT513, YV604, YV605



```
 MOD RTE     LEGS      1/4
  128°       2.0NM
LAC01           250/ 2500
  101°        87NM
YKM             ----/------
  THEN
□□□□□
-- ROUTE DISCONTINUITY -
VAMPS           250/ 8000A
    87°       47NM---------
RUMOR           .637/FL190
------------------------
<ERASE          RTE DATA>
```

YT514 - YT521, YV741 - YV754



```
 MOD RTE 1   LEGS      1/4
  128°       2.0NM
LAC01           250/ 2500
  101°        87NM
YKM             ----/------
  THEN
□□□□□
-- ROUTE DISCONTINUITY -
VAMPS           250/ 8000A
-RNP/ACTUAL-------------
 0.50/0.21NM

<ERASE          RTE DATA>
```

1 Page Title

When the page is modified, MOD appears in front of the title in reverse highlighting. This means the route is now altered. The MOD title also shows that the modifications are not yet executed and can be removed using the ERASE prompt.

2 Modified Waypoint

YKM waypoint is entered into the route between LAC01 and VAMPS. This modification creates a route discontinuity.

3 Discontinuity Waypoint

Box prompts indicate the requirement to link the route by entering a route waypoint into the discontinuity waypoint position.

4 ERASE

The ERASE prompt is displayed when the first modification is entered. The prompt remains on the page until the modifications are erased or executed.

Push – removes all modifications and restores all active data.

5 Discontinuity Header

Indicates that the route is not continuous. Distance to destination on the PROGRESS page is not correct.

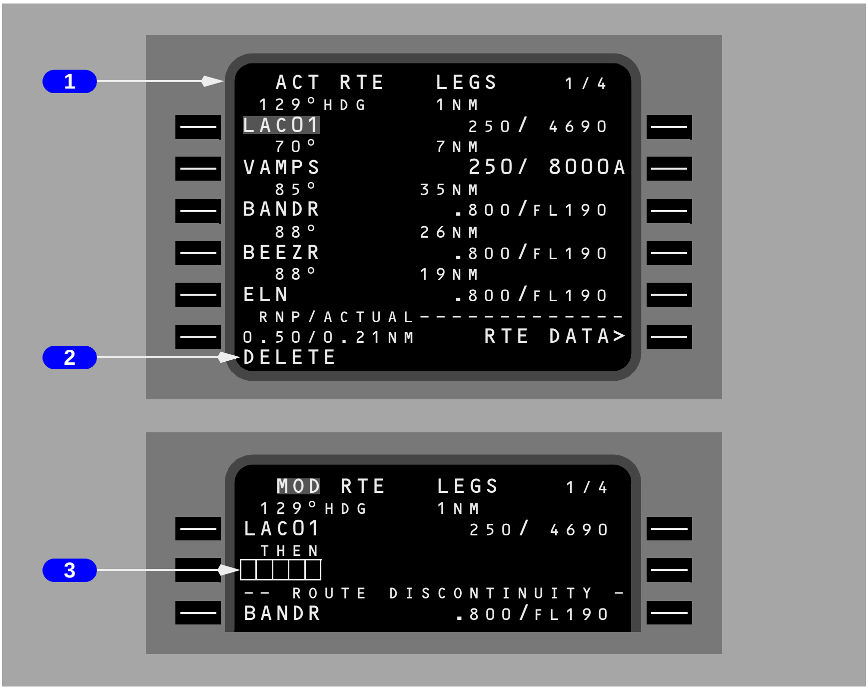
Deleting Waypoints

Waypoints can be removed from the RTE LEGS page. There are two normal methods to remove a waypoint:

- delete the waypoint using the DEL function key (not possible for the active waypoint and some conditional waypoints)
- resequence the route by moving a down–route waypoint up in the sequence and automatically removing all waypoints that are between.

During the deletion process, all of the route prior to the deletion point remains unchanged. Removing a waypoint using the DEL function key causes a route discontinuity to replace the deleted waypoint.

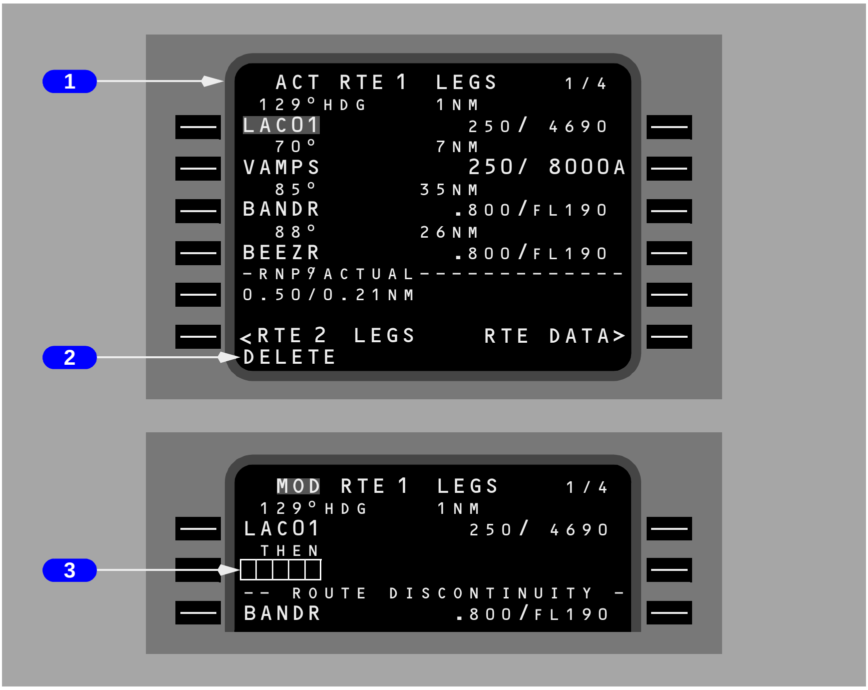
YA701 - YT513, YV604, YV605



```
  ACT RTE    LEGS      1/4
 129°HDG     1NM
LAC01            250/  4690
  70°        7NM
VAMPS            250/ 8000A
  85°       35NM
BANDR           .800/FL190
  88°       26NM
BEEZR           .800/FL190
  88°       19NM
ELN             .800/FL190
 RNP/ACTUAL------------
0.50/0.21NM       RTE DATA>
DELETE
```

```
  MOD RTE    LEGS      1/4
 129°HDG     1NM
LAC01            250/  4690
 THEN
□□□□□
-- ROUTE DISCONTINUITY -
BANDR           .800/FL190
```

YT514 - YT521, YV741 - YV754



```
 ACT RTE 1   LEGS        1/4
  129°HDG    1NM
LAC01            250/ 4690
   70°       7NM
VAMPS            250/ 8000A
   85°      35NM
BANDR           .800/FL190
   88°      26NM
BEEZR           .800/FL190
-RNP/ACTUAL------------
0.50/0.21NM

<RTE 2  LEGS     RTE DATA>
DELETE
```

```
 MOD RTE 1   LEGS        1/4
  129°HDG    1NM
LAC01            250/ 4690
  THEN
□□□□□
-- ROUTE  DISCONTINUITY  -
BANDR           .800/FL190
```

1 Active Route

The existing route shows VAMPS followed by BANDR, BEEZR, and ELN.

2 DELETE Entry

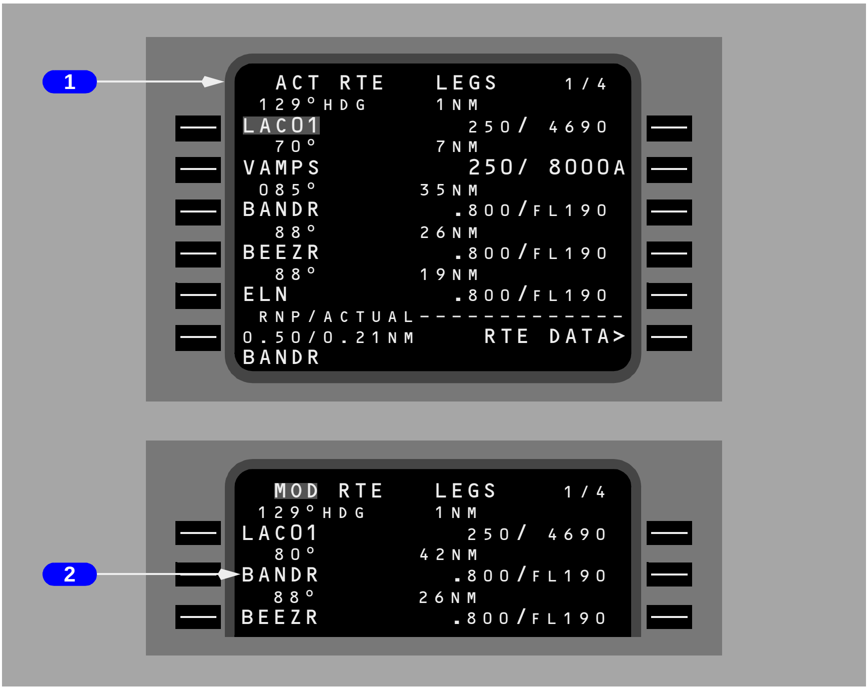
Push the DEL key to arm the delete function. DELETE is displayed in the scratchpad.

3 Delete VAMPS

With DELETE displayed in the scratchpad, push the line select key left of VAMPS to delete the waypoint. Box prompts replace VAMPS and a route discontinuity follows the box prompts.

Resequencing Waypoints

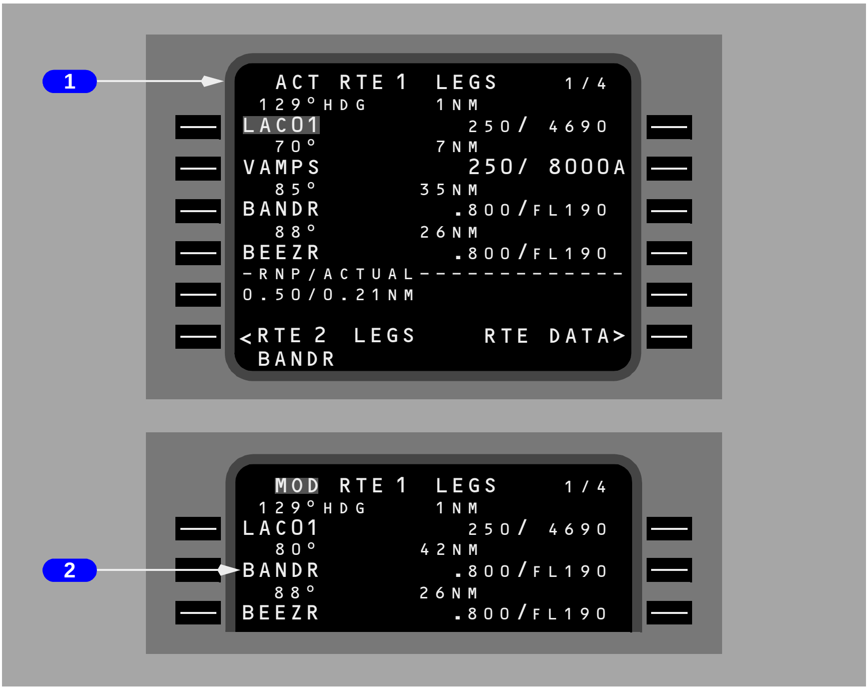
YA701 - YT513, YV604, YV605



```
  ACT RTE     LEGS      1/4
 129°HDG      1NM
LAC01           250/ 4690
  70°         7NM
VAMPS           250/ 8000A
 085°        35NM
BANDR          .800/FL190
  88°        26NM
BEEZR          .800/FL190
  88°        19NM
ELN            .800/FL190
 RNP/ACTUAL-------------
0.50/0.21NM      RTE DATA>
BANDR
```

```
  MOD RTE     LEGS      1/4
 129°HDG      1NM
LAC01           250/ 4690
  80°        42NM
BANDR          .800/FL190
  88°        26NM
BEEZR          .800/FL190
```

YT514 - YT521, YV741 - YV754



```
 ACT RTE 1   LEGS      1/4
 129°HDG     1NM
LAC01          250/ 4690
  70°        7NM
VAMPS          250/ 8000A
  85°       35NM
BANDR         .800/FL190
  88°       26NM
BEEZR         .800/FL190
-RNP/ACTUAL------------
0.50/0.21NM

<RTE 2  LEGS      RTE DATA>
 BANDR
```

```
 MOD RTE 1   LEGS      1/4
 129°HDG     1NM
LAC01          250/ 4690
  80°       42NM
BANDR         .800/FL190
  88°       26NM
BEEZR         .800/FL190
```

1 Active Route

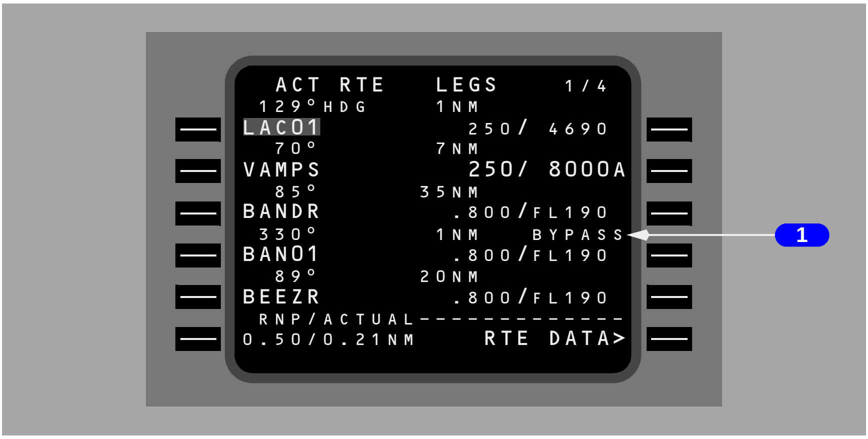
The existing route shows VAMPS followed by BANDR, BEEZR, and ELN. The airplane must fly direct from LAC01 to BANDR. The BANDR waypoint is copied into the scratchpad.

2 Resequence BANDR

BANDR is transferred to the waypoint following LAC01. VAMPS is removed, and the route remains continuous.

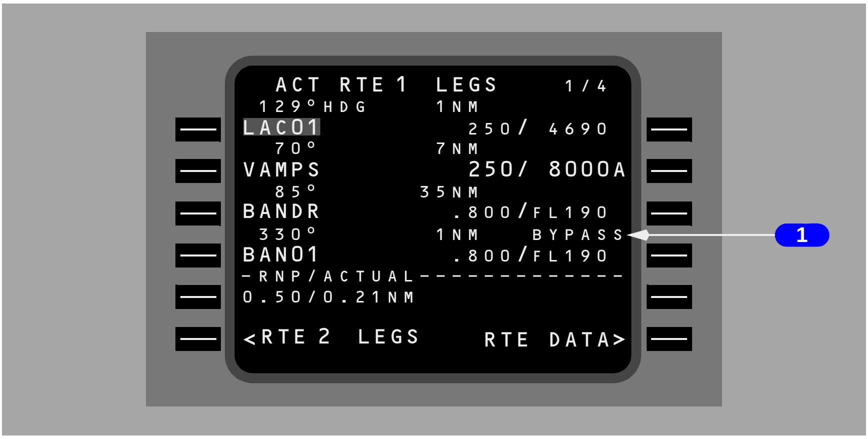
Leg Bypass

YA701 - YT513, YV604, YV605



```
  ACT RTE    LEGS      1/4
 129°HDG     1NM
LAC01          250/ 4690
  70°        7NM
VAMPS          250/ 8000A
  85°       35NM
BANDR         .800/FL190
 330°        1NM     BYPASS
BAN01         .800/FL190
  89°       20NM
BEEZR         .800/FL190
 RNP/ACTUAL------------
0.50/0.21NM     RTE DATA>
```

YT514 - YT521, YV741 - YV754



```
  ACT RTE 1  LEGS      1/4
 129°HDG     1NM
LAC01          250/ 4690
  70°        7NM
VAMPS          250/ 8000A
  85°       35NM
BANDR         .800/FL190
 330°        1NM     BYPASS
BAN01         .800/FL190
-RNP/ACTUAL------------
0.50/0.21NM

<RTE 2 LEGS     RTE DATA>
```

1 Bypass Notification

A waypoint (BAN01) has been entered into the route which is very close to another route waypoint (BANDR). It is impossible for the airplane to turn and capture the leg between BANDR and BAN01, so a bypass is noted.

Turn construction is based upon FMC criteria which assumes that LNAV is engaged. Normal turn construction may not be possible under certain combinations of airspeed, short leg length, and a significant change in leg direction. If normal turn construction cannot be provided to capture the leg into a waypoint, the FMC bypasses the affected waypoint and uses alternative turn construction to intercept that leg. When the bypass is for the active waypoint, the waypoint remains active until the airplane passes abeam.

Any mandatory altitude–crossing restriction for the bypass waypoint is still observed if VNAV is engaged, based on passing abeam the waypoint.

If a triple bypass condition occurs (bypass of three consecutive legs), a route discontinuity will be inserted.

Removing Discontinuities

A discontinuity exists when the FMC is unable to determine the route leg following a waypoint. Discontinuities are removed by linking the route segment following the discontinuity to the route segment preceding the discontinuity.

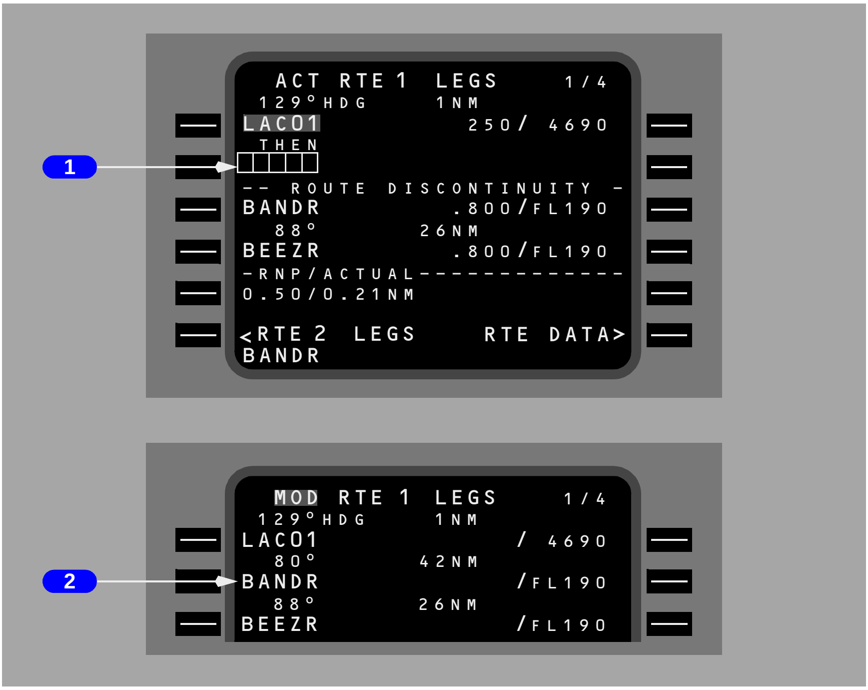
The next desired waypoint from the subsequent route is copied into the CDU scratchpad and entered into the discontinuity, just as when adding a waypoint.

YA701 - YT513, YV604, YV605

```
  ACT RTE    LEGS       1/4
 129°HDG     1NM
LAC01            250/ 4690
 THEN
□□□□□
-- ROUTE DISCONTINUITY -
BANDR           .800/FL190
  88°       26NM
BEEZR           .800/FL190
  88°       19NM
ELN             .800/FL190
 RNP/ACTUAL-----------
0.50/0.21NM      RTE DATA>
BANDR
```

```
  MOD RTE    LEGS       1/4
 129°HDG     1NM
LAC01               / 4690
  80°       42NM
BANDR               /FL190
  88°       26NM
BEEZR               /FL190
```

YT514 - YT521, YV741 - YV754



```
 ACT RTE 1   LEGS       1/4
 129°HDG      1NM
LAC01            250/ 4690
 THEN
□□□□□
-- ROUTE DISCONTINUITY -
BANDR           .800/FL190
  88°       26NM
BEEZR           .800/FL190
-RNP/ACTUAL------------
0.50/0.21NM

<RTE 2 LEGS      RTE DATA>
BANDR
```

```
 MOD RTE 1   LEGS       1/4
 129°HDG      1NM
LAC01                / 4690
  80°       42NM
BANDR                /FL190
  88°       26NM
BEEZR                /FL190
```

1 ROUTE DISCONTINUITY

The active route shows a discontinuity. The airplane must fly direct from LAC01 to BANDR. The BANDR waypoint is copied into the scratchpad in preparation to remove the discontinuity. Any waypoint from the route can be copied into the scratchpad to remove the discontinuity.

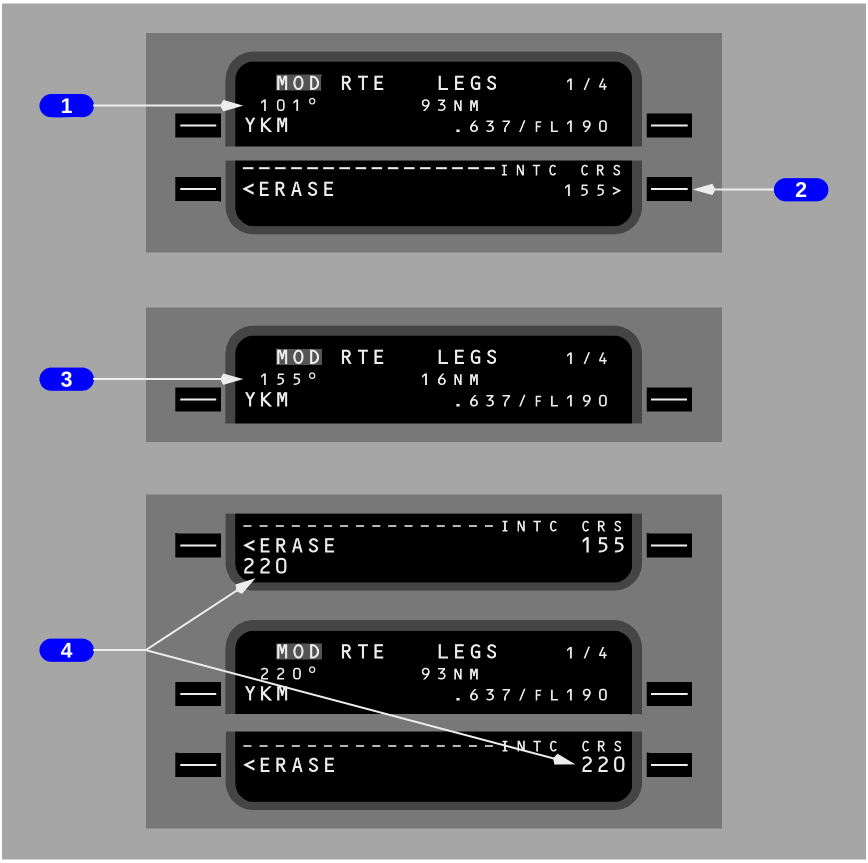
2 Continuous Route

BANDR is copied into the box prompts to remove the discontinuity.

Entering a waypoint which does not already exist on the route moves the discontinuity one waypoint farther down the route.

Direct To and Intercept Course

To fly direct to a waypoint or intercept a course to a waypoint, enter the waypoint name on RTE LEGS page 1 active waypoint line. The INTC CRS prompt displays in line 6R. The example shows the result with YKM entered into the active waypoint line.



1 Direct Course

Direct course from airplane present position to entered waypoint.

Execute to proceed direct to active waypoint.

2 Intercept Course (INTC CRS)

Push – puts displayed course (155) into active waypoint leg direction. Enables intercept course function.

Displayed whenever the active waypoint name is modified.

Displays flight plan leg direction to entered waypoint in small font. Displays dashes if entered waypoint was not in the flight plan.

Valid input is any course from 000 through 360. May be changed until executed. Entered or selected value displays in large font.

3 Leg Direction

Displays the course inbound to the active waypoint after selecting the course displayed in the INTC CRS line.

4 Intercept Course (INTC CRS) – Change

Enter the inbound intercept course to the modified waypoint in the scratchpad.

Select the INTC CRS line to change the leg direction.

The example shows 220° intercept course to YKM entered in the INTC CRS line.

Select Desired Waypoint Page

When a waypoint identifier is not unique (other database waypoints have the same name), a selection of which latitude/longitude to use must be made before that waypoint can be used in the route.

The SELECT DESIRED XXX page is automatically displayed when the FMC encounters more than one identifier for the same waypoint name after a waypoint entry.

1 Identifier

Displays the identifier for the duplicate named waypoints. Select the proper waypoint by pushing the appropriate left or right line select key. This page is automatically removed after a waypoint is selected.

2 Type

Shows type of navaid.

Available types include VOR, VORTAC, VORDME, NDB, LOC, ILS, DME, ILSDME, LOCDME, APT or WPT.

3 Frequency

Displays the frequency of the navaid.

Blank if the waypoint is not a navaid.

4 Waypoint Name

Displays the name of the waypoint.

Blank if the waypoint is not a navaid.

5 Latitude/Longitude

The latitude/longitude is displayed for each duplicate name.

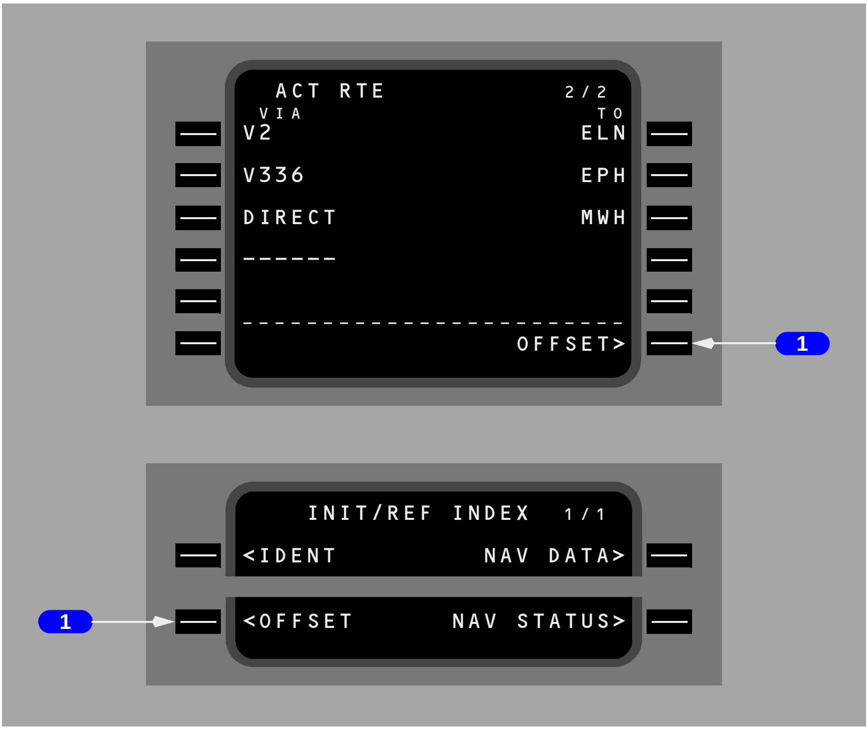
Lateral Offset

A lateral offset may be specified up to 99.9 nautical miles left or right of course. The OFFSET prompt is displayed on the INIT/REF INDEX page and in flight on the RTE page. Selection displays the LATERAL OFFSET (or ACT LATERAL OFFSET page if an offset already exists).

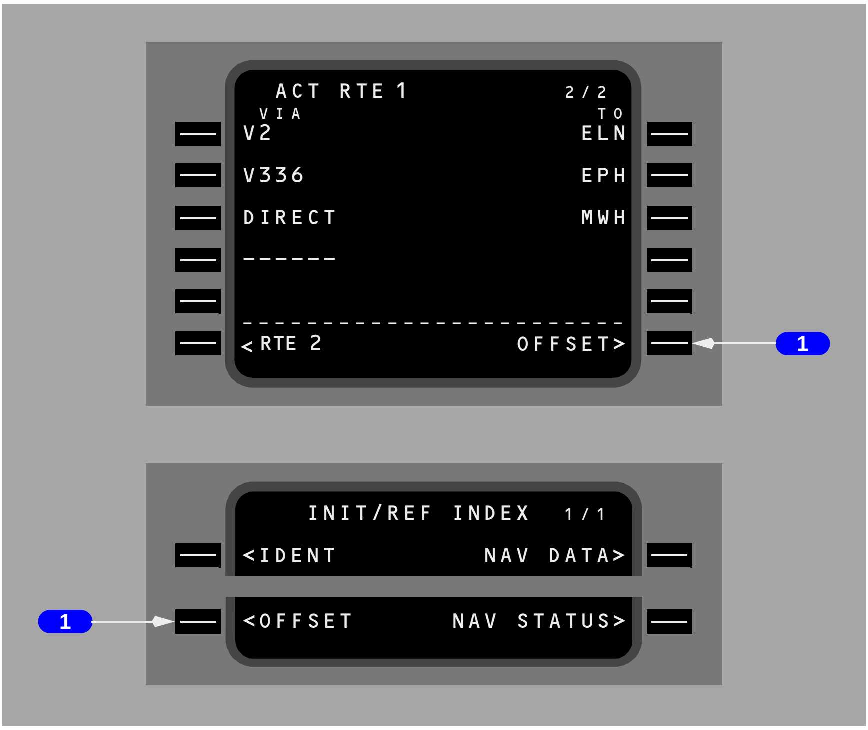
Some legs are invalid for offset. These include:

- End of flight plan waypoint
- Discontinuity
- Beginning of approach transition
- Approach procedure
- DME arc
- Heading leg
- Holding pattern (except PPOS)
- Certain legs containing flyover waypoints
- Course change greater than 135 degrees
- Preplanned termination waypoint.

YA701 - YT513, YV604, YV605



YT514 - YT521, YV741 - YV754



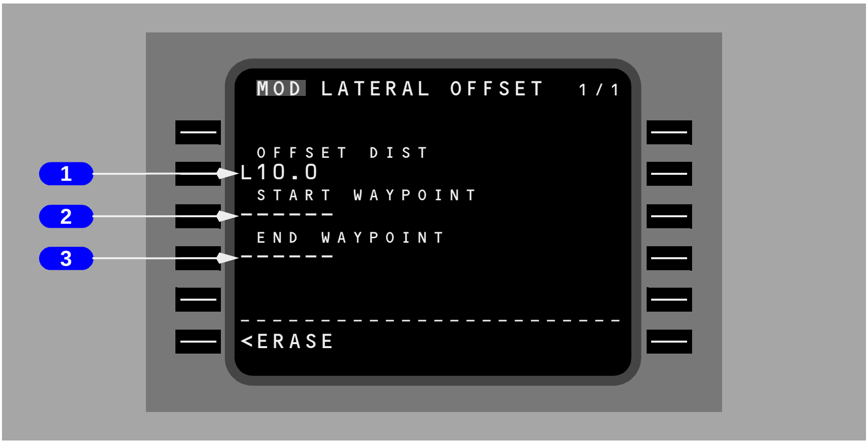
1 OFFSET

Push – displays the lateral offset page.

YT514 - YT521, YV741 - YV754

The offset prompt is only displayed when an ACTIVE or MODIFIED flight plan exists.

Lateral Offset Page



```
MOD LATERAL OFFSET   1/1

 OFFSET DIST
L10.0
 START WAYPOINT
------
 END WAYPOINT
------

-----------------------
<ERASE
```

1 Offset Distance (OFFSET DIST)

The desired lateral offset distance is entered on line 2L In the example, the 10.0 nm offset left of course could be entered L10.0, L10, 10.0L, or 10L.

Entry results in display of start and end waypoint fields.

2 START WAYPOINT

The waypoint at which the offset is to begin may be entered (up to 6 characters).

Dashes are displayed if current leg is valid for offset. Box prompts are displayed if current leg is invalid for offset.

Offset will begin at first valid offset leg after the start waypoint.

Deletion of start waypoint (or no entry) will result in offset beginning at first valid offset leg in the flight plan.

3 END WAYPOINT

The waypoint at which the offset is to end may be entered (up to 6 characters).

Offset will propagate through flight plan until end waypoint is encountered.

Deletion of end waypoint (or no entry) will result in offset propagating until an invalid offset leg is encountered.

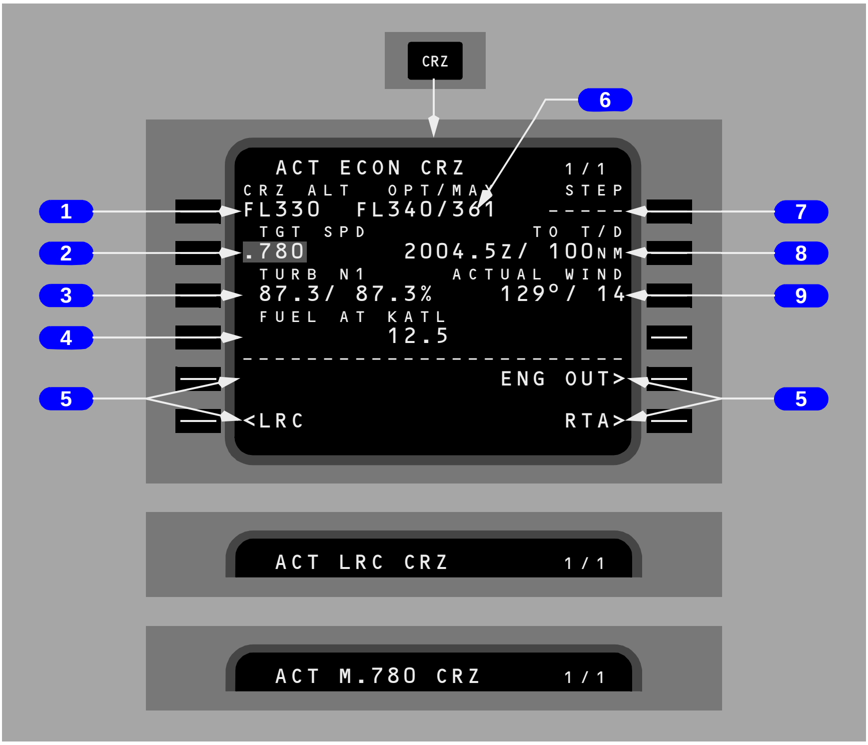
VNAV Modifications

Three primary cruise modes are available – economy (ECON) cruise, long range cruise (LRC), and cruise with a manually selected speed.

Access to the various cruise pages is obtained by pushing the CRZ mode select key.

Cruise Page

YA701 - YT513, YV604, YV605

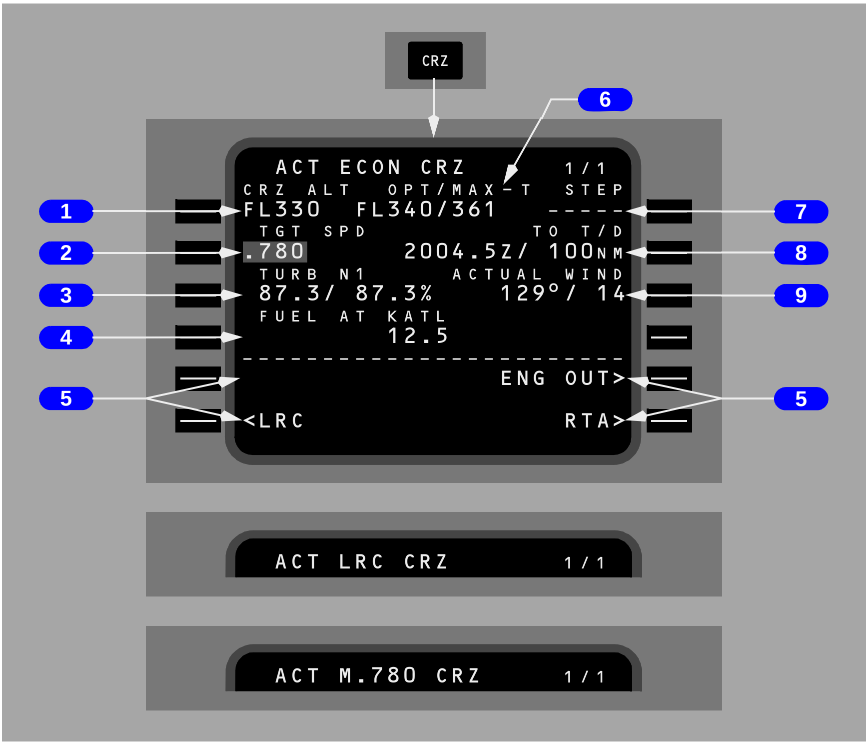


```
  ACT ECON CRZ           1/1
CRZ ALT    OPT/MAX      STEP
FL330   FL340/361      -----
 TGT SPD             TO T/D
.780         2004.5Z/ 100NM
 TURB N1        ACTUAL WIND
 87.3/ 87.3%      129°/ 14
 FUEL AT KATL
          12.5
------------------------
                  ENG OUT>
<LRC                  RTA>
```

```
  ACT LRC CRZ            1/1
```

```
  ACT M.780 CRZ          1/1
```

YT514 - YT521, YV741 - YV754



1 Cruise Altitude (CRZ ALT)

Displays present cruise altitude in flight level or feet x 100. Value may be entered via the keyboard or propagated from the PERF INIT, CLB, CRZ CLB, or CRZ DES pages.

During active cruise, entry of a new value propagates to all other pages which display cruise altitude and causes the MOD CRZ CLB or MOD CRZ DES page to appear.

YF048 - YT513, YV604, YV605
Value may be increased using altitude intervention.

YT514 - YT521, YV741 - YV754
Value may be increased or decreased using altitude intervention.

2 Target Speed (TGT SPD)

The computed target speed displays one of the following:

- computed or manually selected value for target airspeed or Mach

YF048 - YV754

- XXX/MCP when speed intervention is active and the plan is active
  - deletion or modification of XXX/MCP is not allowed
- XXX/HOLD when decelerating to hold speed prior to the hold entry fix
  - deletion or modification of hold speed is not allowed.

The value is reverse highlighted on an active cruise page.

3 Turbulence N1 (TURB N1)

Displays proper N1 for turbulence penetration.

Value is for reference only. It is not commanded to the autothrottle.

4 Fuel at Destination (FUEL AT XXXX)

Displays the predicted fuel remaining at destination.

The value assumes continued flight per the displayed cruise and planned descent modes along the active route.

If a step to altitude is entered on line 1R, the computation assumes that the step will occur at the step point. After passing the step climb point, the predicted fuel weight is based on an immediate step climb from current position.

5 Cruise Page Prompts

Allow line selection of the various cruise pages.

The RTA prompt is replaced with ERASE when a MOD page is displayed.

6 Optimum/Maximum Altitude (OPT/MAX)

Displays the computed optimum altitude for the displayed cruise mode. The value is not constrained by minimum cruise time criteria (as is the TRIP ALT on the PERF INIT page).

Also displays the maximum possible altitude based on the selected target speed and the specified maneuver margin.

YT514 - YT521, YV741 - YV754

The thrust limiting criterion for MAX altitude is labeled in the header.

- “- T” when available thrust is the limiting criterion for maximum altitude.
- “- B” when buffet margin is the limiting criterion for maximum altitude.

YT514 - YT521, YV741 - YV754

Maximum altitude reflects the altitude for the active or mod flight plan.

Values are advisory only. They are provided for crew reference.

7 Step to Altitude Line (STEP)

This line may be used to enter a possible step climb or descent altitude for crew evaluation.

The line will be blank when within 100 nm of top of descent or when RTA mode is active.

8 Top of Descent (TO T/D) Line

Displays time of arrival at and distance to top of descent point.

The data is always displayed when the distance is less than 100 nm. If the distance is more than 100 nm, the data will be displayed only if a step to altitude has not been entered.

9 ACTUAL WIND

Displays computed or manually entered true wind for present altitude.

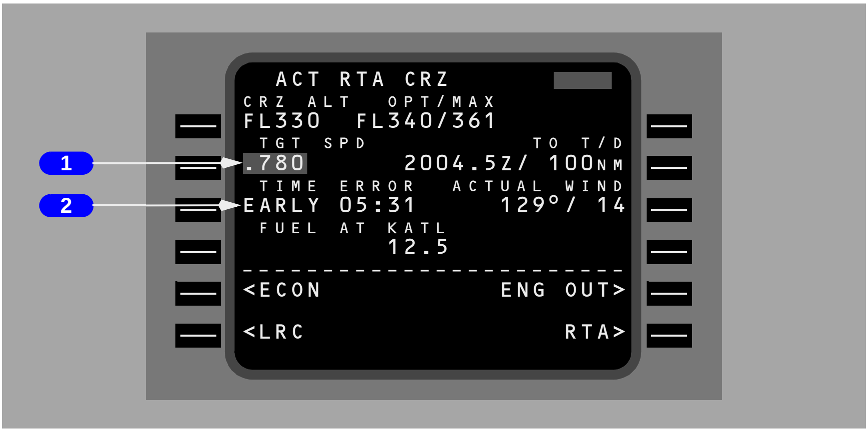
A manual entry has priority. The data line title then changes to EST WIND (estimated wind).

The displayed value is used as the assumed true wind at the step to altitude for making wind/altitude trade computations.

RTA Cruise

If an RTA waypoint has been specified, the cruise page will reflect the RTA data.

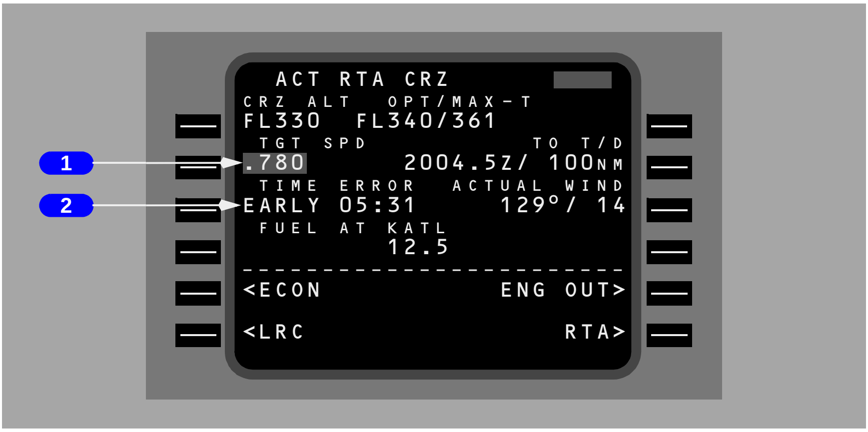
YA701 - YT513, YV604, YV605



```
  ACT RTA CRZ
CRZ ALT   OPT/MAX
FL330   FL340/361
 TGT SPD            TO T/D
.780        2004.5Z/ 100NM
 TIME ERROR   ACTUAL WIND
EARLY 05:31      129°/ 14
 FUEL AT KATL
         12.5
------------------------
<ECON            ENG OUT>

<LRC                 RTA>
```

YT514 - YT521, YV741 - YV754



```
   ACT RTA CRZ
CRZ ALT   OPT/MAX-T
FL330   FL340/361
 TGT SPD              TO T/D
.780          2004.5Z/ 100NM
 TIME ERROR    ACTUAL WIND
EARLY 05:31        129°/ 14
 FUEL AT KATL
         12.5
------------------------
<ECON              ENG OUT>
<LRC                   RTA>
```

1 Target Speed (TGT SPD)

Displays the computed speed required to meet the RTA.

When RTA mode is exited by waypoint sequence or by deletion, this speed becomes the FMC target speed on a manual speed cruise page and the scratchpad message SELECT MODE AFTER RTA is displayed.

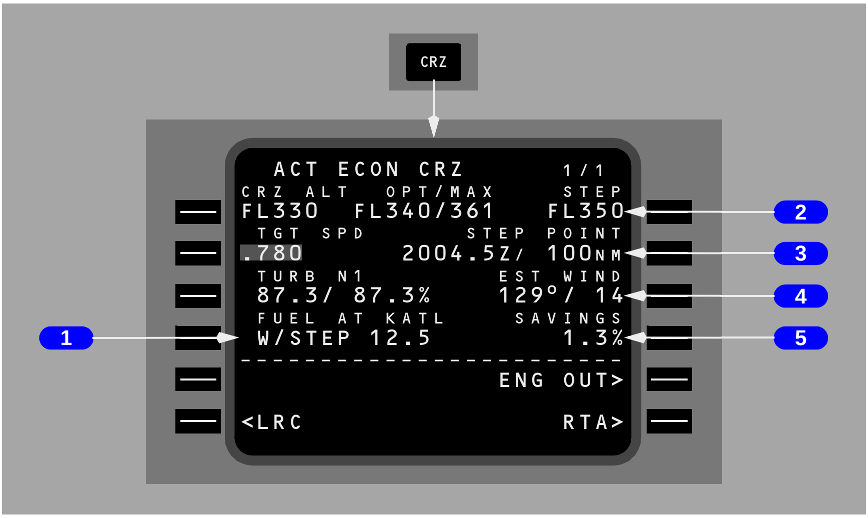
2 TIME ERROR

Displays the computed time error at the RTA waypoint.

Same as time error on RTA PROGRESS page.

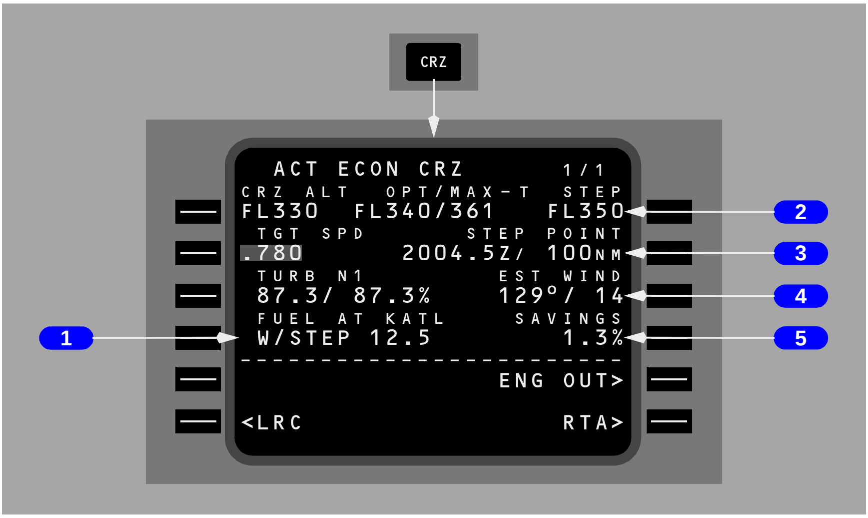
Cruise with Step Climb

YA701 - YT513, YV604, YV605



```
  ACT ECON CRZ             1/1
CRZ ALT    OPT/MAX        STEP
FL330    FL340/361       FL350
  TGT SPD           STEP POINT
.780          2004.5Z/ 100NM
  TURB N1             EST WIND
  87.3/ 87.3%        129°/ 14
  FUEL AT KATL         SAVINGS
  W/STEP 12.5             1.3%
------------------------------
                      ENG OUT>
<LRC                      RTA>
```

YT514 - YT521, YV741 - YV754



```
  ACT ECON CRZ             1/1
CRZ ALT    OPT/MAX-T      STEP
FL330    FL340/361       FL350
  TGT SPD           STEP POINT
.780          2004.5Z/ 100NM
  TURB N1             EST WIND
  87.3/ 87.3%        129°/ 14
  FUEL AT KATL         SAVINGS
  W/STEP 12.5             1.3%
------------------------------
                      ENG OUT>
<LRC                      RTA>
```

1 Fuel at Destination with Step Climb Altitude (FUEL AT XXXX)

The computation assumes the step climb will occur at the STEP point, and the value is prefixed by W/STEP.

2 Step To Altitude (STEP)

Used to enter step climb or step descent altitudes for crew evaluation.

Blank when within 100 nm of top of descent or when RTA mode is active.

3 STEP POINT

Displays the computed ETA at, and distance to, the first possible step climb point based on gross weight.

Blank if no entry on STEP TO line.

4 Wind (ACTUAL WIND or EST WIND)

Used as the assumed true wind at the STEP TO altitude for making wind–altitude trade computations.

5 Savings/Penalty (SAVINGS or PENALTY)

Displays the predicted cost savings or penalty associated with flying the displayed speed/altitude step climb or descent profile, as compared to flying the current cruise speed schedule and maintaining present altitude to top of descent.

Blank if no step data entered.

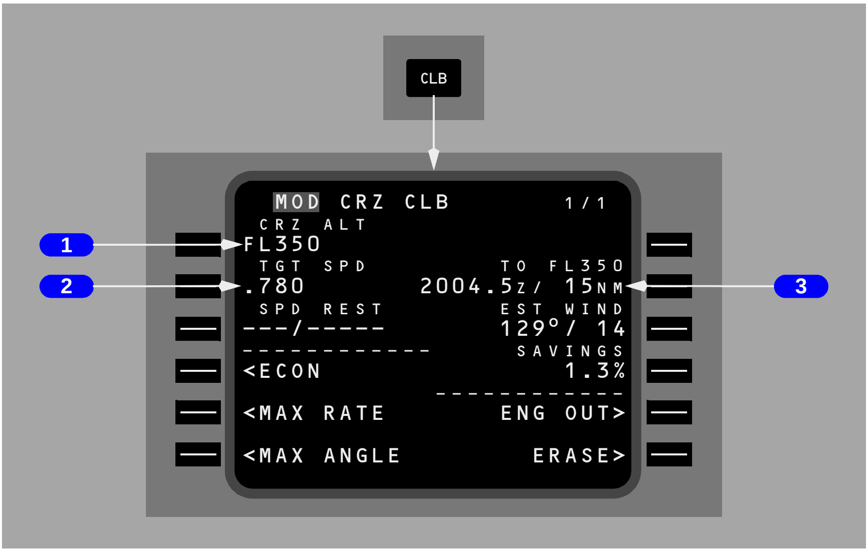
Cruise Climb

The cruise climb page displays data for a cruise climb to a new altitude.

MOD CRZ CLB is automatically displayed during cruise if a higher cruise altitude is entered on the CRZ page.

During VNAV operation, execution initiates a climb at climb thrust and cruise target speed to the new altitude.

The VNAV climb mode is active until reaching the selected altitude. The mode then automatically changes back to cruise.



```
  MOD CRZ CLB              1/1
   CRZ ALT
 FL350
   TGT SPD             TO FL350
 .780            2004.5z/ 15NM
   SPD REST           EST WIND
 ---/-----            129°/ 14
 -----------           SAVINGS
 <ECON                    1.3%
                   -----------
 <MAX RATE            ENG OUT>
 <MAX ANGLE             ERASE>
```

1 Cruise Altitude (CRZ ALT)

Initially displays the CRZ ALT entered on the CRZ page.

Manual entry may be made.

2 Target Speed (TGT SPD)

Displays target cruise speed for the displayed cruise altitude.

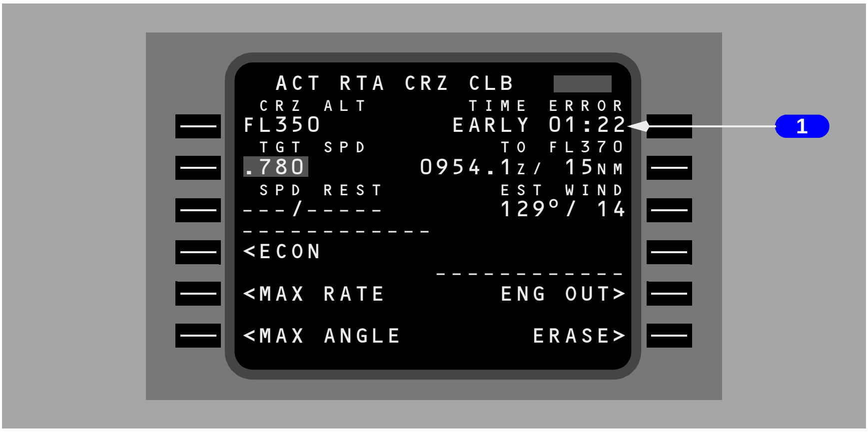
Manual entry may be made.

3 TO FLXXX

Displays ETA at, and distance to, the displayed cruise altitude.

RTA Cruise Climb

The RTA cruise climb page displays the same data as the cruise climb page except for the TIME ERROR line.



```
  ACT RTA CRZ CLB
 CRZ ALT          TIME ERROR
FL350          EARLY 01:22
 TGT SPD            TO FL370
.780          0954.1z/ 15NM
 SPD REST          EST WIND
---/-----          129°/ 14
------------
<ECON
             ------------
<MAX RATE          ENG OUT>
<MAX ANGLE           ERASE>
```

1 **TIME ERROR**

Displays the computed time error at the RTA waypoint.

Same as time error on RTA PROGRESS page.

Cruise Descent

The cruise descent page displays data for a cruise descent to a new altitude.

MOD CRZ DES is automatically displayed during cruise if a lower cruise altitude is entered on the CRZ page.

YT514 - YT521, YV741 - YV754

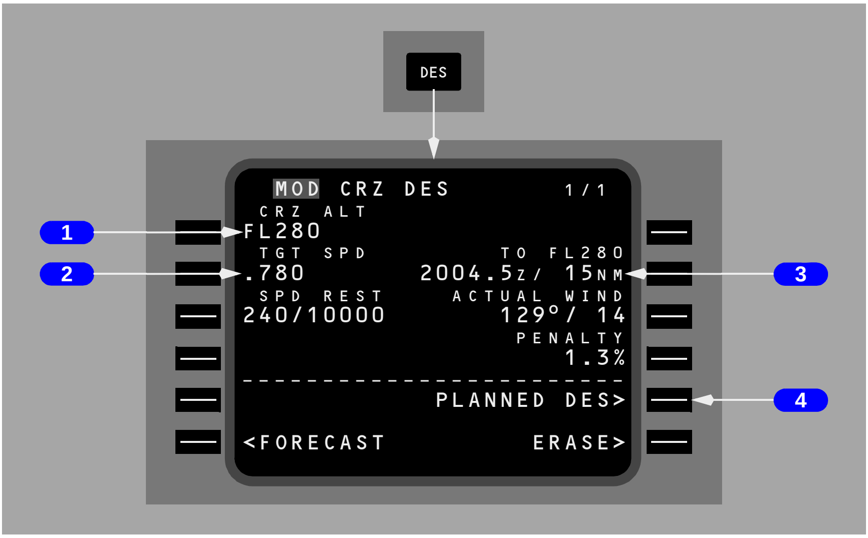
CRZ DES provides the means of initiating step descents to a new cruise altitude during cruise.

During VNAV operation, execution initiates a descent at 1,000 feet per minute and cruise target speed to the new altitude.

YT514 - YT521, YV741 - YV754

The FMC software allows a CRZ DES to the normal Descent Path capture if the normal path is encountered during the Cruise Descent and prior to reaching the new cruise altitude.

- the Descent phase will be entered from a Cruise Descent at the time the extended descent path is captured.



```
  MOD CRZ DES          1/1
  CRZ ALT
FL280
  TGT SPD          TO FL280
.780         2004.5z/ 15NM
  SPD REST      ACTUAL WIND
240/10000         129°/ 14
                    PENALTY
                       1.3%
------------------------
               PLANNED DES>
<FORECAST           ERASE>
```

1 Cruise Altitude (CRZ ALT)

Initially displays the CRZ ALT entered on the CRZ page.

Manual entry may be made.

YT514 - YT521, YV741 - YV754
With Speed/Altitude Intervention software, "CRZ ALT" can be decreased using altitude intervention.

2 Target Speed (TGT SPD)

Displays target cruise speed for the displayed cruise altitude.

Manual entry may be made.

3 TO FLXXX

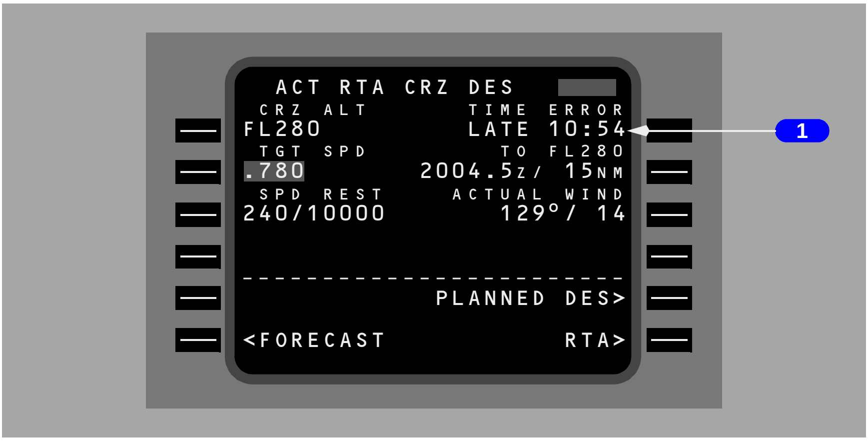
Displays ETA at, and distance to, the displayed cruise altitude.

4 Planned Descent (PLANNED DES)

Push – displays the planned DES page and allows access to the planned standard descent mode.

RTA Cruise Descent

The RTA cruise descent page displays the same data as the cruise descent page except for the TIME ERROR line.



```
   ACT RTA CRZ DES
  CRZ ALT        TIME ERROR
FL280          LATE 10:54
  TGT SPD           TO FL280
.780         2004.5z/ 15NM
  SPD REST      ACTUAL WIND
240/10000          129°/ 14

------------------------
            PLANNED DES>

<FORECAST             RTA>
```

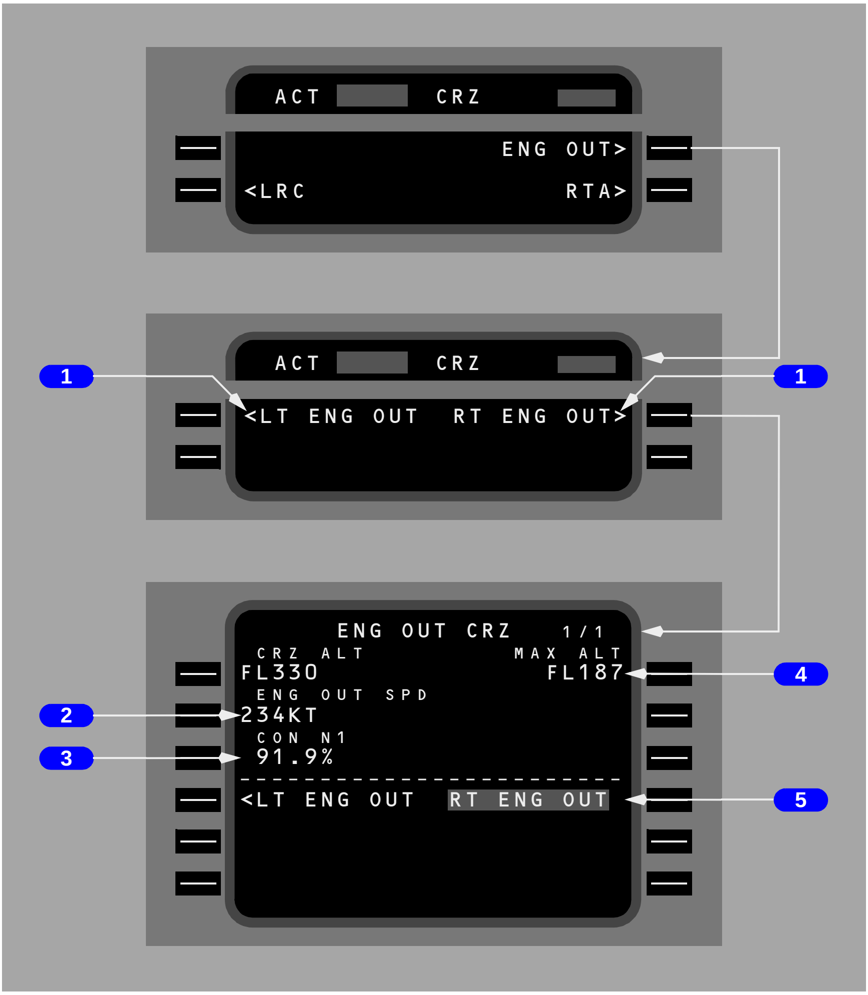
1 **TIME ERROR**

Displays the computed time error at the RTA waypoint.

Same as time error on RTA PROGRESS page.

Engine Out Cruise

The engine out cruise page may be accessed by selecting the ENG OUT prompt on the cruise page. The page displays advisory data for a one engine inoperative condition.



```
 ACT        CRZ
                     ENG OUT>
<LRC                     RTA>
```

```
 ACT        CRZ
<LT ENG OUT   RT ENG OUT>
```

```
        ENG OUT CRZ     1/1
 CRZ ALT            MAX ALT
FL330                 FL187
 ENG OUT SPD
234KT
 CON N1
 91.9%
------------------------
<LT ENG OUT  RT ENG OUT
```

1 Left/Right Engine Out (LT ENG OUT/RT ENG OUT)

Selection changes display to ENG OUT CRZ page. The ENG OUT CRZ page is information only.

2 Engine Out Speed (ENG OUT SPD)

Displays the optimum speed based on minimum drag.

3 Continuous N1 (CON N1)

Displays N1 for maximum continuous thrust.

N1 is computed using actual bleed conditions.

4 Maximum Altitude (MAX ALT)

Displays the computed maximum altitude at which a company–specified rate of climb can be achieved, using one engine at maximum continuous thrust (default climb rate is 100 feet per minute).

After page selection, the FMC accounts for wing and engine anti–ice, air conditioning, and the engine bleed of the operating engine.

5 LT ENG OUT/RT ENG OUT

Selected engine is shown in reverse highlighting.

Early Descent

Early descents are initiated from the DES page. Once an early descent is executed, VNAV transitions to the descent mode and cruise features are no longer available.

For a path descent the DES NOW prompt will not be displayed until a descent path is established. Once executed, the autothrottle adjusts thrust to maintain 1000 feet per minute until intercepting the descent path.

For a speed descent, the autothrottle retards to idle and pitch maintains target speed.

1 Descend Now (DES NOW)

Selecting the PATH DES page before reaching the top of descent displays the normal descent page with the prompt DES NOW on the bottom right of the page. Selecting and executing the DES NOW prompt initiates a VNAV descent of 1000 feet per minute at ECON speed. Upon reaching the planned descent path, VNAV transitions to maintain the planned descent path.

Selecting the SPD DES page and executing the DES NOW prompt initiates a VNAV descent at idle thrust and target speed.

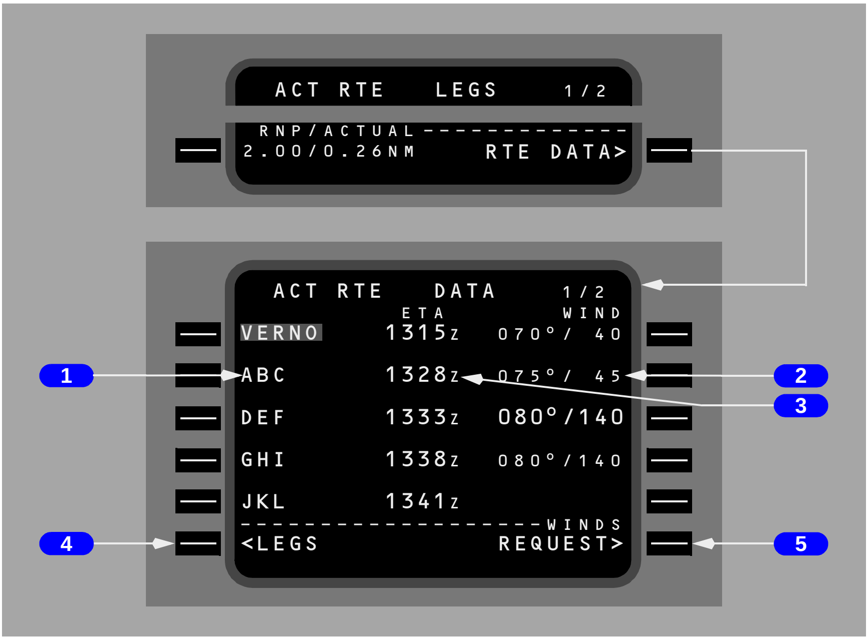
Route and Waypoint Data

Route Data (RTE DATA) Page

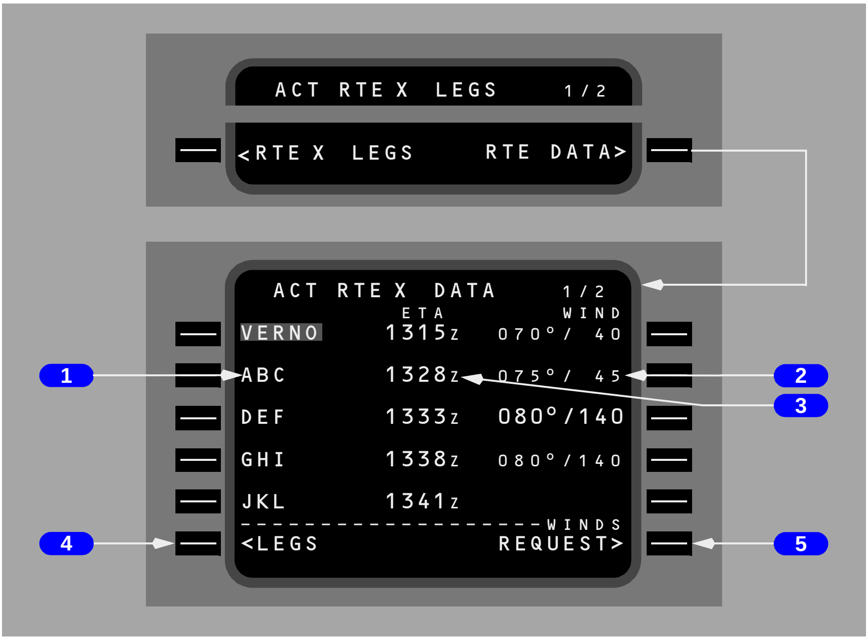
The RTE DATA page displays ETA for each waypoint on the RTE LEGS page. This page also displays forecast wind data for cruise waypoints.

One page displays data for five waypoints.

YA701 - YT513, YV604, YV605



YT514 - YT521, YV741 - YV754



1 Waypoint

Displays the identifier for the waypoint from the ACT RTE LEGS page.

2 WIND

Used for entry and/or display of the true winds at the cruise waypoint identified on the same line.

Entry may be via the keyboard, or propagated from the CRZ WIND entry on the PERF INIT page.

The CRZ WIND value (075°/45 is depicted) propagates to all cruise waypoints (ABC to GHI is the depicted cruise segment).

If no CRZ WIND entry was made, the FMC assumes 000°/000.

A keyboard entry has priority and propagates to all down path cruise waypoints (an entry of 080°/140) at DEF is depicted). The entry must be executed.

Any entries propagated from the CRZ WIND entry are displayed in small font. Keyboard entries are displayed in large font.

Crew entries of forecast winds (or default 000°/000) are automatically biased with the actual wind computed by the FMC when within 100 NM of a cruise waypoint and within 2000 feet of a cruise altitude. Biased values are not displayed.

Blank for non–cruise waypoints (VERNO and JKL are depicted). Entry is inhibited.

3 Estimated Time of Arrival (ETA)

Displays the FMC calculated waypoint ETA.

4 LEGS

Push – displays the RTE LEGS page.

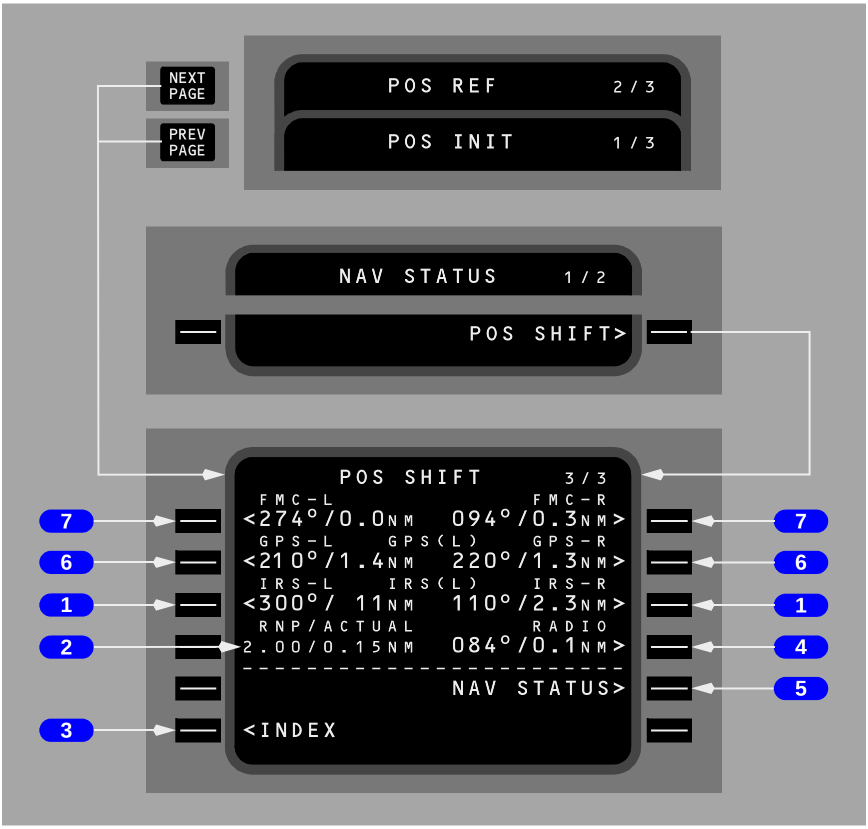
5 WINDS REQUEST

Push – transmits a data link request for winds uplink.

Position Shift Page 3/3

On the POS SHIFT page, each prompt indicates the bearing and distance of the indicated system relative to the FMC position. FMC position is displayed on line 1R of POS REF page 2/3. The entries with parentheses in the center of the page show the active position references.

Data fields are blank when on the ground.



1 IRS Position L/R

Displays left and right IRS position relative to FMC position using current mag/true reference. Blank if IRS position is invalid.

Push – highlights the line, illuminates the EXEC key, and displays the CANCEL prompt.

2 Required Navigation Position/Actual (RNP/ACTUAL)

Displays the required navigation accuracy compared to actual navigation accuracy.

Manual entry is allowed.

3 INDEX

Push – displays the INIT/REF INDEX page.

4 RADIO Position

Displays radio position relative to FMC position using current mag/true reference. Blank if radio position is invalid.

Push – highlights the line, illuminates the EXEC key, and displays the CANCEL prompt.

5 Navigation Status (NAV STATUS)

Push – displays the NAV STATUS page.

6 GPS Position L/R

Displays left and right GPS position relative to FMC position using current mag/true reference. Blank if GPS position is invalid.

Push – highlights the line, illuminates the EXEC key, and displays the CANCEL prompt.

7 FMC Position L/R

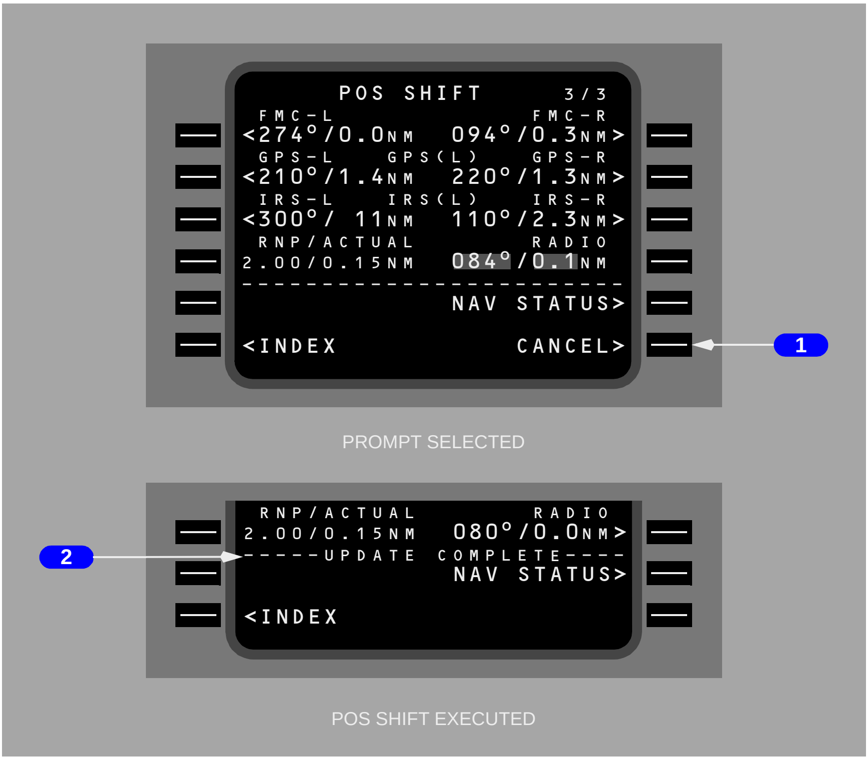
Displays left and right FMC position relative to FMC position using current mag/true reference. Blank if FMC position is invalid.

Push – highlights the line, illuminates the EXEC key, and displays the CANCEL prompt.

Inflight Position Update

FMC position update is accomplished on the POS SHIFT 3/3 page in flight. Selecting a prompt stops the updating of the relative position. The selection is highlighted, the associated caret is removed, the execute key is illuminated, and the CANCEL prompt is displayed in line 6R.

When the position shift is executed, UPDATE COMPLETE is displayed.



```
      POS SHIFT          3/3
  FMC-L                FMC-R
<274°/0.0NM    094°/0.3NM>
  GPS-L     GPS(L)     GPS-R
<210°/1.4NM    220°/1.3NM>
  IRS-L     IRS(L)     IRS-R
<300°/ 11NM    110°/2.3NM>
  RNP/ACTUAL           RADIO
2.00/0.15NM    084°/0.1NM
------------------------
               NAV STATUS>

<INDEX             CANCEL>
```

PROMPT SELECTED

```
  RNP/ACTUAL           RADIO
2.00/0.15NM    080°/0.0NM>
-----UPDATE COMPLETE----
               NAV STATUS>

<INDEX
```

POS SHIFT EXECUTED

1 CANCEL

Displayed when a line selection is made for position update.

Push – prior to execution cancels the line selection.

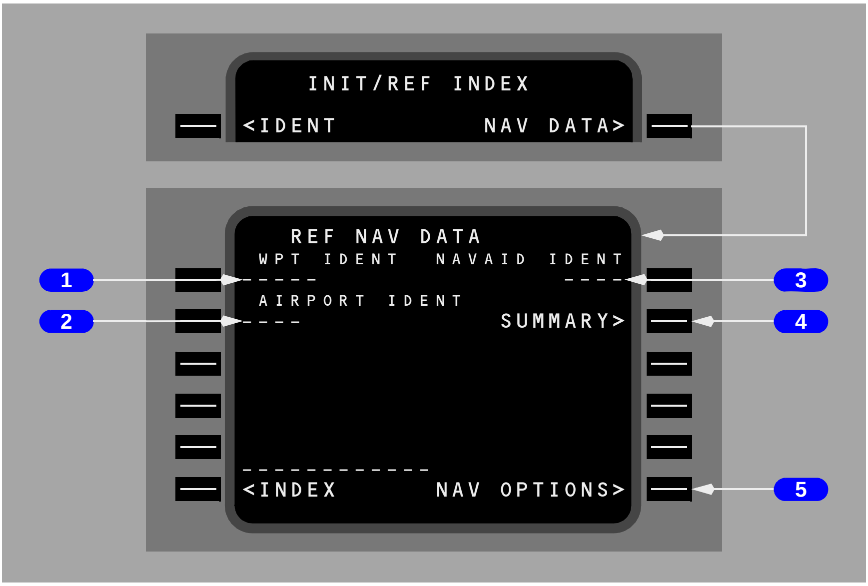
2 UPDATE COMPLETE

Displayed after a position shift has been selected and executed.

Navigation Data

Reference Navigation Data (REF NAV DATA) Page

The reference navigation data page provides information about waypoints, navaids, airports, and runways. Entering the appropriate identifier initiates the display. Writing SUPP in the scratch pad prior to selecting NAV DATA results in display of the supplemental navigation data (SUPP NAV DATA) page.



1 Waypoint Identifier (WPT IDENT)

Displays dashes initially.

Any waypoint, navaid or runway can be entered.

Format for runway entry is “RWnna” where “nn” is a one or two digit numeric (with or without leading zeros) and “a” is an optional character L, R, or C.

In order to access runway data, an airport must be identified.

2 Airport Identifier (AIRPORT IDENT)

Displays dashes initially.

Displays box prompts if runway is entered into 1L prior to airport entry.

An invalid airport/runway pair will result in “NOT IN DATA BASE” displayed in the scratchpad.

3 Navigation Aid Identifier (NAVAID IDENT)

Displays dashes initially.

Valid entries are up to 4 alphanumeric characters.

If the navaid is not contained in the databases, box prompts will appear in related data fields needing entry.

4 SUMMARY

Push – displays NAV SUMMARY pages.

Blank if supplemental and temporary databases are empty.

5 Navigation Options (NAV OPTIONS)

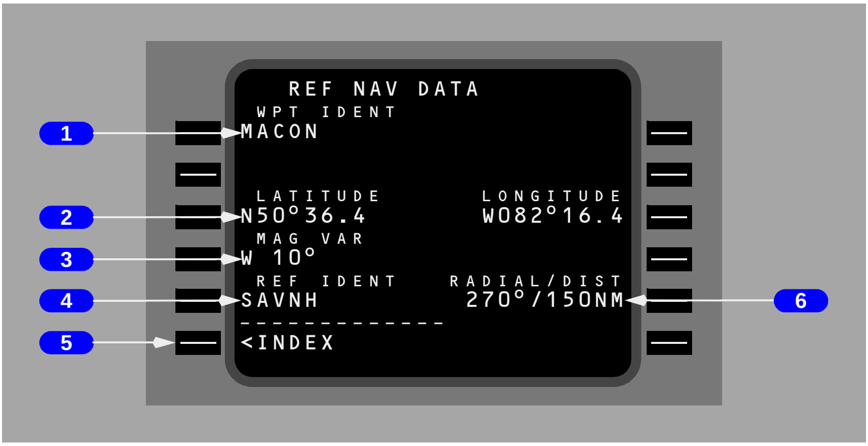
Push – displays NAV OPTIONS page.

If the entered identifier is already stored in the permanent, supplemental, or temporary database, then relevant data propagates to the subsequent REF NAV DATA display.

If the entered identifier is not stored in any database, the subsequent REF NAV DATA display contains box prompts. Following entry of the required information, the new data may be stored in the temporary database by executing (except for runway data). Data may be subsequently deleted from the temporary database by deleting the individual identifier, if the identifier is not presently being displayed on another page (e.g., RTE LEGS, PROGRESS, etc.).

All data stored in the temporary database is cleared at flight completion.

Waypoint Data Display



1 Waypoint Identifier (WPT IDENT)

Displays or permits entry of the desired waypoint. When this entry is complete, the associated data lines are displayed.

2 LATITUDE/LONGITUDE

Displays or permits entry of waypoint latitude and longitude. Entry on the REF IDENT and RADIAL/DIST lines cause latitude and longitude to be computed and displayed.

3 Magnetic Variation (MAG VAR)

Displays or permits entry of waypoint magnetic variation. Data is automatically computed based on latitude and longitude.

Manual entry has priority.

4 Reference Identifier (REF IDENT)

Together with RADIAL/DIST, displays or permits entry of reference point for a created waypoint.

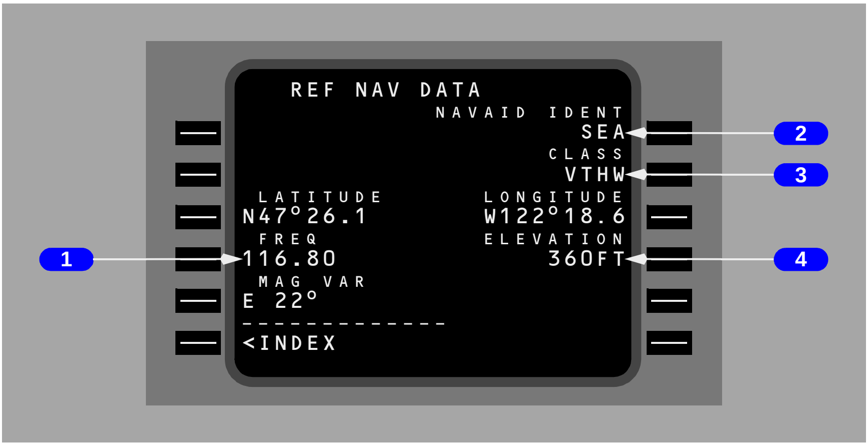
5 INDEX

Push – displays INIT/REF INDEX page.

6 Radial/Distance (RADIAL/DIST)

Together with REF IDENT, displays or permits entry of bearing and distance for a created waypoint.

Navigation Aid Data Display



```
     REF NAV DATA
                 NAVAID IDENT
                          SEA
                        CLASS
                         VTHW
 LATITUDE           LONGITUDE
N47°26.1           W122°18.6
 FREQ               ELEVATION
116.80                  360FT
 MAG VAR
E 22°
-------------
<INDEX
```

1 **Frequency (FREQ)**

Displays or permits entry of the frequency of the entered navaid.

2 **Navigation Aid Identifier (NAVAID IDENT)**

Displays or permits entry of navaid identifier (5 characters maximum). Following entry, the associated data lines are displayed.

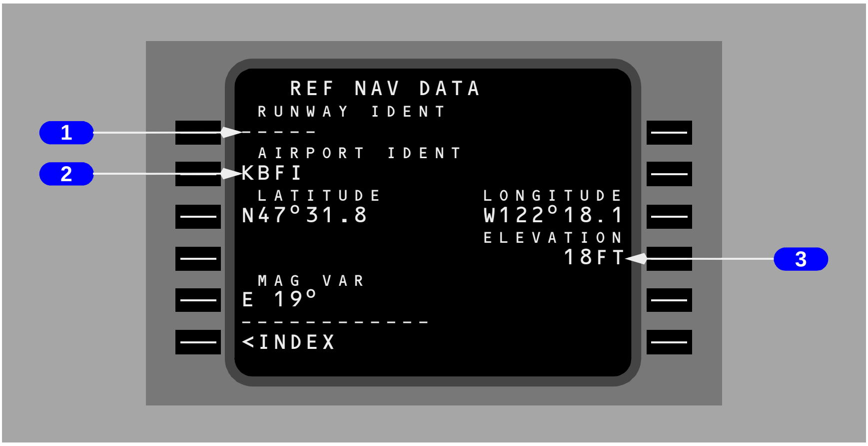
3 **Classification (CLASS)**

Displays or permits entry of the classification of the entered navaid.

4 **ELEVATION**

Displays or permits entry of the elevation (feet above MSL) of the entered navaid.

Airport Data Display



```
    REF NAV DATA
  RUNWAY IDENT
-----
  AIRPORT IDENT
KBFI
  LATITUDE              LONGITUDE
N47°31.8               W122°18.1
                        ELEVATION
                             18FT

  MAG VAR
E 19°
------------
<INDEX
```

1 **Runway Identifier (RUNWAY IDENT)**

Permits entry of runway identifier.

2 **Airport Identifier (AIRPORT IDENT)**

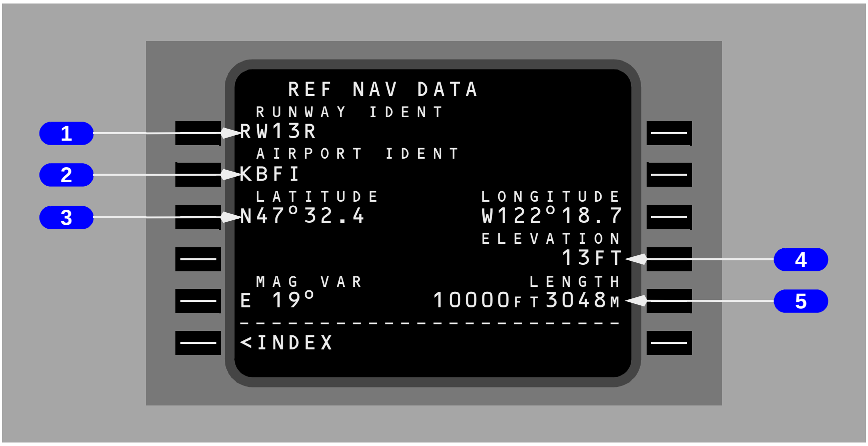
Displays airport identifier.

3 **ELEVATION**

Displays or permits entry of the elevation (feet above MSL) of the entered airport.

Runway Data Display

A runway identifier may be entered on the airport data display page or as a waypoint on the REF NAV DATA page. On the airport data display page, entry may be in the form of 13R or RW13R. Single digit entries are possible, with or without leading zeros. If the waypoint method is used, entry must be in the form RW13R, and the proper airport identifier must be entered on the runway data display page. Runways must be stored in the permanent navigation database.



```
    REF NAV DATA
 RUNWAY IDENT
RW13R
 AIRPORT IDENT
KBFI
 LATITUDE           LONGITUDE
N47°32.4            W122°18.7
                    ELEVATION
                         13FT
 MAG VAR               LENGTH
E 19°           10000FT3048M
------------------------
<INDEX
```

1 Runway Identifier (RUNWAY IDENT)

Displays runway identifier.

2 Airport Identifier (AIRPORT IDENT)

Displays airport identifier.

3 LATITUDE/LONGITUDE

Displays latitude and longitude of entered runway.

4 ELEVATION

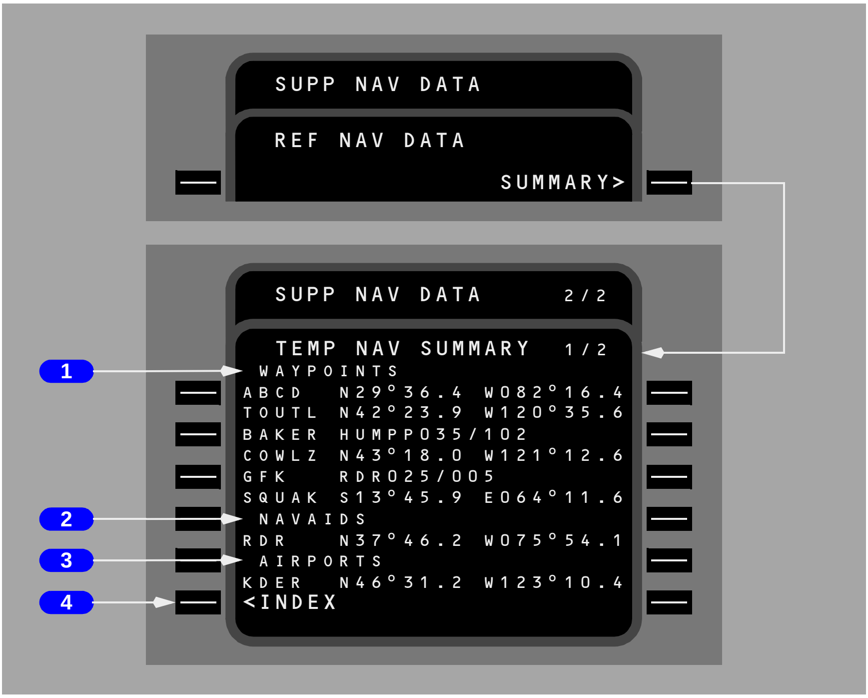
Displays elevation (feet above MSL) of the entered runway.

5 Runway Length (LENGTH)

Displays length of entered runway in feet and meters.

Navigation Summary (NAV SUMMARY)

The NAV SUMMARY pages show the contents of the temporary and supplemental navigation databases. Contents of the temporary navigation database show first, followed by contents of the supplemental navigation database.



```
SUPP NAV DATA
REF NAV DATA
                 SUMMARY>
```

```
SUPP NAV DATA          2/2
TEMP NAV SUMMARY       1/2
 WAYPOINTS
ABCD  N29°36.4  W082°16.4
TOUTL N42°23.9  W120°35.6
BAKER HUMPP035/102
COWLZ N43°18.0  W121°12.6
GFK   RDR025/005
SQUAK S13°45.9  E064°11.6
 NAVAIDS
RDR   N37°46.2  W075°54.1
 AIRPORTS
KDER  N46°31.2  W123°10.4
<INDEX
```

1 WAYPOINTS

Shows waypoints stored in related database.

Waypoints show in defining format.

YT514 - YT521, YV741 - YV754
Waypoints may also be defined on the LEGS pages in either route as part of a flight plan.

2 NAVAIDS

Shows navaids stored in related database.

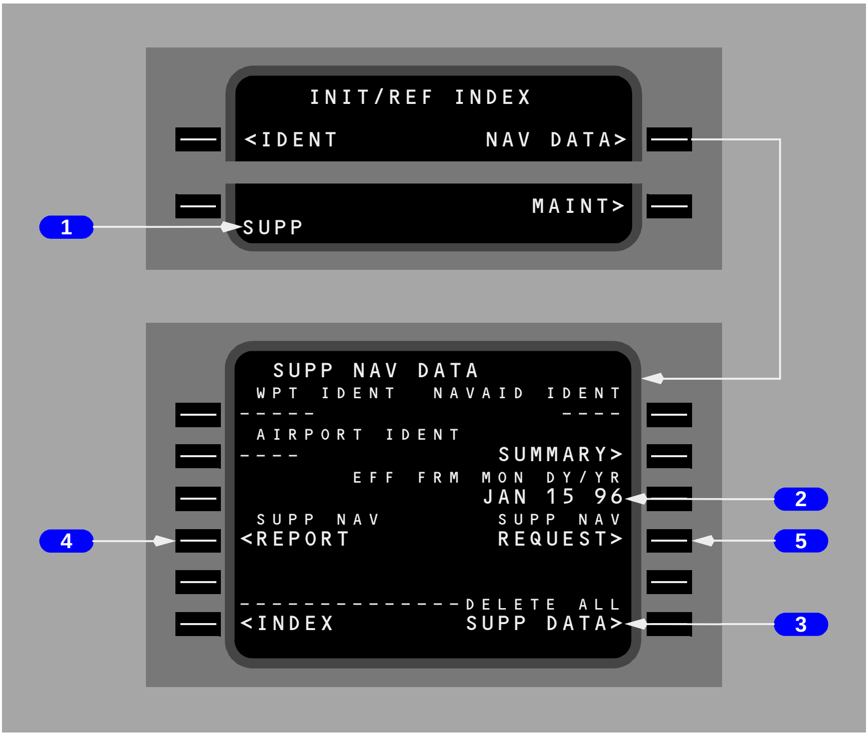
3 AIRPORTS

Shows airports stored in related database.

4 INDEX

Push – shows page (REF NAV DATA or SUPP NAV DATA) used to access NAV SUMMARY pages.

Supplemental Nav Data



1 SUPP Scratchpad Entry

The supplemental navigation database is accessed by typing SUPP in the scratchpad while on the INIT/REF INDEX page, then selecting the NAV DATA prompt. Access is only available on the ground.

2 Effectivity Date (EFF FRM MON DY/YR)

Allows entry of month, day, and year that the supplemental database becomes valid. The date will be displayed on IDENT page 1/2 after entry. Box prompts are displayed if an effectivity date is not entered.

3 Delete All Supplemental Data (DELETE ALL SUPP DATA)

Data may be deleted from the supplemental database by two methods. Deletion may be accomplished one item at a time on the display pages, or the entire database may be deleted by selecting this prompt. The prompt is only available before entry of an origin airport.

4 SUPP NAV REPORT

Push – transmits a copy of supplemental navigation database.

5 SUPP NAV REQUEST

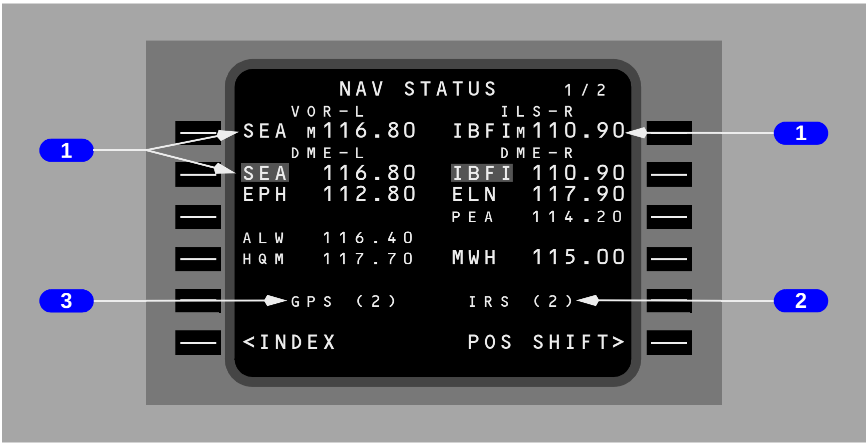
Push – transmits a data link request for a supplemental navigation database uplink.

Navigation Status Display

The NAV STATUS page displays the current status of the navaids being tuned.

Access to the NAV STATUS display is from the NAV STATUS prompt on the POS SHIFT page 3/3, the PROGRESS page 1/4, and (in flight) the INIT/REF INDEX page or from the NAV OPTIONS page 2/2, NEXT or PREV PAGE.

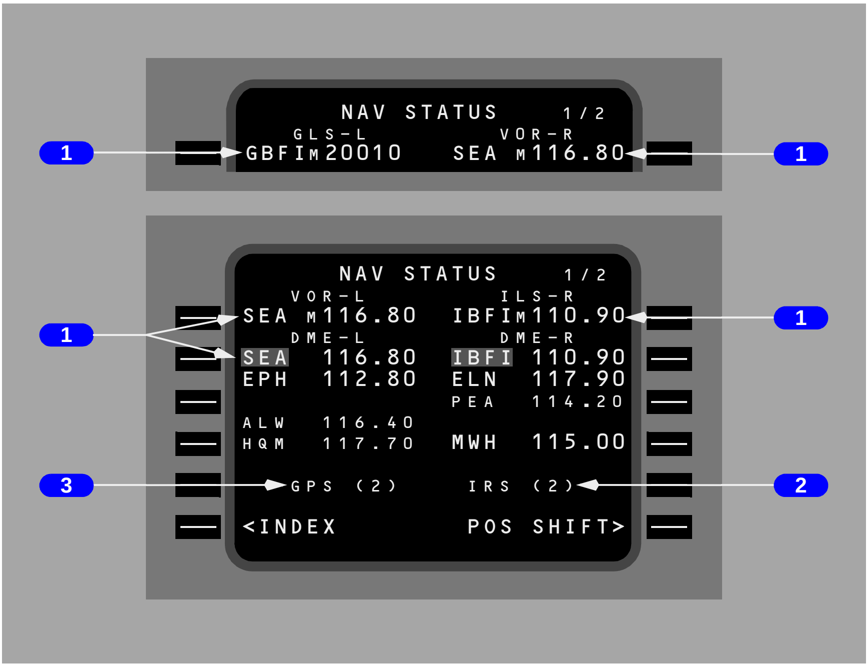
YA701 - YV750



```
          NAV  STATUS        1/2
      VOR-L            ILS-R
SEA  M116.80     IBFIM110.90
      DME-L            DME-R
SEA   116.80     IBFI  110.90
EPH   112.80     ELN   117.90
                 PEA   114.20
ALW   116.40
HQM   117.70     MWH   115.00

     GPS (2)        IRS (2)
<INDEX            POS SHIFT>
```

YV751 - YV754



YA701 - YV750

1 VOR/ILS and DME Lines

Lines 1L and 1R display VOR or ILS identifier and frequency tuned on the corresponding VHF NAV control panel.

Lines 2L – 2R through 4L – 4R display up to five DME identifiers and frequencies tuned by the corresponding scanning DME receiver.

Data is displayed in large font with the identifier highlighted if that facility is being used for navigation.

Data is displayed in large font with the identifier not highlighted if that facility is being received but not used for navigation.

Data is displayed in small font if that facility is being tuned but not received.

If the navaid has failed, FAIL will be displayed in small font.

If there is no corresponding identifier for the displayed frequency, then the identifier field will be blank and only the frequency will be displayed.

On lines 1L or 1R, for VOR/ILS displays, the mode of tuning will be shown:

- M – Manual
- P – Procedural

On lines 2L – 2R through 4L – 4R, if no DME information is received then the identifier and frequency field is blank.

YV751 - YV754

1 VOR, ILS, GLS and DME Lines

Lines 1L and 1R display VOR, ILS or GLS identifier and frequency tuned on the corresponding VHF NAV control panel.

Lines 2L – 2R through 4L – 4R display up to five DME identifiers and frequencies tuned by the corresponding scanning DME receiver.

Data is displayed in large font with the identifier highlighted if that facility is being used for navigation.

Data is displayed in large font with the identifier not highlighted if that facility is being received but not used for navigation.

Data is displayed in small font if that facility is being tuned but not received.

If the navaid has failed, FAIL will be displayed in small font.

If there is no corresponding identifier for the displayed frequency, then the identifier field will be blank and only the frequency will be displayed.

On lines 1L or 1R, for VOR/ILS/GLS displays, the mode of tuning will be shown:

- M – Manual
- P – Procedural

On lines 2L – 2R through 4L – 4R, if no DME information is received then the identifier and frequency field is blank.

2 IRS Status Display

Displays the IRS currently selected for use in navigation. “L” or “R” indicates left or right IRS is being used in the FMC position calculation.

“2” indicates a dual system with both IRSs used in the FMC position calculation.

3 GPS Status Display

Displays the GPS currently selected for use in navigation. “L” or “R” indicates left or right GPS is being used in the FMC position calculation.

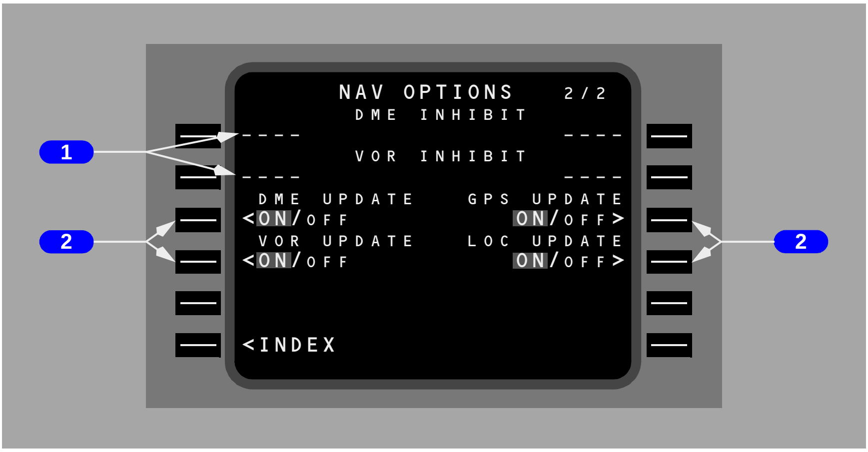
“2” indicates dual system with both GPSs used in the FMC position calculation.

The display will be blank if GPS is inhibited for use in navigation.

Navigation Options (NAV OPTIONS)

The FMC normally rejects the use of navaids that are not suitable for navigation. However, when the aircrew is aware that unreliable navaids exist (either by NOTAM, ATC, etc.) they should manually exclude these navaids from the FMCs navigation solution. This will prevent the possibility of incorrect position calculations and maximize the FMCs reliability. This is accomplished through the NAV OPTIONS page.

Access to the NAV OPTIONS page may be gained by selecting the NAV OPTIONS prompt on the REF NAV DATA page or by selecting NEXT or PREV PAGE on the NAV STATUS page.



```
          NAV OPTIONS      2/2
           DME INHIBIT
----                         ----
           VOR INHIBIT
----                         ----
 DME UPDATE          GPS UPDATE
<ON/OFF                 ON/OFF>
 VOR UPDATE          LOC UPDATE
<ON/OFF                 ON/OFF>


<INDEX
```

1 DME/VOR INHIBIT

Enter the identifier of up to two VOR/DME, VORTAC, or DME stations that must not be used for FMC position updates.

Entries are blanked at flight completion.

Deleting or overwriting removes a previous inhibit.

The FMC normally uses DME from two different ground stations to update its position solution. When two DME stations are not available, the FMC reverts to single station radial-DME updating to determine position. Only two of the four inhibit entries are utilized at any one time depending upon which update mode the FMC is operating in. The DME INHIBIT entries are excluded from the FMCs update solution whenever the FMC is updating from two DME stations. The VOR INHIBIT entries are excluded from the FMCs update solution whenever the FMC is radial-DME updating.

2 DME/VOR/GPS/LOC UPDATE

Push – permits switching between ON and OFF modes for updating FMC position. Default mode is ON. The current mode is highlighted.

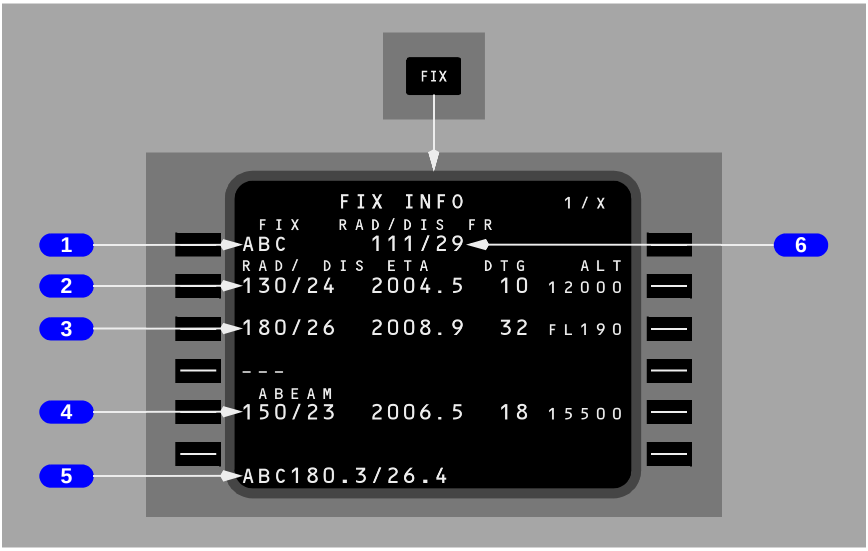
Note: When the DME UPDATE is OFF, the VOR-DME and LOC-DME UPDATES are also inhibited even if the VOR and LOC UPDATES are selected ON. If the FMC hasn't done a GPS UPDATE in the last 5 seconds then the FMC can do a LOC only UPDATE without DME if the LOC UPDATE is selected ON and the DME UPDATE is selected OFF.

Selection is reset to ON at flight completion.

Fix Information Page

Two identical FIX INFO pages are used to identify waypoint fixes for display on the navigation display map mode. If desired, fix information can be copied into the route. Page access is via the FIX key.

Radial or distance entries from the fix may be made on any line 2L to 4L. Valid format is a three character numeric entry. Slash rule is used to differentiate between radial and distance in the scratch pad.



```
          FIX INFO          1/X
  FIX      RAD/DIS FR
ABC          111/29
RAD/ DIS   ETA     DTG     ALT
130/24     2004.5   10    12000
180/26     2008.9   32    FL190

---
  ABEAM
150/23     2006.5   18    15500

ABC180.3/26.4
```

1 FIX Name

Enter the desired fix.

Valid entries are airports, navaids, waypoints or runway identifiers from the navigation database.

The selected fix is displayed on the navigation display map mode and highlighted by a green circle.

2 Distance Entry (example)

Enter a distance from the fix. Distances from the fix are displayed on the navigation display map mode as a dashed green circle around the fix.

When the distance intersects the active route, the ETA, DTG, and predicted altitude at the intersection are displayed for that intersection.

If there is more than one intersection, the data will apply to the first occurrence and will sequence as each intersection is passed.

Valid entries are xxx.x:

- distance is limited to 511 NM or less and may contain 1/10 NM entry
- leading zeros can be omitted for distance
- decimal values can be omitted
- distance only entries must start with a /.

ETA – displays the estimated time of arrival to the intersection point.

DTG – displays the distance to go to the intersection point.

ALT – displays the predicted altitude at the intersection point.

3 Radial Entry (example)

Enter a radial from the fix. Radials are displayed on the navigation display map mode as green dashed lines from the fix.

When the radial intersects the active route, the ETA, DTG, and predicted altitude at the intersection are displayed.

If there is more than one intersection, the data will apply to the first occurrence and will sequence as each intersection is passed.

Valid entries are xxx or xxx/.

4 ABEAM

Displays the abeam point and calculates the ETA, DTG, and ALT information.

The fix abeam point ahead of the airplane is displayed by a radial line from the waypoint ending at the nearest perpendicular route leg intersection.

If there is more than one intersection, the data will apply to the first occurrence and will sequence as each intersection is passed.

5 Route Intersection Point Copied

Pushing the line select key for one of the RAD/DIS entries copies the fix place/bearing/distance definition into the scratchpad. This fix can be placed into the route on a LEGS page as a waypoint.

6 Radial/Distance From Fix (RAD/DIS FR)

Displays the radial and distance from the fix to the airplane. This information is continually updated as the airplane position changes.

Intentionally
Blank

Introduction

The descent phase begins at the top of descent point and continues to the end of descent point. Planning for the descent phase begins during cruise.

The approach phase begins at the end of descent point and continues to touchdown or go–around. When a go–around is accomplished, the FMC enters the cruise phase.

The only automatic page change provided in the descent/approach modes is the transition from cruise to descent at the top of descent.

Early Descent

Early descent may be commenced prior to reaching the top of descent by using the DES NOW prompt.

YT514 - YT521, YV741 - YV754
A CRZ DES occurs upon lowering the MCP ALT to a lower altitude while at or above any descent constraint altitude and pressing ALT INTV. The airplane must be further than 50 nm from the Top of Descent (T/D) at the current cruise altitude. If within 50 nm of the top of descent, the Early Descent mode will be invoked. In the previous Operational Flight Programs (OFPs), this action resulted in always going into the Early Descent mode of operation regardless of distance from the top of descent.

- A cruise descent can be started by using the altitude intervention feature on the MCP when the airplane is not within a distance of 50 NM to the T/D.
- Altitude Intervention may be used to initiate Early Descent when the airplane is 50 nm or less to T/D.
- If Altitude Intervention is used to initiate descent when 50 NM or less to T/D with VNAV engaged and the MCP ALT below current altitude, Early Descent vertical speed commands of -1000 fpm will be generated by the FMC for autopilot V/S tracking until path intercept or MCP ALT level off occurs.

- If Altitude Intervention is used to initiate descent when more than 50 NM to T/D with VNAV engaged and the MCP ALT below current altitude but at or above any descent constraint altitude, the result will be cruise altitude reset to the MCP ALT and Cruise Descent vertical speed commands of -1000 fpm to the new cruise altitude.
- If Altitude Intervention is used to initiate descent when more than 50 NM to T/D with VNAV engaged and the MCP ALT below current altitude and below a descent constraint altitude, the result will be Early Descent vertical speed commands of -1000 fpm until path intercept or MCP ALT level off occurs.

Descent

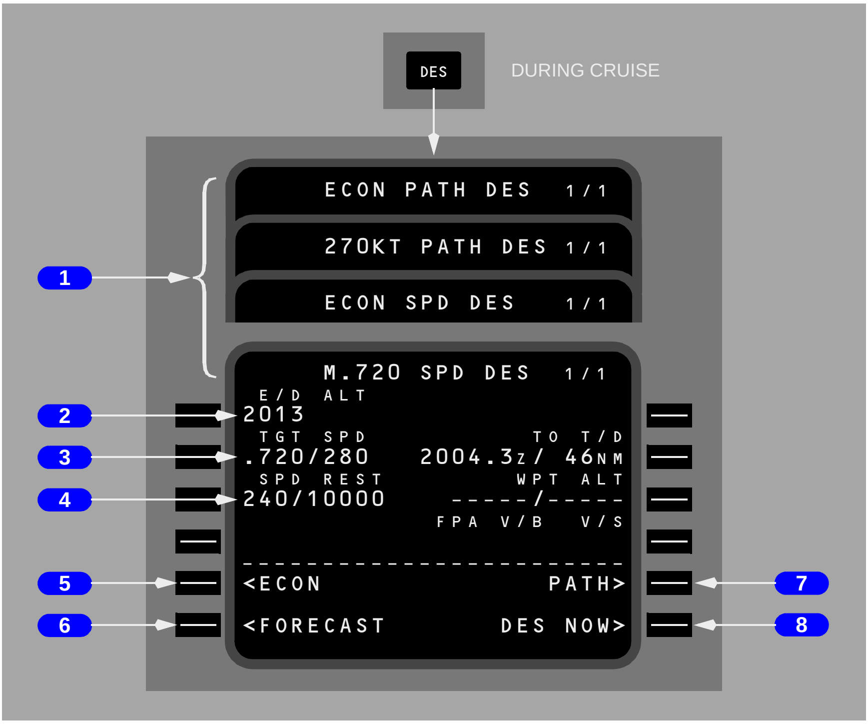
During descent, LNAV progress is managed using the RTE LEGS and PROGRESS pages, as in the cruise phase. VNAV descent management is accomplished primarily on the DES page.

The DES FORECASTS page is also available to enter forecast wind data to aid in descent planning.

Descent Page (During Cruise)

The descent page is used to monitor, revise, or select the descent path. Descent modes are economy (ECON) path or speed and manual path or speed. The default VNAV descent mode is ECON PATH. The crew must select a manual speed descent mode.

The page title reflects the VNAV descent mode. The path mode controls descent to fly a vertical path which complies with altitude and speed restrictions in the flight plan. The speed mode controls descent at a fixed speed and complies with altitude and speed restrictions in the flight plan.



1 Page Title

The page title identifies the selected mode. When a manual speed is selected, the title includes XXXKT for fixed CAS or M.XXX for fixed Mach selections.

Displays ACT when the descent phase is active.

2 End of Descent Altitude (E/D ALT)

Displays the end of descent altitude.

- for a PATH DES page, displays the altitude restriction for the E/D waypoint; blank if path descent not available
- for a SPD DES page, displays the altitude restriction for the E/D waypoint, if an E/D waypoint is present
- if an approach is selected which ends at RWXXX, the E/D altitude will be Threshold Crossing Height (TCH), 50 feet above the runway.

The end of descent altitude is the altitude constraint or predicted altitude of the last descent waypoint. End of descent may follow a lateral discontinuity. If a lateral discontinuity exists, the FMC will construct a great circle path across the discontinuity and VNAV will be valid while flying the discontinuity.

3 Target Speed (TGT SPD)

Displays the command speed maintained by VNAV while descending to waypoints, constraints, or speed restrictions.

YF048 - YV754
Displays XXX/MCP when speed intervention is active.

On ECON PATH or ECON SPD DES pages, displays the computed values for target Mach and airspeed. Speeds are performance limited.

Manual entries may be made and cause the manual PATH or manual SPD DES page for that value to display (M.720 SPD DES is depicted).

Blank for any PATH DES page if a path descent is not available.

4 Speed Restriction (SPD REST)

Displays the most restrictive of the following speeds:

- speed restrictions at the destination airport minus 10 knots
- waypoint speed restriction if greater than minimum flaps up maneuvering speed
- minimum flaps up maneuvering speed
- selected Vref + wind correction for landing flap setting
- whenever flaps are extended, the, appropriate flap speed will be displayed as XXX/FLAPS. This will supersede any other speed restriction.
- displays XXX/HOLD when decelerating to hold speed prior to hold entry fix.

Dash prompts displayed when there is no active speed restriction.

Manual crew entries or deletions may be made. HOLD or FLAPS speed may not be deleted or modified.

5 Economy (ECON)

Displayed on the manual DES pages.

Push – selects the corresponding ECON SPD or ECON PATH DES page.

6 Descent Forecasts (FORECAST)

Push – selects the DES FORECASTS page.

7 PATH

Displayed on the SPD DES pages if a path descent is available.

Push – selects the corresponding PATH DES page.

8 Descend Now (DES NOW)

Displayed on the standard DES pages whenever descent is not ACT or MOD.

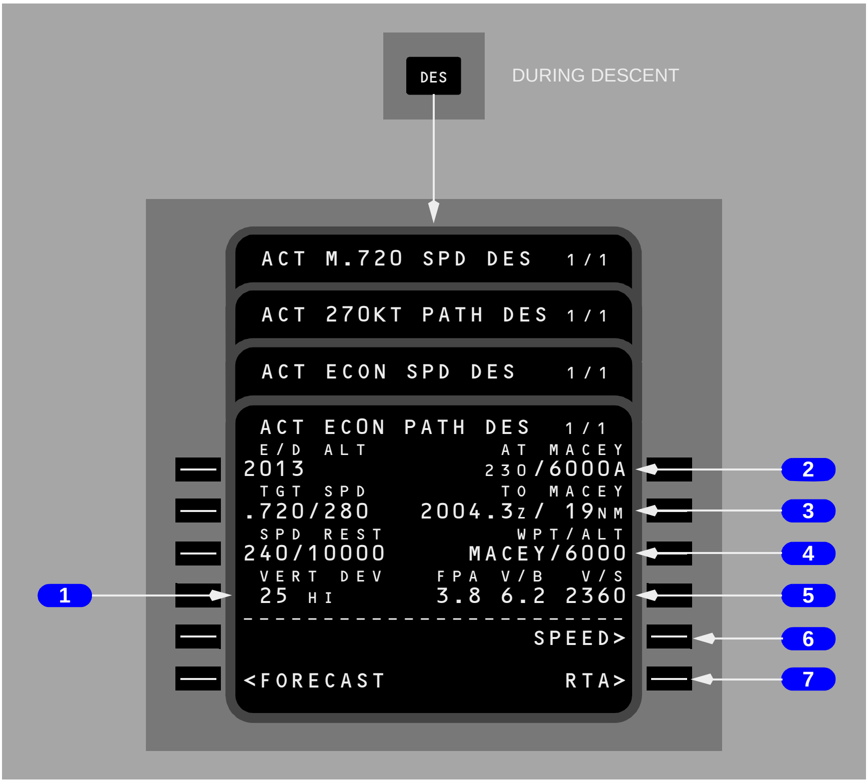
Blank for any PATH DES page if a path descent is not available.

Push – arms the DES NOW function and illuminates the EXEC light.

On a PATH DES page, execution allows early initiation of PATH descent at 1000 fpm until intercepting the computed path. On a SPD DES page, execution allows early initiation of a SPD descent at the specified speed (ECON or manual).

Descent Page (During Descent)

Display when any descent mode is active after beginning of descent.



```
ACT M.720 SPD DES        1/1
ACT 270KT PATH DES       1/1
ACT ECON SPD DES         1/1
ACT ECON PATH DES        1/1
 E/D ALT            AT MACEY
2013               230/6000A
 TGT SPD            TO MACEY
.720/280      2004.3z/ 19NM
 SPD REST            WPT/ALT
240/10000        MACEY/6000
 VERT DEV    FPA  V/B   V/S
 25 HI       3.8  6.2  2360
------------------------
                     SPEED>
<FORECAST              RTA>
```

1 **Vertical Deviation (VERT DEV)**

Displays present deviation (feet HI or LO) from the computed vertical path.

The deviation is always in relation to the path descent profile, regardless of which page is active (PATH DES or SPD DES).

Blank if a path is not available.

2 **Altitude Restriction (AT XXXXX)**

Displays the next waypoint constraint from the RTE LEGS page.

The constraint is speed/altitude. If an airspeed restriction exists at the waypoint, it will be displayed in large font; otherwise the predicted speed will be displayed in small font.

Can be deleted on this page.

The display is blank when no constraint exists, or for any PATH DES page if a path descent is not available.

3 To Waypoint (TO XXXXX)

Displays computed ETA and distance to go to T/D when not in an active descent mode.

If an early descent is in progress (initiated using DES NOW prompt), ETA and distance to go to original T/D is displayed until passing the T/D.

If a descent mode is active, displays ETA and distance to go to the first of the following points:

- the waypoint in the AT XXXXX line
- an intermediate T/D (TO T/D – XXXXX, where XXXXX is the altitude).

The display is blank if a path descent is not available, or if the AT XXXXX line is blank and no T/D information is displayed.

4 Waypoint/Altitude (WPT/ALT)

Displays the waypoint and altitude that serves as the basis for the vertical bearing (V/B) display on line 4R.

Normally displays the same waypoint/altitude restriction that is displayed on the AT XXXXX line.

May be overwritten by pilot entry.

YA701 - YT513, YV604, YV605
A runway identifier may be entered for a runway at the destination airport of the displayed flight plan. Format may be either RWXX/, RWXXX/, RWXX/AA, or RWXXX/AA where XX or XXX is the runway designation and AA is the altitude. When RWXX/ or RWXXX/ is used the altitude will automatically be set to runway elevation plus threshold crossing height.

YT514 - YT521, YV741 - YV754
A runway identifier may be entered for a runway at the destination airport of the active flight plan. Format may be either RWXX/, RWXXX/, RWXX/AA, or RWXXX/AA where XX or XXX is the runway designation and AA is the altitude. When RWXX/ or RWXXX/ is used the altitude will automatically be set to runway elevation plus threshold crossing height.

Dash prompts are displayed if there is no entry.

5 Vertical Path Parameters (FPA V/B V/S)

Displays the following parameters related to the present vertical path:.

- FPA – actual flight path angle based on present ground speed and vertical speed (that is, the present vertical bearing being flown)
- V/B – vertical bearing direct from present position on the WPT/ALT line (that is, the flight path angle required if flying direct to the waypoint and altitude on the WPT/ALT line).
- V/S – the required vertical speed (in fpm, based on present ground speed) to fly the displayed V/B.

Blank if no entry on the WPT/ALT line.

6 SPEED

Displayed on PATH DES pages.

Push – selects the related SPD DES page.

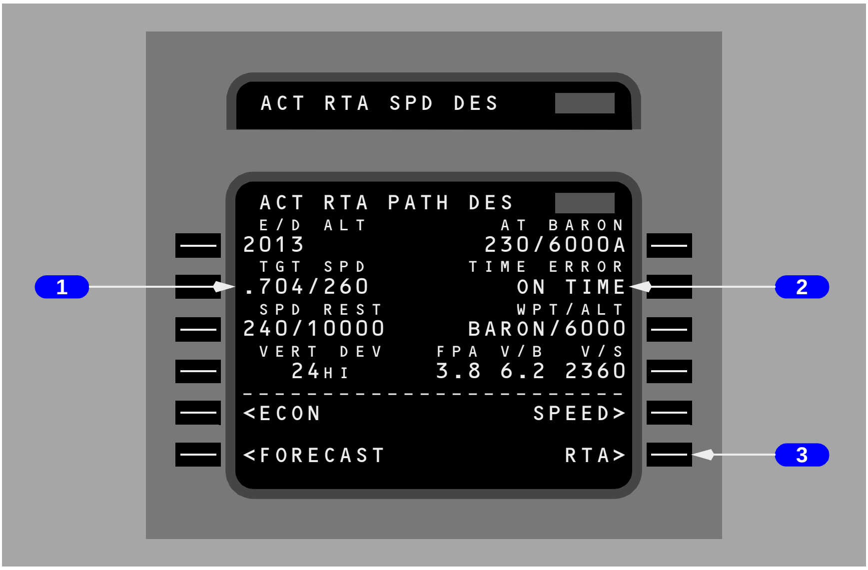
7 RTA

Displayed when DES NOW or ERASE prompt is not displayed.

Push – selects the RTA PROGRESS page.

RTA Descent Page

RTA Descent pages are displayed when an RTA mode is active. Displays are the same as on other descent pages except as noted.



```
ACT RTA SPD DES

ACT RTA PATH DES
 E/D ALT                AT BARON
2013                 230/6000A
 TGT SPD              TIME ERROR
.704/260               ON TIME
 SPD REST               WPT/ALT
240/10000           BARON/6000
 VERT DEV         FPA  V/B  V/S
   24HI           3.8  6.2 2360
------------------------------
<ECON                   SPEED>

<FORECAST                 RTA>
```

1 Target Speed (TGT SPD)

Displays computed RTA target speed.

Changes to FMC target speed if the RTA mode is exited.

2 TIME ERROR

Displays computed time error at the RTA waypoint.

Same as time error line on RTA PROGRESS page.

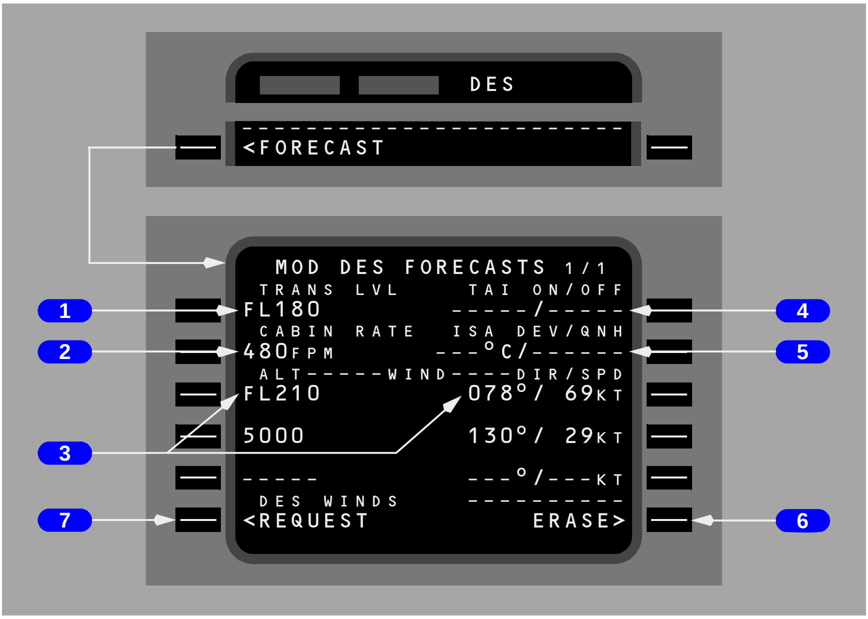
3 RTA

Push – selects the RTA PROGRESS page.

Descent Forecast Page

The descent forecast page is used for pre–descent planning to enter forecast data for more precise descent path calculation.

The primary entries are wind direction and speed for up to three descent altitudes, and the altitude that anti–icing is turned on and off.



1 Transition Level (TRANS LVL)

Normally displays FL180 as the assumed descent transition level.

YA701 - YT513, YV604, YV605
Changes automatically if an arrival procedure having a different stored value is entered.

YT514 - YT521, YV741 - YV754
Changes automatically when entering flight plan data based on the following criteria if a pilot entered value has not already been entered:

- the FMC will use the transition level from the NDB stored for the STAR or terminal approach record if the flight plan is active, a STAR or terminal approach has been selected and the transition level exists for the STAR.
- if an active flight plan exists and no transition level exists on the STAR or terminal approach NDB record or a STAR or terminal approach has not been selected, then the FMC will use the transition level from the NDB stored for the DESTINATION airport.

- if there is no trans level for the DESTINATION airport in the NDB for the conditions defined above, then the default transition level will default to the transition altitude from the NDB stored for the DESTINATION airport.
- if the transition level is not available from any of the sources above,ained in a loaded custom performance defaults data base.

Manual entry allowed and takes priority.

Data may be up-linked via ACARS message. The up-linked value will appear in small font until EXECuted at which time it will be displayed in large font.

2 CABIN RATE

YA701 - YT513, YV604, YV605
Displays the predicted cabin rate of descent required by the flight plan descent profile.

YT514 - YT521, YV741 - YV754
Displays the predicted cabin rate of descent required by the active flight plan descent profile.

3 Descent Wind (ALT – – – – – WIND – – – – DIR/SPD)

Allows entry of altitude and wind direction/speed for up to three forecast wind values.

Entries may be made in any altitude sequence and will be automatically ordered by altitude from highest to lowest.

Data may be up-linked via ACARS message. The up-linked value will appear in small font until EXECuted at which time it will be displayed in large font.

4 Thermal Anti–Ice On/Off (TAI ON/OFF)

Enter the altitudes in flight level or feet at which anti–ice is expected to be turned on and off.

Data may be up-linked via ACARS message. The up-linked value will appear in small font until EXECuted at which time it will be displayed in large font.

5 ISA Deviation and QNH (DEV/QNH)

Enter the average ISA deviation for descent in °C (+/–XX°C) or °F (+/–XX°F)

Enter the destination QNH altimeter setting (IN. HG. or MB). Do not enter a QFE altimeter setting.

Data may be up-linked via ACARS message. The up-linked value will appear in small font until EXECuted at which time it will be displayed in large font.

6 ERASE or LOAD

Push – (ERASE) deletes modification and returns page to previously displayed descent page.

Push – (LOAD) initiates the loading of ACARS up-linked descent forecasts data.

LOAD is displayed when ACARS descent forecasts has the highest load priority and no EXECutes or ACCEPT/REJECTs are pending.

7 DES WINDS REQUEST

Push – transmits a data link request for descent winds.

Engine Out Descent

There are no specific engine out pages for descent. Use the normal descent planning features and pages.

Approach

During approach, LNAV and VNAV guidance normally transitions to the approach guidance provided by navigation radios. The FMC continues to calculate and display present position and can provide LNAV and VNAV approach guidance for certain types of approaches when radio navigation is not used.

The RTE LEGS and PROGRESS pages are used to manage the airplane until other approach guidance becomes active. Other pages which support approaches are:

- APPROACH REF page – to select the approach VREF
- ARRIVALS page – to select the desired arrival and approach procedures
- HOLD page – to manage holding patterns.

Holding is described in this section but it can be used during any phase of flight.

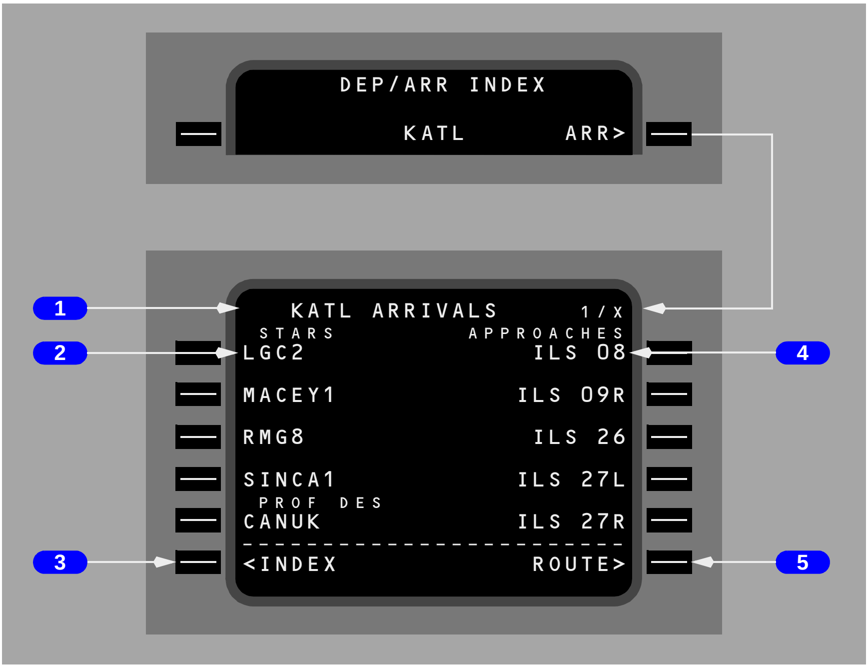
Arrivals Page – IFR Approaches

The arrivals page allows selection of an approach, standard terminal arrival route (STAR), and arrival transitions to the destination airport. This page can also be used to view information about a selected airport that is not the destination. Only procedures for the origin and destination airport can be selected for entry into the flight plan.

The approaches, STARS/profile descents, and transitions are displayed and selected on this page.

YT514 - YT521, YV741 - YV754
With Route 2 software the ARRIVALS page will designate which route the displayed arrivals are for by placing a RTE 1 or RTE 2 at the top center of the ARRIVALS page.

YA701 - YT513, YV604, YV605



```
        DEP/ARR INDEX

            KATL          ARR>
```

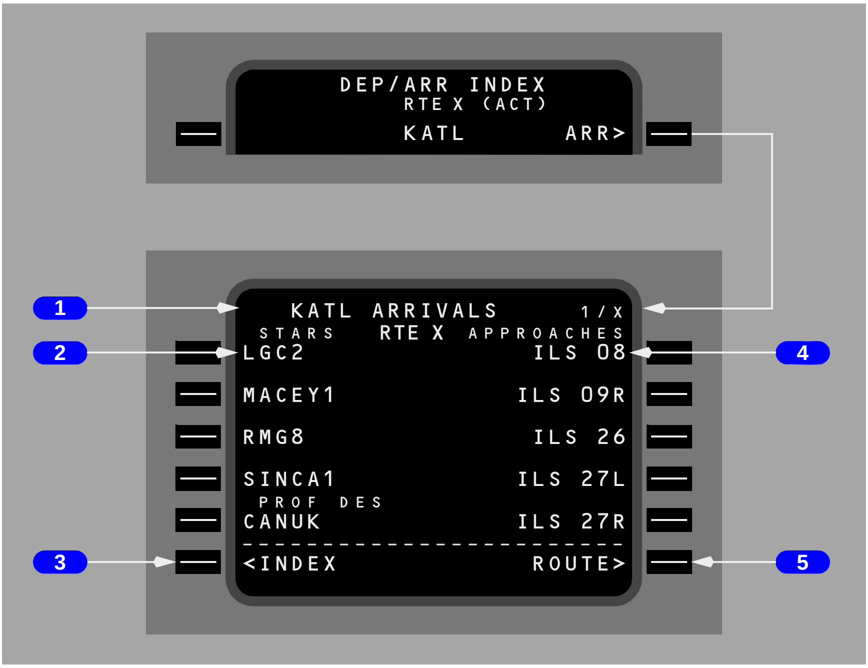
```
     KATL ARRIVALS        1/X
  STARS            APPROACHES
LGC2                   ILS 08

MACEY1                ILS 09R

RMG8                   ILS 26

SINCA1                ILS 27L
  PROF DES
CANUK                 ILS 27R
------------------------
<INDEX                 ROUTE>
```

YT514 - YT521, YV741 - YV754



1 Page Title

The destination airport identifier is displayed in the title.

Airports with more than 5 runways or STARs produce multiple arrivals pages.

2 Standard Terminal Arrival Routes (STARS)

Upon initial selection, an alphabetical listing of all STARS and profile descents is displayed.

STARS are displayed first in a list under the STAR label. Profile descents are listed after the STARS under the PROF DES label.

Selection of the desired STAR deletes all other STARs and non–applicable approaches/runways, and displays a listing of any arrival transitions applicable to that STAR.

The selection of an approach or runway deletes all STARs not related to that approach/runway.

3 INDEX

Push – displays the DEP/ARR INDEX page.

4 Approaches and Runways (APPROACHES)

Upon initial page display, an alphabetical listing of all approaches for the airport, followed by a numerical listing of all runways, is displayed.

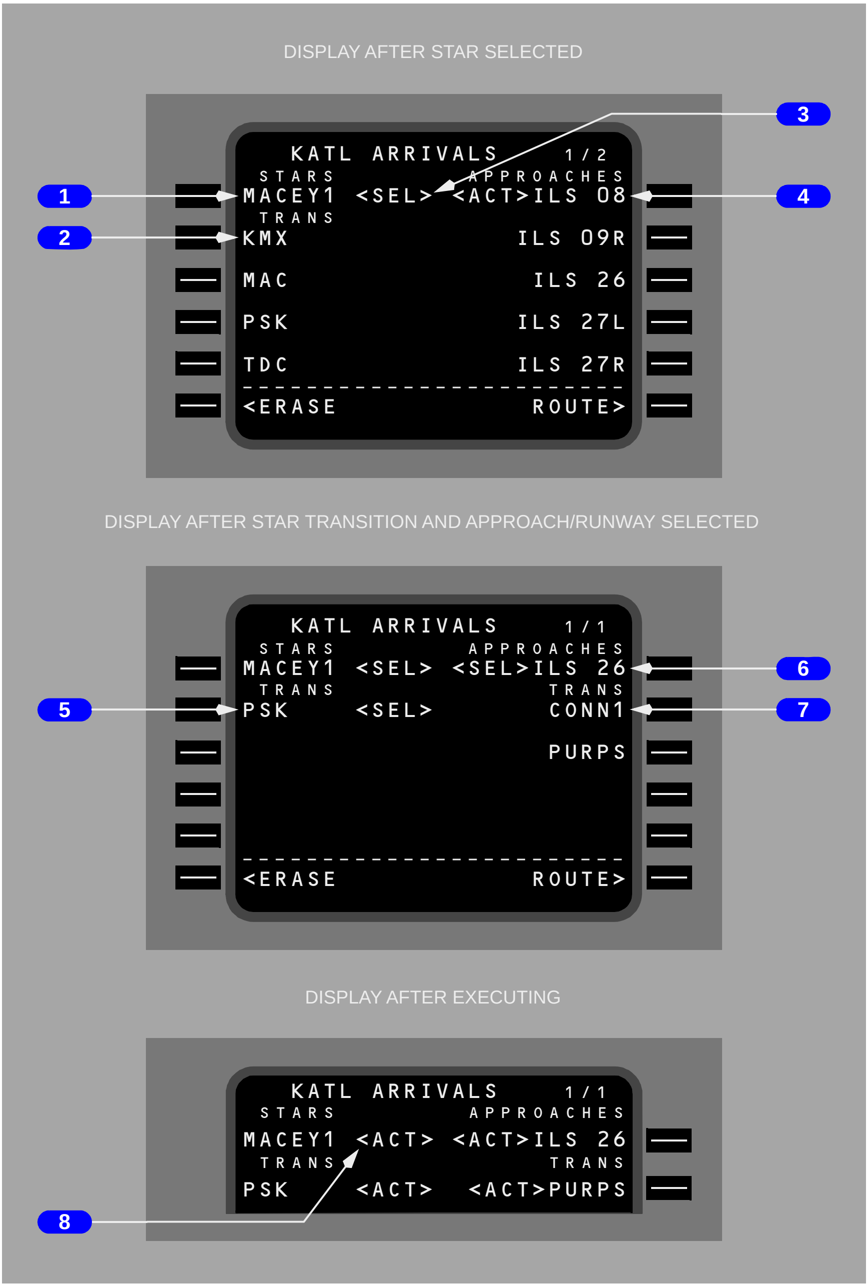
Selection of the desired approach or runway deletes all other approaches/runways.

5 ROUTE

Push – displays the RTE page.

Arrivals Page during approach selection

YA701 - YT513, YV604, YV605



DISPLAY AFTER STAR SELECTED

```
   KATL  ARRIVALS      1/2
  STARS             APPROACHES
MACEY1  <SEL>  <ACT>ILS 08
  TRANS
KMX                ILS 09R
MAC                 ILS 26
PSK                ILS 27L
TDC                ILS 27R
-----------------------
<ERASE              ROUTE>
```

DISPLAY AFTER STAR TRANSITION AND APPROACH/RUNWAY SELECTED

```
   KATL  ARRIVALS      1/1
  STARS             APPROACHES
MACEY1  <SEL>  <SEL>ILS 26
  TRANS                  TRANS
PSK     <SEL>        CONN1
                     PURPS

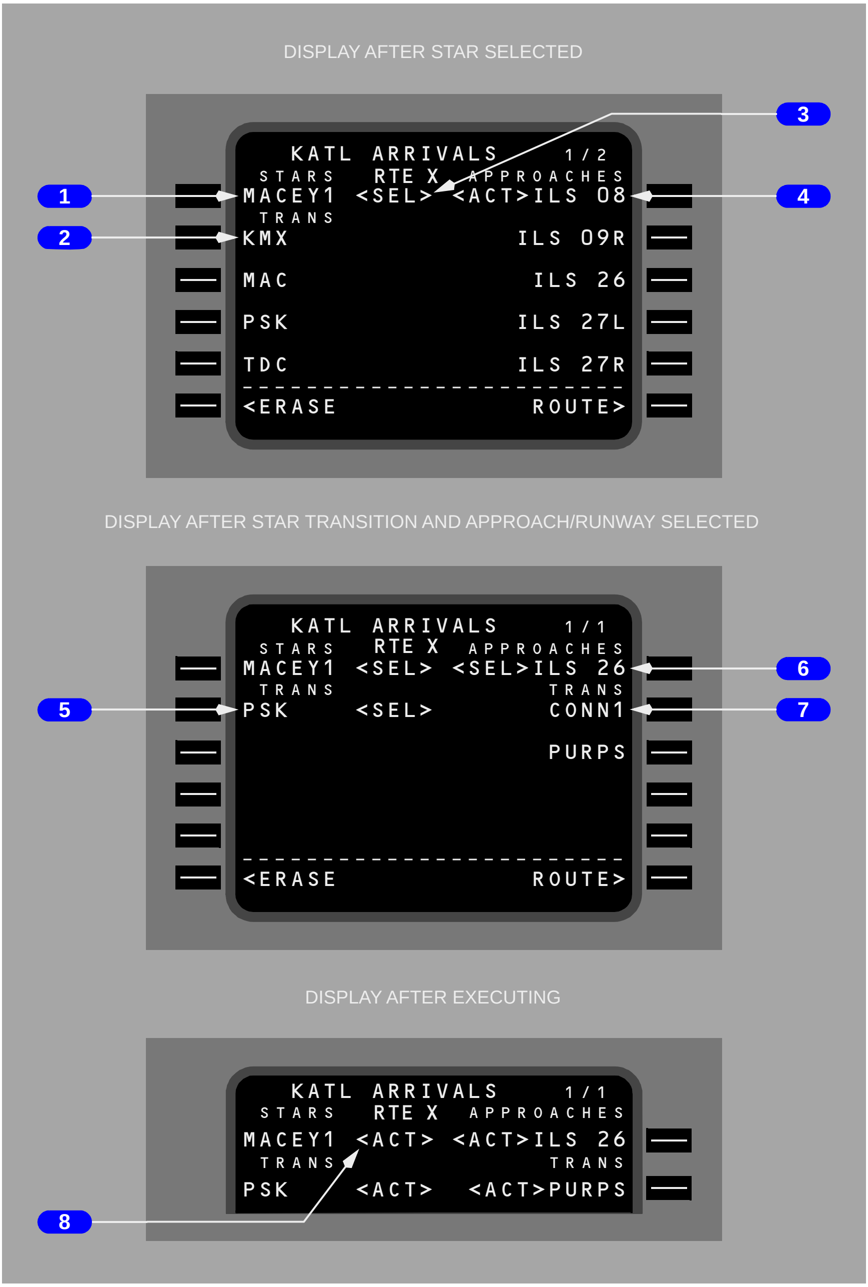


-----------------------
<ERASE              ROUTE>
```

DISPLAY AFTER EXECUTING

```
   KATL  ARRIVALS      1/1
  STARS             APPROACHES
MACEY1  <ACT>  <ACT>ILS 26
  TRANS                  TRANS
PSK     <ACT>   <ACT>PURPS
```

YT514 - YT521, YV741 - YV754



DISPLAY AFTER STAR SELECTED

```
     KATL ARRIVALS        1/2
  STARS    RTE X   APPROACHES
MACEY1  <SEL>  <ACT>ILS 08
  TRANS
KMX                  ILS 09R

MAC                   ILS 26

PSK                  ILS 27L

TDC                  ILS 27R
------------------------
<ERASE                ROUTE>
```

DISPLAY AFTER STAR TRANSITION AND APPROACH/RUNWAY SELECTED

```
     KATL ARRIVALS        1/1
  STARS    RTE X   APPROACHES
MACEY1  <SEL>  <SEL>ILS 26
  TRANS                 TRANS
PSK     <SEL>          CONN1

                       PURPS




------------------------
<ERASE                ROUTE>
```

DISPLAY AFTER EXECUTING

```
     KATL ARRIVALS        1/1
  STARS    RTE X   APPROACHES
MACEY1  <ACT>  <ACT>ILS 26
  TRANS                 TRANS
PSK     <ACT>   <ACT>PURPS
```

1 STARS

Displays the selected STAR.

2 Arrival Transitions (TRANS)

Displays all arrival transitions related to the selected STAR.

3 Selected Status Label (<SEL>)

Identifies arrival/approach procedures or a runway which has been selected for entry into the route, but not executed.

All <SEL> entries propagate to the MOD RTE and MOD RTE LEGS pages for subsequent execution.

4 Approach and Runway (APPROACHES, RUNWAYS)

Displays all approaches related to the selected STAR, followed by all related runways (unless the desired approach/runway was selected on the initial display).

5 Arrival Transition (TRANS)

Displays the selected arrival transition.

6 APPROACHES

Displays selected approach/runway.

7 Approach Transition (TRANS)

Displays all approach transitions related to the selected approach.

8 Active Status Labels (<ACT>)

Following execution of the selected entries, the arrival/approach procedures and runway are identified as active.

Note: For an existing active route, the execute key illuminates upon STAR or approach/runway selection. Following selections, the ERASE prompt is available. Selections should be executed on the RTE or RTE LEGS pages after linking any route discontinuities.

Arrivals Page – Runway Extension Fix and Flight Path Angle

YA701 - YT513, YV604, YV605

INITIAL DISPLAY

```
    KBCD ARRIVALS        1/4
  STARS              RUNWAYS
-NONE-                    04

                          09

                          24



------------------------
<INDEX                ROUTE>
```

DISPLAY AFTER RUNWAY 09 SELECTED

```
    KBCD ARRIVALS        1/4
  STARS              RUNWAYS
-NONE-               <SEL>09


                     RWY EXT
                      --.-NM
                         FPA
                        -.--
```

DISPLAY AFTER RUNWAY 09 EXTENSION FIX AND FPA INSERTED AND EXECUTED

```
    KBCD ARRIVALS        1/4
  STARS              RUNWAYS
-NONE-               <ACT>09


                     RWY EXT
                      16.0NM
                         FPA
                        3.00



------------------------
<INDEX                ROUTE>
```

YT514 - YT521, YV741 - YV754

INITIAL DISPLAY

```
    KBCD  ARRIVALS      1/4
   STARS  RTE X      RUNWAYS
-NONE-                    04

                          09

                          24




------------------------
<INDEX             ROUTE>
```

DISPLAY AFTER RUNWAY 09 SELECTED

```
    KBCD  ARRIVALS      1/4
   STARS  RTE X      RUNWAYS
-NONE-             <SEL>09

                   RWY  EXT
                     --.-NM
                        FPA
                       -.--
```

DISPLAY AFTER RUNWAY 09 EXTENSION FIX AND FPA INSERTED AND EXECUTED

```
    KBCD  ARRIVALS      1/4
   STARS  RTE X      RUNWAYS
-NONE-             <ACT>09

                   RWY  EXT
                     16.0NM
                        FPA
                       3.00


------------------------
<INDEX             ROUTE>
```

1 Runway Extension (RWY EXT)

Permits optional entry of a runway extension waypoint following selection of desired runway.

Desired extension distance is entered in scratch pad, then inserted on RWY EXT line. Valid entries are between 1 and 25 NM (.1 NM resolution). This creates a waypoint on the extended runway centerline at the specified distance from the runway threshold.

Waypoint is identified on the RTE and RTE LEGS pages as RX–YYY, where YYY is the runway designation.

A speed/altitude constraint may be entered for the RWY EXT fix from the RTE LEGS page.

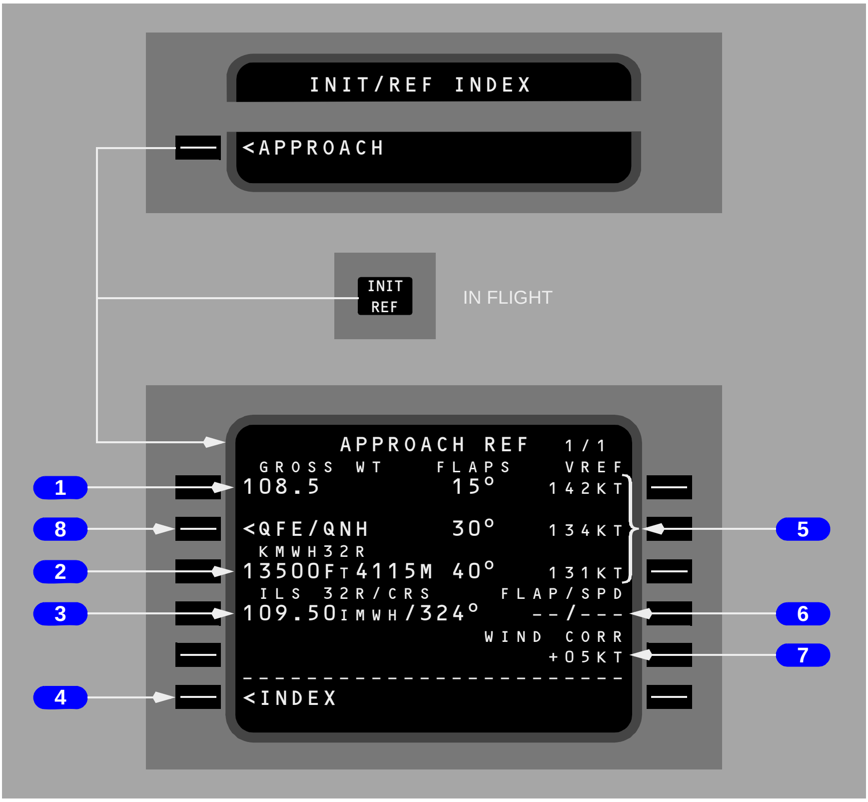
2 Flight Path Angle (FPA)

Permits optional entry of a flight path angle between the runway threshold and the runway extension fix. Default is 3.0 degrees. Valid entries are from 2.0 to 5.5 degrees.

Note: Dashes (–.– –) are displayed on the DEP/ARR page when the default is used.

Approach Reference Page

The approach reference page displays approach planning information and approach reference speed (VREF) selection. The displayed data is for the DEST airport and the arrival/ approach entered into the FMC flight plan.



1 Airplane Gross Weight (GROSS WT)

Normally displays the FMC calculated airplane gross weight.

A manual entry of gross weight is allowed.

Displays box prompts when gross weight is not available from the FMC.

Valid entry is XXX.X.

Leaving and returning to this page replaces a manually entered weight with FMC computed gross weight.

2 Runway Length

Displays the length in feet and meters of the referenced runway.

Blank if no runway has been entered and executed.

YA701 - YV750

3 Approach Information

Displays the runway number and associated ILS frequency/identifier for the ILS, LOC, or back course approach in the active flight plan.

Displays front course, if an ILS, localizer, or localizer backcourse is displayed on 4L. If the course is true displays is suffixed with “T”.

Blank if no approach has been executed.

YV751 - YV754

3 Approach Information

Displays the runway number, associated ILS frequency (GLS channel) and approach identifier for the ILS, LOC, LDA, SDF, GLS or back course approach in the active flight plan.

Displays front course in large font, if a localizer based or GLS based approach is displayed on 4L. If the course is true displays is suffixed with “T”.

Blank if no localizer or GLS based approach has been executed.

4 INDEX

Push – selects the INIT/REF INDEX page.

5 Vref (FLAPS – – – VREF)

Displays landing Vref for three flap settings as computed by the FMC. Displayed in small size characters.

Selection causes the flap and VREF speed to be placed in 4R.

Double line selection of a displayed Vref, or manual entry of another value, causes the flap and VREF speed to be placed in 4R and causes Vref to be displayed on the airspeed display. CDU display changes to large size characters.

Speeds are based on displayed gross weights.

Double line selection provides Vref to be used by VNAV in combination with wind correction.

Vref, once selected, will not be updated. To obtain an updated speed, the current speed must be deleted or a different Vref selected or entered.

6 Flap/Speed (FLAP/SPD)

Displays selected approach reference flap and speed setting.

Manual input of desired flap and/or speed settings may be made.

Valid entry format is FF/SSS, SSS, /SSS, FF/ or F/, where F or FF is a flap setting of 0, 1, 2, 5, 10, 15, 25, 30, 40 and SSS is a speed within the range allowed in 1R to 3R.

Entries may be deleted and are blanked at flight completion.

7 Wind Correction (WIND CORR)

Displays current wind correction for approach. Default is +05 knots.

Manual input of desired wind correction may be made up to +20 knots.

8 Landing Reference (LANDING REF)

Push – Toggles altimeter reference between QFE and QNH.

Default is QNH.

Resets to QNH at flight complete.

Reflects TAKEOFF REF selection on TAKEOFF REF page 2.

Active altimeter reference is highlighted.

During descent with QFE selected, the PFD altitude indications show zero feet at the arrival runway. The PFD altitude indication background colors change to green.

If QFE is the current altimeter reference, and the EFIS control panel STD switch is pushed, The takeoff reference automatically toggles to QNH.

Holding

The FMC computes holding patterns with constant radius turns based on current winds and FMC commanded airspeed. The pattern size is limited to FAA or ICAO protected airspace. In LNAV, the AFDS tracks the holding pattern using up to a 30 degree bank angle. Strong winds or airspeed in excess of FAA or ICAO entry speeds may result in the airplane flying outside the protected airspace.

YT514 - YT521, YV741 - YV754

The FMC generates steering commands to enter, track, and exit a holding pattern inserted into the active flight plan through CDU action by the pilot.

With LNAV active before sequencing the holding fix, holding pattern entries are determined by the following:

- the angle between the flight plan leg into the holding fix and the holding inbound course determines the entry method used (parallel, teardrop or direct entry)
- the airplane flies the initial outbound leg for a specified time (1.0 minute at or below 14,000 feet and 1.5 minutes above 14,000 feet)

- teardrop entries use an FMC calculated offset angle designed to intercept the outbound leg at the point where the inbound turn begins
- parallel and teardrop entries may cause the airplane to fly beyond the displayed holding pattern; however, the airplane remains in protected FAA or ICAO limits.

Descent in Holding

YT514 - YT521, YV741 - YV754

The FMC provides the capability for starting descents when in the holding pattern airspace with a T/D displayed on one of the holding legs. This is based on the airplane entering the Hold in the Cruise phase of flight.

- The requirement is to descend in VNAV while holding when a T/D is encountered in the holding pattern, the MCP ALT has been lowered, and the EXIT ARMED mode has been executed.

When an exit from a holding pattern is requested by the pilot through a CDU action:

- a turn path to the inbound leg is generated immediately if the airplane is on the outbound leg or in the fix end turn when the T/D does not occur in the hold pattern.
- the entire hold pattern is flown when the T/D does occur in the hold pattern.

After EXIT HOLD has been executed, T/D, if applicable, is displayed on the holding exit lateral path. The FMC switchs from cruise to descent upon passing T/D if the MCP altitude is lower than the FMC CRZ altitude. The descent is performed in a SPEED on Elevator mode at hold speed until leaving the HOLD.

HOLD Page

The hold page is used to enter a holding pattern into the route.

When the flight plan does not have a holding pattern, push the HOLD function key to show the LEGS page with the HOLD AT line.

Two versions of the hold page are possible:

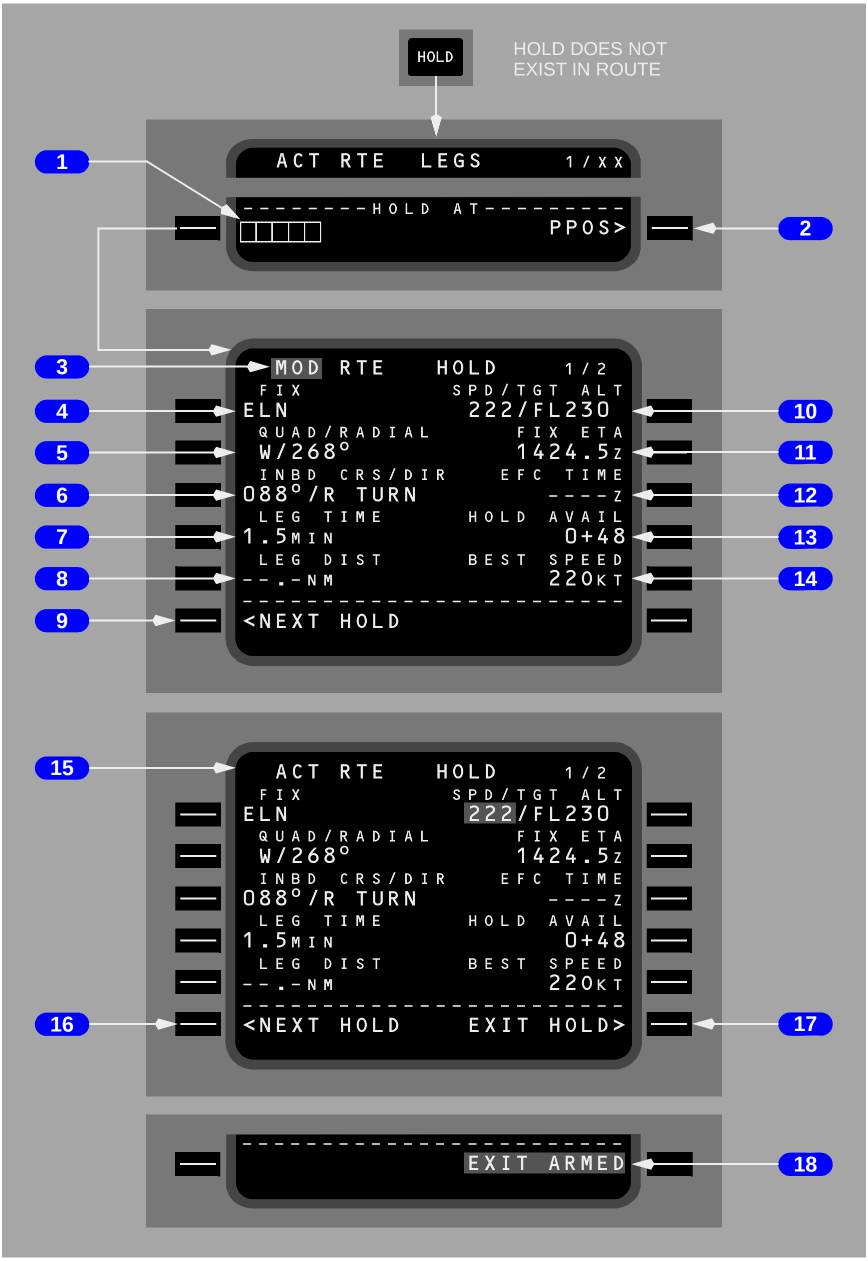
- an airway or procedure holding pattern (from the navigation database)
- a flight crew–entered holding pattern.

The holding page shows actual or default data about the holding pattern.

Entries make route modifications, which can be erased or executed.

Active holding patterns are magenta on the navigation display.

YA701 - YT513, YV604, YV605



```
   ACT RTE  LEGS     1/XX

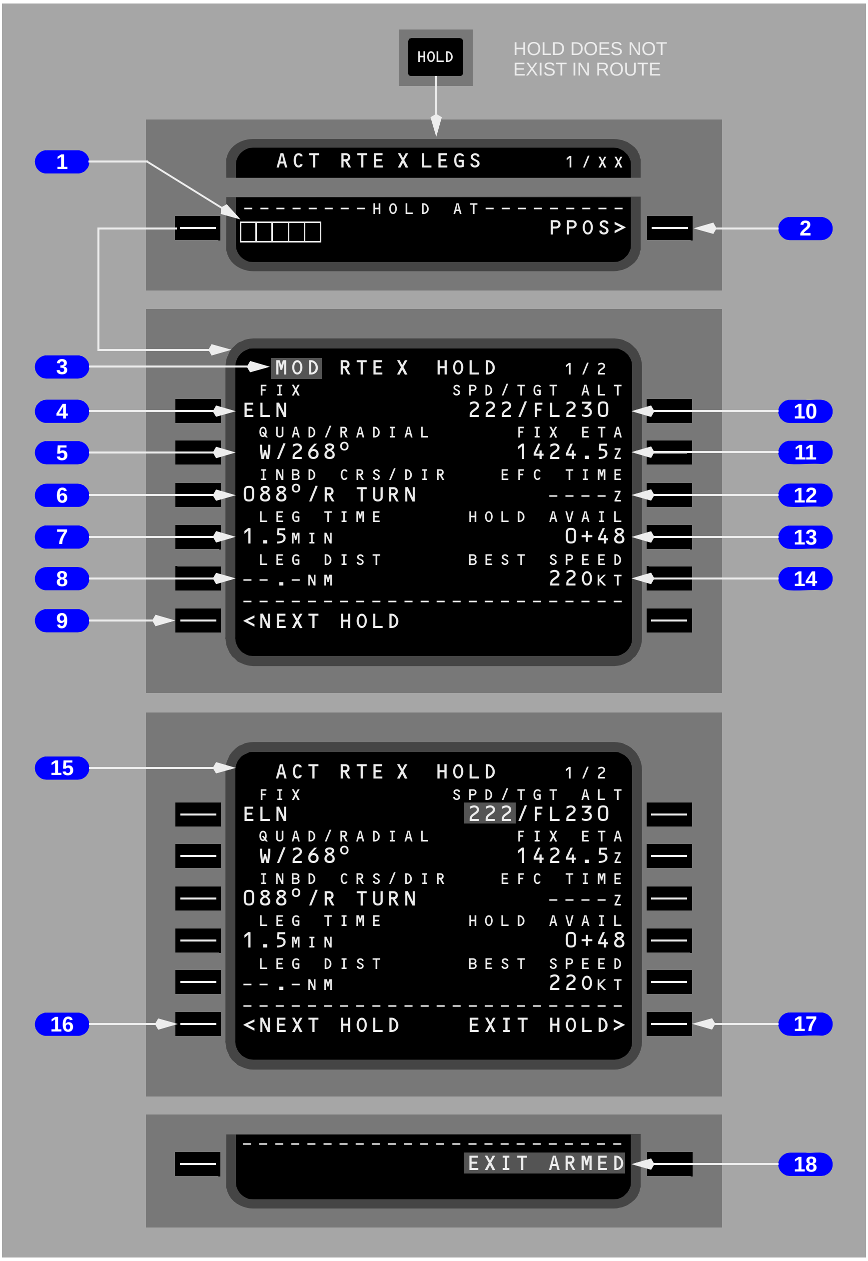
--------HOLD AT---------
□□□□□              PPOS>
```

```
 MOD RTE    HOLD      1/2
  FIX          SPD/TGT ALT
ELN             222/FL230
 QUAD/RADIAL      FIX ETA
 W/268°           1424.5Z
 INBD CRS/DIR    EFC TIME
088°/R TURN         ----Z
 LEG TIME      HOLD AVAIL
1.5MIN               0+48
 LEG DIST      BEST SPEED
--.-NM              220KT
------------------------
<NEXT HOLD
```

```
 ACT RTE    HOLD      1/2
  FIX          SPD/TGT ALT
ELN             222/FL230
 QUAD/RADIAL      FIX ETA
 W/268°           1424.5Z
 INBD CRS/DIR    EFC TIME
088°/R TURN         ----Z
 LEG TIME      HOLD AVAIL
1.5MIN               0+48
 LEG DIST      BEST SPEED
--.-NM              220KT
------------------------
<NEXT HOLD     EXIT HOLD>
```

```
------------------------
               EXIT ARMED
```

YT514 - YT521, YV741 - YV754



```
 ACT RTE X LEGS       1/XX
--------HOLD AT----------
□□□□□               PPOS>
```

```
 MOD RTE X  HOLD      1/2
 FIX          SPD/TGT ALT
ELN             222/FL230
 QUAD/RADIAL      FIX ETA
 W/268°           1424.5Z
 INBD CRS/DIR    EFC TIME
088°/R TURN         ----Z
 LEG TIME      HOLD AVAIL
1.5MIN               0+48
 LEG DIST      BEST SPEED
--.-NM              220KT
------------------------
<NEXT HOLD
```

```
 ACT RTE X  HOLD      1/2
 FIX          SPD/TGT ALT
ELN             222/FL230
 QUAD/RADIAL      FIX ETA
 W/268°           1424.5Z
 INBD CRS/DIR    EFC TIME
088°/R TURN         ----Z
 LEG TIME      HOLD AVAIL
1.5MIN               0+48
 LEG DIST      BEST SPEED
--.-NM              220KT
------------------------
<NEXT HOLD     EXIT HOLD>
```

```
------------------------
               EXIT ARMED
```

1 HOLD AT

When the HOLD function key is pushed and no holding pattern exists in the route, the LEGS page shows prompts to enter the holding fix. Enter the holding fix to show the RTE HOLD page.

Displays a prompt to enter the holding fix, a route waypoint, or present position.

A waypoint is entered as the holding fix.

2 HOLD AT Present Position (PPOS)

Selects the airplane present position as the holding fix.

Only displayed during flight when not in a holding pattern.

3 Modified Route Hold Status

MOD indicates that the holding fix has not been executed.

Execution changes the page title to RTE HOLD (ACT RTE HOLD if holding at PPOS).

4 FIX

Displays waypoint identifier of the holding fix.

Entry is propagated either automatically from the database, or from a manual entry on the HOLD AT page.

If PPOS was selected on the HOLD AT page, then the FMC assigns PPOS as the fix identifier.

5 Quadrant/Radial (QUAD/RADIAL)

Displays holding pattern quadrant and radial.

Entry is propagated either automatically from the database, or from a manual entry on the HOLD AT page.

The default holding pattern inbound course and turn direction are in small font. Crew entered or holding patterns extracted from the database are in large font.

Valid entry is XXX (radial) or XX/XXX (quadrant/radial). Valid quadrant entry is N, NE, E, SE, S, SW, W, NW.

Quadrant will be determined by the resulting inbound course.

6 Inbound Course/Direction (INBD CRS/DIR)

Displays holding inbound course and turn direction.

Entry is propagated either automatically from the database, or from a manual entry on the HOLD AT page.

The default holding pattern inbound course and turn direction are in small font. Crew entered or holding patterns extracted from the database are in large font.

Valid entry is XXX (inbound course), XXX/X (inbound course/turn direction), /X or X (turn direction).

Automatically changes QUAD/RADIAL to agree.

For a flight crew–entered holding pattern, the inbound course is initially the same as the preceding leg to the fix.

For a flight crew–entered holding pattern, if no entry is made, the FMC assumes right turns.

7 LEG TIME

Displays holding pattern leg time.

Valid entry is XXX.X. Manual entry has priority.

If no entry is made, the FMC assumes the standard times of 1.0 minute at or below 14,000 feet and 1.5 minutes above 14,000 feet.

The default leg times are displayed in small font. Crew entered or holding patterns extracted from the database are displayed in large font.

The holding pattern will automatically be resized when climbing or descending through 14,000 feet if the holding pattern size is not defined in the database or has not been manually entered.

If a LEG DIST is manually entered, then dashes will be displayed.

8 Leg Distance (LEG DIST)

Dash prompts are normally displayed.

Entry may be propagated either automatically from the database, or made by manual entry.

Manual entry has priority.

Overrides

LEG TIME.

9 NEXT HOLD

Displayed when the route contains less than five holding patterns.

Push – displays (RTE LEGS) HOLD AT page and prompts for new holding fix entry.

To delete the hold modification return to the RTE or RTE LEGS page and select ERASE prompt at LSK 6L.

10 Speed/Target Altitude (SPD/TGT ALT)

Displays current speed and altitude (small font).

Speed or altitude constraint may be entered. Manual entries are in large font and propagate to LEGS page.

Note: When a cruise hold exists, cruise speed changes propagate around the hold but have no effect on holding speed.

11 Fix Estimated Time of Arrival (FIX ETA)

Displays computed time for next passage over holding fix.

12 Expect Further Clearance Time (EFC TIME)

Entry of the EFC time will help optimize FMC performance computations.

Computation of destination fuel assumes that departure from the holding fix will occur at this time.

13 Hold Available (HOLD AVAIL)

Displays available holding time in hours + minutes remaining if destination is to be reached with planned fuel reserves as entered on PERF INIT page.

14 BEST SPEED

Displays computed best holding speed based on present altitude and conditions.

Note: May exceed maximum speed permitted by regulatory agency.

15 Active Route Hold Status

ACT indicates that the airplane has entered the holding pattern.

16 NEXT HOLD

Displayed when the route contains less than five holding patterns and there is no route modification in progress.

Push – displays (RTE LEGS) HOLD AT page and prompts for new holding fix entry.

17 EXIT HOLD

Displayed on the holding page when in the holding pattern.

Used when preparing to depart holding pattern.

Push – changes prompt to EXIT ARMED and illuminates execute key.

18 EXIT ARMED

Displayed on the holding page when in the holding pattern and after line selection of EXIT HOLD prompt.

Execution activates LNAV flight back to the holding fix via a shortened holding pattern, departure from holding pattern, and continued flight along the active route. ACT RTE LEGS page 1/XX appears after holding exited.

Highlighted in reverse video after execution.

RTE LEGS HOLD AT (Fix in Route)

Used to enter proposed fix for racetrack holding pattern at either present position or any waypoint.

A maximum of five holding patterns may exist at one time.

Two holding patterns may exist at the same waypoint if one is in the route and the other is in the missed approach.

YA701 - YT513, YV604, YV605

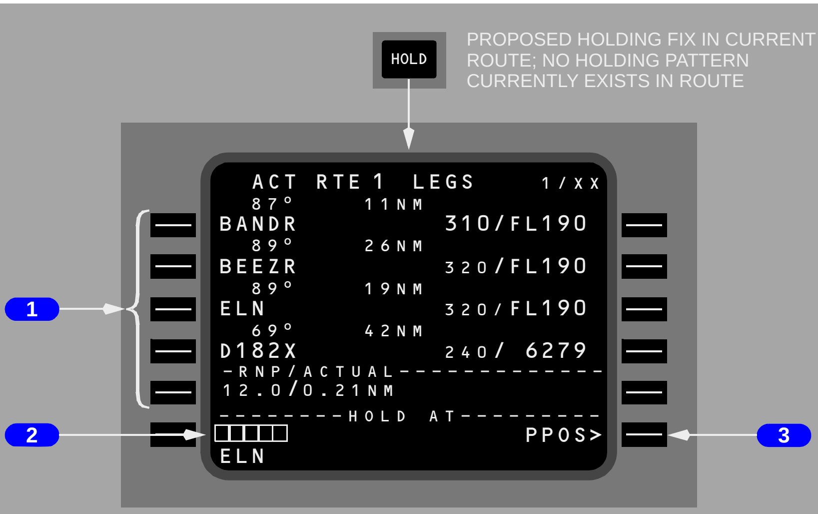
PROPOSED HOLDING FIX IN CURRENT ROUTE; NO HOLDING PATTERN CURRENTLY EXISTS IN ROUTE

```
    ACT RTE    LEGS      1/XX
    87°       11NM
BANDR            310/FL190
    89°       26NM
BEEZR            320/FL190
    89°       19NM
ELN              320/FL190
    69°       42NM
D182X            240/ 6279
    92°        4NM
D160X            240/ 5352
--------HOLD AT---------
□□□□□                PPOS>
ELN
```

AFTER EXECUTING ROUTE HOLD AT DOWNTRACK WAYPOINT

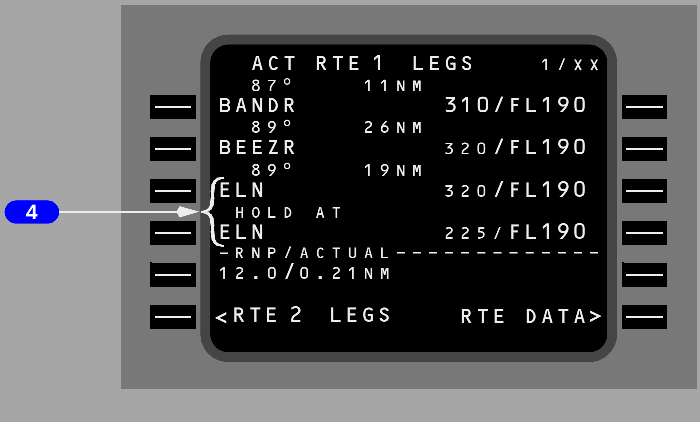
```
    ACT RTE    LEGS      1/XX
    87°       11NM
BANDR            310/FL190
    89°       26NM
BEEZR            320/FL190
    89°       19NM
ELN              320/FL190
  HOLD AT
ELN              225/FL190
    69°       42NM
D189X            240/ 6279
-RNP/ACTUAL-------------
12.0/0.21NM     RTE DATA>
```

YT514 - YT521, YV741 - YV754



PROPOSED HOLDING FIX IN CURRENT ROUTE; NO HOLDING PATTERN CURRENTLY EXISTS IN ROUTE

AFTER EXECUTING ROUTE HOLD AT DOWNTRACK WAYPOINT



1 Data Lines

Display same data as the corresponding RTE LEGS page.

2 HOLD AT

Used to enter any waypoint identifier, which then defines a holding fix.

Entry may be via keyboard, or by transfer of any downpath waypoint which is in the existing route (the example depicts ELN line selected into the scratch pad).

Following line selection of the desired waypoint into the box prompts, the MOD RTE HOLD page appears and the execute key illuminates.

3 Present Position (PPOS)

Push – selects holding fix at present position. The MOD RTE HOLD page appears and the execute key illuminates ("present" is at the time of execution of the MOD RTE HOLD page).

Displayed only in flight.

Default parameters are a standard holding pattern on the inbound leg.

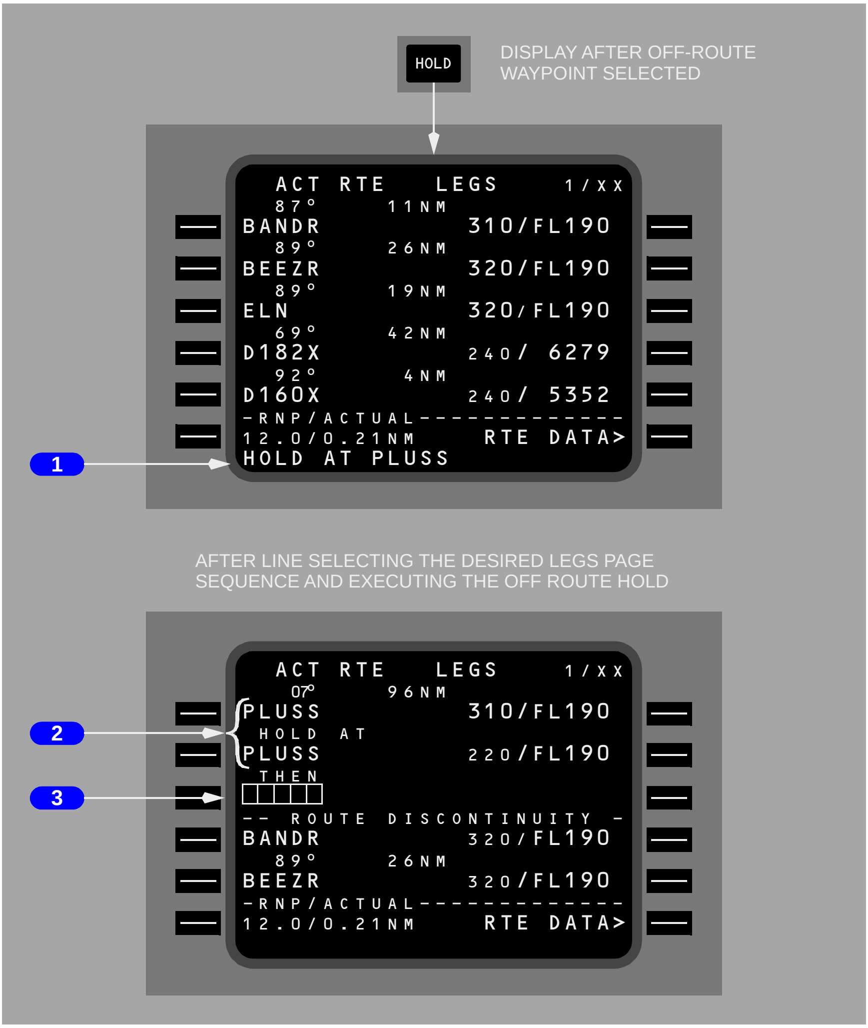
4 Hold at Waypoints (HOLD AT)

A holding fix creates a new HOLD AT waypoint following the leg to that waypoint.

Displayed on the RTE LEGS page in the proper route sequence after executing the related MOD RTE HOLD page.

RTE LEGS HOLD AT (Fix not in Route)

YA701 - YT513, YV604, YV605



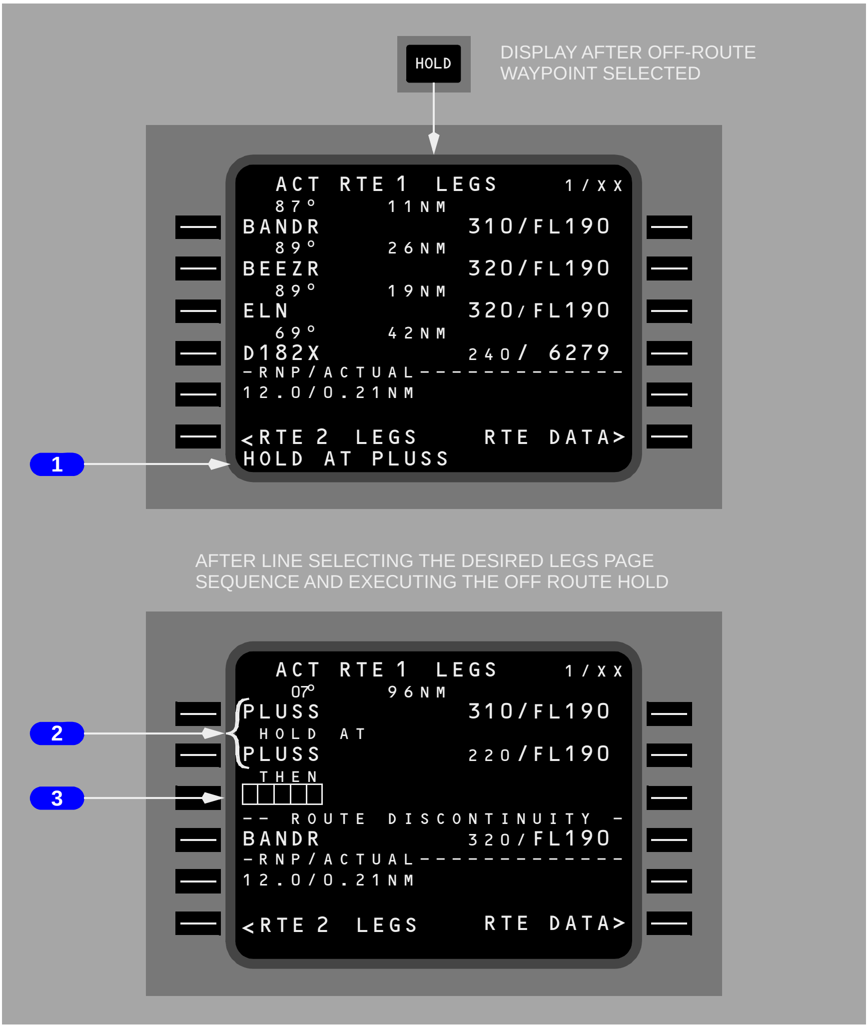
DISPLAY AFTER OFF-ROUTE WAYPOINT SELECTED

```
   ACT RTE   LEGS      1/XX
   87°      11NM
BANDR           310/FL190
   89°      26NM
BEEZR           320/FL190
   89°      19NM
ELN             320/FL190
   69°      42NM
D182X           240/ 6279
   92°       4NM
D160X           240/ 5352
-RNP/ACTUAL------------
12.0/0.21NM     RTE DATA>
HOLD AT PLUSS
```

AFTER LINE SELECTING THE DESIRED LEGS PAGE SEQUENCE AND EXECUTING THE OFF ROUTE HOLD

```
   ACT RTE   LEGS      1/XX
   07°      96NM
PLUSS           310/FL190
  HOLD AT
PLUSS           220/FL190
  THEN
□□□□□
-- ROUTE DISCONTINUITY -
BANDR           320/FL190
   89°      26NM
BEEZR           320/FL190
-RNP/ACTUAL------------
12.0/0.21NM     RTE DATA>
```

YT514 - YT521, YV741 - YV754



```
   ACT RTE 1  LEGS       1/XX
   87°       11NM
BANDR              310/FL190
   89°       26NM
BEEZR              320/FL190
   89°       19NM
ELN                320/FL190
   69°       42NM
D182X              240/ 6279
-RNP/ACTUAL------------
12.0/0.21NM

<RTE 2  LEGS     RTE DATA>
HOLD AT PLUSS
```

```
   ACT RTE 1  LEGS       1/XX
    07°      96NM
PLUSS              310/FL190
  HOLD AT
PLUSS              220/FL190
  THEN
□□□□□
-- ROUTE DISCONTINUITY -
BANDR              320/FL190
-RNP/ACTUAL------------
12.0/0.21NM

<RTE 2  LEGS     RTE DATA>
```

1 Hold at Waypoint (HOLD AT XXXX)

Displayed in the scratch pad whenever the entry in the HOLD AT line is not a waypoint in the existing route (the example above depicts entry of PLUSS).

Route position of the holding fix is defined by line selecting to the desired LEGS page sequence.

Following line selection to the desired LEGS page sequence, the MOD RTE HOLD page appears and the execute key illuminates.

2 Hold at Waypoints (HOLD AT)

A holding fix creates a new HOLD AT waypoint following the leg to that waypoint.

Displayed on the RTE LEGS page in the proper route sequence after executing the related MOD RTE HOLD page.

3 ROUTE DISCONTINUITY

The entered route must always form a continuous path of linked legs.

The example depicts a HOLD AT entry where the entry was not a downpath waypoint.

The FMC computes a direct course to the off–route holding fix.

The HOLD AT waypoint becomes a termination identifier which is not part of the existing route. The resulting route discontinuity is identified by box prompts, requiring entries to define the route after PLUSS.

Intentionally
Blank

Flight Management, Navigation Chapter 11

FMC Messages Section 60

Introduction

FMC messages tell the flight crew when system operation is degraded or if there are data input errors.

FMC messages show in the CDU scratchpad. The messages are categorized as:

- alerting messages
- entry error messages
- advisory messages.
- FMC data link messages (alerting and advisory)

The FMC messages are shown according to their level of importance. Alerting messages are most important, followed by entry error messages. Advisory messages are least important. If multiple messages exist, a less important message replaces another message in the scratchpad when the CLR key is pushed or the condition is corrected.

The amber FMC alert light on each pilot's instrument panel illuminates when there is an FMC alerting message. All FMC messages illuminate the CDU message (MSG) light. Clear the message or correct the condition to cancel the message.

The following tables are general lists; some messages may not apply to all FMC configurations.

FMC Alerting Messages

These messages relate to operationally significant conditions which affect FMC operation.

FMC alerting messages:

- are shown in the CDU scratchpad
- cause the amber FMC alert light on each pilot's instrument panel to illuminate
- illuminate message lights (MSG) on both CDUs.

Use the CLR key or correct the condition responsible for the message to remove the message. The message is temporarily removed from the scratchpad when manually entering data. The message returns when the data is removed from the scratchpad.

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION
CRZ ALT CHANGED TO XXXXX (U10.5 and later)	An altitude constraint added due to entering a new company route, a new destination airport, or selection of a new procedure conflicts with the cruise altitude, resulting in automatically raising the cruise altitude to match the highest waypoint altitude constraint in the mod plan, when not in active descent.	Clear the message. Verify MCP cruise altitude.
CHECK ALT TGT (U10.5 and later)	VNAV disengages while airplane is between MCP and FMC altitudes or VNAV button pressed while airplane is between MCP and FMC altitudes.	Clear the message.
CUTBACK DISARMED (U10.6 and later)	Cutback turned off as a result of changing or deleting the flight plan runway while on the ground.	Clear the message. Re-arm as required.

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION
CUTBACK UNAVAILABLE (U10.3 and later)	The FMC is unable to compute a Cutback N1 value.	Clear the message.
CYCLE IRS OFF–NAV	IRS is unable to complete alignment under current conditions.	Cycle IRS mode selector to “OFF” and back to “NAV.”
DATA BASE INVALID	The automatic validity test of the permanent navigation database has failed.	Advise maintenance personnel to check the FMC and reload the database, as required. If desired, consider the use of the temporary nav database.
DISCO INSRTD AFTR XXXXX (waypoint identifier)	A ROUTE DISCONTINUITY has been inserted into the flight plan due to undefined termination of a downpath leg or a triple waypoint BYPASS.	Select the RTE or RTE LEGS pages and modify the waypoints for a continuous route.
DISCONTINUITY	Passing the last waypoint in the route prior to a ROUTE DISCONTINUITY (LNAV disengages) or pressing LNAV while in a discontinuity.	Select the RTE LEGS page. Enter the desired active waypoint into the box prompts. Correct any ROUTE DISCONTINUITY and EXECute. Reengage LNAV.
DRAG REQ AFTER XXXXX (U10.7 and later)	A waypoint speed constraint greater than 10 knots above the predicted speed exists at waypoint XXXXX.	Modify flight plan as required. Clear the message.
END OF OFFSET	Two minutes prior to passing offset leg termination.	Confirm clearance.

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION
END OF ROUTE	LNAV engaged and passing the last waypoint in the route (LNAV disengages).	Select the RTE LEGS page. Enter the desired active waypoint into the dash prompts and EXECute. Reengage LNAV.
ENG OUT SID MOD (U10.3 and later)	An engine–out SID has been automatically inserted into the flight plan as a modification.	Clear the message.
ENTER IRS POSITION	IRS in the alignment mode needs present position to complete alignment. Previous present position entry was not received back from the IRS.	Enter IRS present position into the scratchpad pad and line select 4R on the POS INIT page of the CDU. If present position was previously entered, overwrite displayed data. If necessary, enter present position directly into the IRS control /display unit.
FMC APP/TUNE DISAGREE (U10.5 and later)	An approach that utilizes FMC generated glide path is in the active flight plan but an approach navaid (ILS/GLS) has been tuned with G/S ON.	Confirm the tuned frequency and approach selected in the FMC are both consistent with the actual approach intended to be flown. Resolve tuning or approach selection inconsistency. Clear the message.

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION
FMC DISAGREE (U10.8 and later)	During approach or on the ground, monitored parameters required for dual FMC operation are in disagreement. (Dual FMC as installed) Message will remain displayed until the condition has been resolved. The FMC does not check for mach and indicated air speed miscompares on the ground.	Monitor FMCs closely. Both FMCs remain online. Limit approaches to single FMC only. If desired, revert to SINGLE FMC OPERATION in this section.
FMC DISAGREE - VERTICAL (U10.8A and later)	A vertical deviation, FMC Airspeed, or FMC Mach value disagreement between the FMCs by more than the allowed tolerance occurs and long enough that all attempts to resynchronize failed while the aircraft in a path descent. Message display is inhibited when in the Approach Nav environment. (dual FMC as installed)	Do not move the FMC source select switch. Monitor crossing altitudes to ensure compliance.
FMC POS/RW DISAGREE (U10.7 and later)	Position information is contradictory.	Refer to FMC Navigation Check Supplementary Procedure.

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION
GPS-L INVALID GPS-R INVALID (U10.7 and later)	FMC is no longer receiving valid information from the displayed GPS system.	Clear the message. For ADS-B operations (if installed), when one GPS is invalid, ensure that the transponder selector is positioned to the side with the valid GPS. For dual GPS installations, if both GPS-L INVALID and GPS-R INVALID messages show, refer to FMC Navigation Check supplementary procedure. For single GPS installations, refer to FMC Navigation Check supplementary procedure
INSUFFICIENT FUEL (U13.0 and earlier)	A change in conditions or flight plan route causes predicted fuel at destination to be 2000 lbs/900 kilograms or less.	Modify the route plan or cruising altitude, or divert for additional fuel.
IRS MOTION	IRS has automatically restarted the alignment due to detection of excessive motion.	Clear message and attempt to reduce airplane movement, if practicable.

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION
IRS-(L or R) DRIFT (U11.0 and later)	An FMC has detected that the IRS-(L or R) position or velocity data is unreasonable, and deselected IRS-(L or R) due to velocity divergence or position blunder checks.	Refer to FMC Navigation Check Supplementary Procedure.
IRS POS/ORIGIN DISAGREE (U10.7 and later)	Position information is contradictory.	Refer to FMC Navigation Check Supplementary Procedure.
LNAV BANK ANGLE LIMITED (U10.6 and later)	LNAV is engaged and the airplane is not on a lateral offset and is not near or in an orbit or hold and the airplane is within 5 minutes or less from an LNAV guided course change, and will exceed the airway/route boundaries for non-flyover turns less than or equal to 135 degrees due to performance limited bank angle. This message does not apply to fixed radius turns.	Review the LNAV course change. If course change exceeds airway/route boundary, consider flight plan change.
MAX ALT FLXXX (flight level value)	Altitude intervention (as installed) attempt to raise cruise altitude when MCP altitude is above maximum altitude.	Clear the message.
MISSED CAPTURE	Proper localizer capture maneuver was performed, but the AFDS did not capture.	Clear the message.

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION
MODEL/ENG DATA INVALID	A valid performance database is not available.	Contact maintenance personnel.
NAV DATA OUT OF DATE	Effectivity dates of nav database do not agree with date input from clock.	Check the IDENT page and reverse the dates for ACTIVE NAV DATA if required.
NAV INVALID–TUNE XXXXX (navaid identifier)	FMC is unable to auto–tune or receive the navaid for a RNAV or VOR approach procedure.	Cross–check radios and manually tune the desired navaid.
NO VNAV AFTER XXXXX, (U11.0 and later)	The descent path is monitored independent of path construction for the following scenarios: A) - an “at”, “at or above”, “at or below” or “window” constraint is violated B) - a navigation data base gradient (vertical angle) is violated If a violation is detected and not resolved, VNAV will disconnect after the point of the violation. The alerting message is displayed one minute prior to the violation.	After sequencing waypoint XXXXX, VNAV INVALID - PERF logic applies: Pilot should reenter the CI using either the previous CI displayed or enter a new CI. Reengage VNAV when change has been EXECuted.

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION
OAT DISAGREE - DELETED (U12.0 and later)	A check of entered OAT versus sensed OAT occurs after first engine start. A difference of +/- 6 degrees Celsius between the OAT value on the N1 LIMIT / TAKEOFF REF page and the engine temperature sensors.	Enter updated/corrected OAT on the N1 LIMITS page.

OVERSPEED DISCONNECT (U10.2 and later)	During path descent and above or below the speed restriction altitude, VNAV disengages when airspeed exceeds FMC speed restriction by more than 15 knots.	Manually reduce speed and reengage VNAV.
PARTIAL ROUTE LOADED (U10.3 and later)	A route is loaded which references data not contained in the database.	Clear the message.
PARTIAL ROUTE X LOADED (U11.0 and later)	A route is loaded into the active/inactive RTE 1 or 2 flight plan buffer which references data not contained in any of the databases.	Clear the message.
PERF DEFAULTS INVALID	Validity check of performance defaults database has failed.	Contact maintenance personnel.

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION
RESET MCP ALT (U10.5A and later)	During the FMC cruise phase with VNAV engaged, when within 5 NM of the top-of-descent point without selecting a lower altitude on the AFDS MCP.	Select lower MCP altitude values as clearances permit.
RTA UNACHIEVABLE	The RTA is not in the computed RTA window under current parameters.	Enter an achievable RTA or discontinue the RTA mode of navigation. Adjust parameters to meet the RTA.
RW/APP TUNE DISAGREE (U10.4 and later)	During approach, manual tuned approach frequency or channel does not match active flight plan.	Clear the message and select correct approach frequency.
RW/APP CRS ERROR (U10.4 and later)	During approach, MCP selected course does not match front course for the approach in the active flight plan.	Clear the message and select correct MCP course.
SCANNING DME FAIL	Inputs from both frequency scanning DME radios have failed.	Clear the message and check position. Radio updating of FMC position is not available.
SELECT MODE AFTER RTA	RTA mode has been discontinued due to sequencing of RTA waypoint or RTA waypoint has been removed from the flight plan.	Select alternate performance mode. (ECON, manual speed, etc.)

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION
SINGLE FMC OPERATION	The primary FMC has determined that the secondary FMC is not available. (Dual FMC as installed)	If the FMC source selector switch is in the “Normal” position, move to “BOTH ON L”. No action is required if the FMC source selector switch is already positioned to “BOTH ON L” or “BOTH ON R”.
SW OPTIONS INVALID (U10.5 and later)	The CRC performed during power up BIT on the current software options data base has failed, or the CRC of the software options data base that has been loaded via the data loader has failed.	Reload the FMC OPC software by maintenance.
TAKEOFF SPEEDS DELETED (U10.6 and later)	A change to runway, runway data, takeoff thrust selection or performance data is made after the V speeds have been selected, or entered V speeds fail to meet relative value check.	Reselect new V speeds and clear message.

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION
TAKEOFF SPEEDS DELETED (U12.0 and later)	A change to runway, runway data, takeoff thrust selection or performance data is made after the V speeds have been selected, or entered V speeds fail to meet relative value check. A check, after first engine start, of entered OAT versus sensed OAT has a difference of +/- 6 degrees Celsius.	Reselect new V speeds and clear message. Enter updated/corrected OAT on the N1 LIMITS page, then reselect new V speeds and clear message.

THRUST REQUIRED (U10.5 and later)	Airplane is in an underspeed condition.	Clear the message. Increase airspeed to within 15 knots of speed target.
UNABLE HOLD AIRSPACE (U10.2 and later)	The lateral predicted hold path using the bank angle limit causes protected airspace to be exceeded.	Review the holding pattern. If holding pattern exceeds allowable holding airspace, consider flight plan change.
UNABLE NEXT ALTITUDE (U10.4 and later)	Unable to meet the next flight plan altitude constraint in a VNAV climb or descent. The message appears only with VNAV engaged.	Clear the message and review the prediction. For undershoot condition during climb, consider selection of MAX RATE CLB or MAX ANGLE CLB, or a different N1 limit as appropriate.
UNABLE PROC AIRSPACE (U10.6 and later)	Minimum procedure turn built by guidance exceeds the allowable excursion distance.	Modify flight plan as required. Clear the message.

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION
UNABLE YYY KTS AT XXXXX (U10.7 and later)	Next waypoint speed restriction (speed YYY, at waypoint XXXXX) cannot be met.	Modify flight plan as required. Clear the message.
UNABLE REQD NAV PERF–RNP (U10.3 and later)	FMC actual navigation performance is not sufficient for the displayed RNP.	Refer to UNABLE REQD NAV PERF - RNP non-normal checklist in the QRH. Note: When on a procedure or airway without an RNP alerting requirement, the FMC Navigation Check supplementary procedure in SP11 can be used to verify position.
VERIFY GW AND FUEL	Fuel data becomes invalid, PERF INIT fuel value is replaced with dashes. FMC uses last valid fuel quantity for performance predictions until manual entry is made. Shows if 30 minutes have elapsed since last manual entry. Does not show in descent with Vref selected.	Enter fuel weight on PERF INIT page 1/2. Periodic update of fuel weight is required to keep gross weight value current.
VERIFY POS: FMC-FMC (U10.7 and later)	Position information is contradictory.	Refer to FMC Navigation Check Supplementary Procedure.
VERIFY POS: FMC-GPS (U10.7 and later)	Position information is contradictory.	Refer to FMC Navigation Check Supplementary Procedure.

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION
VERIFY POS: FMC-RADIO (U10.7 and later)	Position information is contradictory.	Refer to FMC Navigation Check Supplementary Procedure.
VERIFY POS: IRS-FMC (U10.7 and later)	Position information is contradictory.	Refer to FMC Navigation Check Supplementary Procedure.
VERIFY POS: IRS-IRS (U10.7 and later)	Position information is contradictory.	Refer to FMC Navigation Check Supplementary Procedure.
VERIFY POS: IRS-RADIO (U10.7 and later)	Position information is contradictory.	Refer to FMC Navigation Check Supplementary Procedure.
VERIFY POSITION (on ground)	Position information is contradictory.	Clear message. Check accuracy of manually entered data. Crosscheck IRS, GPS and FMC positions. Manually re-align both IRS's if needed.
VERIFY RNP (U10.3 and later)	Underlying RNP value is less than manually entered value.	Enter appropriate RNP.
VERIFY TAKEOFF SPEEDS	A PERF INIT change has been made after takeoff speeds were specified.	On TAKEOFF REF page 1, accept previous V speeds, or reject previous V speeds and enter new V speeds.

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION
VERIFY TAKEOFF THRUST (U10.7 and later)	With the Takeoff Thrust Auto Selection option enabled, the system determines that the selected takeoff thrust setting is not compatible with the engine thrust rating configuration.	Clear the message. Manually change takeoff thrust setting, or accept uplink of different thrust setting.
VERIFY VERT RNP (U10.5 and later)	During an active descent with CDS navigation performance scales enabled, a manually entered vertical RNP is greater than the default vertical RNP.	Clear CDU message. Enter appropriate vertical RNP.
VNAV DISCONNECT (U10.4 and later)	The criteria for VNAV engagement is not satisfied (VNAV disengages). On approach, with VNAV engaged, the FCC has switched to LVL CHG.	Manually control the vertical path.
VNAV INVALID-PERF (U10.8 and later)	If the exception affects both the MOD and the ACT flight plan, the Cost Index (CI) will be replaced with box prompts on the PERF INIT page and the message will result. LNAV is still valid and can navigate the airplane laterally but VNAV will disconnect. Reference section 11.32 for further Software Exception Logic.	Pilot should reenter the CI using either the previous CI displayed or enter a new CI. Reengage VNAV when change has been EXECuted.

FMC Entry Error Messages

These messages relate to incorrect scratchpad entries. FMC entry error messages:

- are shown in the CDU scratchpad
- illuminate the message light (MSG) of the CDU where the entry error was made
- temporarily overwrite data in the scratchpad.

Use the CLR key or key in new data to remove the message. If the CLR key is used to remove the message, the data previously entered is once again displayed. If new data is keyed in over the message, the message and the data previously entered are removed.

ENTRY ERROR MESSAGE	CAUSE	CORRECTIVE ACTION
ALT CONSTRAINT XXXXX (waypoint identifier)	A flight plan modification has caused an altitude conflict with a waypoint that has an altitude constraint.	Clear the message and revise the entry.
DATA BASE FULL	Entry attempted into a supplemental or temporary navigation database category which is full.	Go to the NAV DATA pages and delete unneeded waypoints, navaids, or airports from the appropriate database and re–attempt entry.
DUPLICATE FLIGHT PLAN ID (U10.3 and later)	The entry attempted is a duplicate of an existing supplemental flight plan name.	Clear the message and select a unique flight plan name.
INVALID DELETE	DEL key operation was attempted for a data line to which it was not applicable.	Clear the message and select the proper line after the DEL key is pressed.
INVALID ENTRY	Attempted data entry has incorrect format, range, etc. for the selected data line. Entered RTA waypoint is not in the flight plan.	Clear the message and scratchpad entry, and repeat the entry with the correct data.

ENTRY ERROR MESSAGE	CAUSE	CORRECTIVE ACTION
INVALID QUAD (U10.2 and later)	Attempted HOLD page QUAD entry has incorrect format or range.	Clear the message and revise the QUAD entry.
NO OFFSET AT LEG XXXXX (waypoint)	Attempted entry of a lateral offset start or end waypoint XXXXXX that is not offsetable (lateral offset as installed).	Clear the message and amend the route.
NOT IN DATA BASE	FMC does not contain the required data for the entered identifier.	Clear the message and check data entry, or enter the required information into the supplemental or temporary navigation database via the NAV DATA pages.
NOT IN FLIGHT PLAN	RTA waypoint or lateral offset (as installed) start/end waypoint entry is not in the active flight plan.	Clear the message and amend the entry.
ROUTE FULL	Entry of more than maximum allowed number of waypoints or holding patterns attempted.	Clear the message and review existing and desired waypoints and holding patterns for possible deletion.
SUPP RTE DATA BASE FULL (U10.3 and later)	Attempted save of the 11th supplemental flight plan.	Clear the message, delete unneeded supplemental flight plans and re–attempt entry.

FMC Advisory Messages

These messages relate to FMC status. FMC advisory messages:

- are shown in the CDU scratchpad
- illuminate message lights (MSG) on both CDUs.

Use the CLR key or correct the condition responsible for the message to remove the message. The message is temporarily removed from the scratchpad when manually entering data. The message returns when the data is removed from the scratchpad.

ADVISORY MESSAGE	CAUSE	CORRECTIVE ACTION
ABOVE MAX CERT ALT	The airplane is above its maximum certified altitude.	Descend to an altitude below the maximum certified altitude.
APPRCH VREF NOT SELECTED	Airplane has transitioned into approach environment and Vref has not been selected on APPROACH REF page.	Select Vref on APPROACH REF page.
ARR N/A FOR RUNWAY	Runway or approach does not match the selected arrival procedure.	Go to the ARRIVALS page and modify selection.
BUFFET ALERT	Current conditions result in a maneuver margin less than specified.	Bring the airplane back within the operating envelope.
CHECK FMC FUEL QUANTITY	The FMC has detected an unexpected drop in the fuel quantity.	Check the fuel quantity indications for correctness.
DES PATH UNACHIEVABLE	When in path descent and above the path, the FMC predictions show the profile restrictions at the next waypoint cannot be achieved (LNAV remains engaged).	Modify the restrictions.

ADVISORY MESSAGE	CAUSE	CORRECTIVE ACTION
DRAG REQUIRED	Airspeed is 10 kts or more above FMC target speed or within 5 kts of Vmo/Mmo.	Use speedbrakes, trim or reduced thrust, as required, to bring the airplane within 5 kts of FMC target speed.
ENTER EO CRZ SPD AND ALT (U10.8 and later)	Engine-out operation has been terminated and no cruise speed or altitude has been entered.	Enter cruise speed and altitude on cruise page.
FMC APP MODE UNAVAIL–GP (U10.5 and later)	The approach selected in the FMC does not have a specified glide path angle for final approach. The FMC approach mode cannot be used for this approach.	Select an alternate approach. Clear the message.
FMC APP MODE UNAVAIL–QFE (U10.5 and later)	An approach that utilizes FMC generated glide path is in the flight plan, but QFE is selected on the FMC.	Select QNH as the landing altimeter reference on the APPROACH REF page. Clear the message.
INVALID INACTIVE PLAN (U10.8 and later)	An exception has occurred in the INACTIVE plan prior to execution and it has been deleted as a result.	Reenter a new version of the INACTIVE plan.
INVALID MOD PLAN (U10.8 and later)	An exception has occurred in the MOD plan and it has been deleted as a result.	Reenter a new version of the MOD plan.
INVALID OFFSET	Desired offset does not meet FMC offset criteria.	Clear the message and amend the entry.

ADVISORY MESSAGE	CAUSE	CORRECTIVE ACTION
KEY/FUNCTION INOP	A mode key is pressed for which an FMC function has not been implemented or has not been enabled. (FANS MCDU only)	Clear the message or select another CDU page for display.
LOC CAP ACTIVE	The airplane is approaching its turn onto the localizer or GLS course and will maintain an intercept heading.	Clear the message manually, or wait for the AFDS to signal reset status to the FMC.
LOC CAP CANCELLED	Flight plan modifications or the airplane condition did not facilitate localizer capture.	Clear the message manually, or wait for the AFDS to reset to LOC CAP ACTIVE.
MAX ALT FLXXX (flight level value)	Altitude entry on any page is above the maximum altitude for current selected performance margins.	Clear the message or amend the data entry.
MAX MACH .XXX/MIN MACH .XXX OR MAX CAS .XXX/MIN CAS .XXX	FMC target speed is greater than the maximum or less than the minimum buffet speed for the entered cruise or step climb altitude.	Change the target speed to within the message limits or enter a lower altitude.
NO DES PATH AFTER XXXXX (waypoint)	FMC is unable to construct a PATH DES that satisfies all altitude restrictions after XXXXX.	Modify speed or altitude restrictions on the RTE LEGS pages.

ADVISORY MESSAGE	CAUSE	CORRECTIVE ACTION
NOT ON INTERCEPT HEADING	Airplane is not within the LNAV capture criteria for the active leg (LNAV disengages). If the LNAV button is pressed and the airplane is not within the capture criteria. (LNAV will not engage)	Manually place the airplane on an intercept heading and reengage LNAV.
OFFSET DELETED	The entered start waypoint has been deleted from the flight plan. (lateral offset as installed)	Clear the message and amend the route.
OFST ENDS ABEAM XXXXXX	An invalid offset leg exists between the end waypoint (XXXXXX) and the start of offset or no end waypoint exists.	Clear the message and amend the route.
PERF DEFAULTS DELETED	Performance database has been automatically deleted due to conflict with performance database limits.	Contact maintenance personnel.
POS SHIFT OVER 50NM (U10.6 and later)	A viable position shift is currently selected that will result in an FMC position shift in excess of 50nm when executed.	Clear the message.
PROGRAM PIN ERROR	FMC connector wiring is incorrect.	System unusable; advise maintenance personnel. The CLR key will not clear the message.
PROGRAM PIN NOT IN DB	FMC connector wiring or performance database is incorrect.	Advise Maintenance Personnel

ADVISORY MESSAGE	CAUSE	CORRECTIVE ACTION
RESET MCP ALT	Normal FMC operation would require flying away from MCP altitude.	Select a MCP altitude value in the proper direction (higher for climb, lower for descent).
RESET MCP APP MODE (U10.5 and later)	A change in the expected approach is made with an FCC approach mode armed or engaged.	Clear and rearm FCC approach mode. Clear the message.
RUNWAY N/A FOR SID	The selected runway is not applicable to the selected departure procedure.	Clear the message and check selections on the DEPARTURES page. Modify as required.
SELECT ACTIVE WPT/LEG	Power–up restart or insertion of a different flight plan while airborne.	EXECute a direct–to or leg intercept to tell the FMC which leg of the route is active.
STEEP DESCENT AFTER XXXXXX	An excessive vertical discontinuity exists after point XXXXXX.	Check routing.
TAI ON ABOVE 10°C	Airplane is operating with anti–icing with TAT above +10°C.	Clear the message and check the use of anti–icing for engines and/or wings.
UNABLE CRZ ALT	FMC predicts that no cruise time is possible at the entered CRZ ALT.	Clear the message and review the CRZ ALT selection.
UNABLE MACH. XXX	The entered cruise Mach is unattainable based on present gross weight.	Select a smaller Mach number or wait until gross weight is reduced sufficiently.
UNABLE TO OFFSET	A valid offset cannot be constructed due to geometric limitations.	Clear the message and amend the route.

ADVISORY MESSAGE	CAUSE	CORRECTIVE ACTION
USING RSV FUEL (U13.0 and earlier)	Predicted fuel remaining at DEST is less than the RESERVES entry on the PERF INIT page.	Clear the message and change routing if required.
V SPEEDS UNAVAILABLE	FMC cannot compute V speeds (as installed) due to unreasonable inputs on the RTE, PERF INIT, or TAKEOFF REF pages.	Correct inputs that affect V speed computation.
VERIFY RNP VALUE	When entering an RNP the underlying RNP value is smaller than the manually entered value or the ANP is greater than the manually entered RNP.	Change or delete the manually entered RNP.
VERIFY VERT RNP VALUE (U10.5 and later)	With CDS navigation performance scales enabled, a manually entered vertical RNP is greater than the default vertical RNP or manually entered vertical RNP is less that vertical ANP.	Clear the message. Change or delete the manually entered RNP.
XXXX (airport identifier)	A REF AIRPORT is entered on the POS INIT page and no entry of ORIGIN yet appears on RTE page 1.	Enter the airport identifier on the ORIGIN data line.

ADVISORY MESSAGE	CAUSE	CORRECTIVE ACTION
XXXXX (MCP altitude value)	With the CRZ page displayed, resetting the AFDS MCP altitude to a value different from the CRZ ALT causes the value to appear in the scratchpad.	Enter the MCP altitude value on the appropriate target altitude data line.

FMC Data Link Messages

These messages relate to FMC data link message status. FMC data link alerting and advisory messages function the same as the alerting and advisory messages described above:

FMC Data Link Alerting Messages

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION
ALTN DEST UPLINK	An FMC alternate destinations uplink message has been loaded on the ALTERNATE DESTS page, and is ready for flight crew review. (Alternate destinations as installed)	Review the alternate destinations uplink.
CRZ WIND UPLINK LOADING	An FMC cruise wind uplink message is loading (after LOAD selected on the RTE DATA page).	Wait for load to complete.
CRZ WIND UPLINK READY (U10.8A and earlier)	An FMC cruise wind uplink message has been received and is available for loading on the RTE DATA page.	Select RTE DATA page, LOAD cruise wind, and execute or ERASE.
CRZ WIND UPLINK READY (U11.0 and later)	Receipt of an ACARS uplink that contans cruise wind data, and the cruise wind data LOAD prompt is displayed on the RTE 1 or 2 DATA page.	Select RTE DATA page, LOAD cruise wind, and execute or ERASE.
CRZ WIND XXXXX (cruise altitude) UPLINK	An FMC cruise wind uplink message has been loaded on the RTE DATA page, and is ready for flight crew review.	Review the cruise wind uplink, and execute or ERASE.

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION
DATALINK CONFIG INVALID	Validity check of the FMC datalink configuration file has failed.	Contact maintenance personnel.
DESCENT FORECASTS UPLINK	An FMC descent forecasts uplink message has been loaded on the DESCENT FORECASTS page, and is ready for flight crew review.	Review the descent forecasts uplink, and execute or ERASE.
FORECASTS UPLINK READY	An FMC descent forecasts uplink message has been received and is available for loading on the DESCENT FORECASTS page.	Select DESCENT FORECASTS page, LOAD descent forecasts winds, and execute or ERASE.
INVALID TAKEOFF XXX/YYY (runway or runway/intersection identifier)	Runway (RTE page) or runway/intersection (TAKEOFF REF page) has been entered that matches runway takeoff data in FMC memory. However, the airplane is performance limited for the selected runway.	Clear the message. Enter correct takeoff data, request new takeoff data uplink, or enter new runway or runway/intersection identifier.
NAV DATA LOADING	An FMC supplemental navigation data uplink message has been received and is loading.	Wait for load to complete.
NAV DATA UPLINK	An FMC supplemental navigation data uplink message has been loaded on the SUPP NAV DATA page, and is ready for flight crew review.	Review the supplemental navigation data uplink, and execute or ERASE.

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION
PARTIAL ALTN DEST UPLINK	An FMC alternate destinations uplink message has been loaded on the ALTERNATE DESTS page, but errors were encountered during the loading process. (Alternate destinations as installed)	Review the alternate destinations uplink, and execute or ERASE.
PARTIAL FORECASTS UPLINK	An FMC descent forecasts uplink message has been loaded on the DESCENT FORECASTS page, but errors were encountered during the loading process.	Review the descent forecasts uplink, and execute or ERASE.
PARTIAL LIMITS UPLINK	An FMC performance limits uplink message has been loaded on the PERF LIMITS page, but errors were encountered during the loading process.	Review the performance limits uplink, and execute or ERASE.
PARTIAL NAV DATA UPLINK	An FMC supplemental navigation data uplink message has been loaded on the SUPP NAV DATA page, but errors were encountered during the loading process.	Review the supplemental navigation data uplink, and execute or ERASE.
PARTIAL PERF INIT UPLINK	An FMC performance initialization uplink message has been loaded on the PERF INIT page, but errors were encountered during the loading process.	Review the performance initialization uplink, and execute or ERASE.

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION
PARTIAL ROUTE UPLINK (U10.8A and earlier)	An FMC route uplink message has been loaded on the RTE page, but errors were encountered during the loading process.	Review the route uplink, and execute or ERASE.
PARTIAL ROUTE X UPLINK (U11.0 and later)	Receipt of an ACARS non-ATC uplink message that contains route data. The route data has been partially loaded into the active/inactive RTE 1 or 2 flight plan buffer due to errors.	Review the route uplink, and execute or ERASE.
PERF INIT UPLINK	An FMC performance initialization uplink message has been loaded on the PERF INIT page, and is ready for flight crew review.	Review the performance initialization uplink, and execute or ERASE.
PERF INIT UPLINK READY	An FMC performance initialization uplink message has been received and is available for loading on the PERF INIT page.	Select PERF INIT page, LOAD performance initialization data, and execute or ERASE.
PERF LIMITS UPLINK	An FMC performance limits uplink message has been loaded on the PERF LIMITS page, and is ready for flight crew review.	Review the performance limits uplink, and execute or ERASE.
PERF LIMITS UPLINK READY	An FMC performance limits uplink message has been received and is available for loading on the PERF LIMITS page.	Select PERF LIMITS page, LOAD performance limits, and execute or ERASE.

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION
RESEND MESSAGE	An FMC downlink message was attempted, but the FMC was unable to deliver the message to the ACARS MU.	Re–send the downlink message.
ROUTE DATA UPLINK (U10.8A and earlier)	An FMC route uplink message has been loaded on the RTE page, and is ready for flight crew review.	Review the route uplink, and execute or ERASE.
ROUTE X DATA UPLINK (U11.0 and later)	An FMC route uplink message has been loaded into the active/inactive RTE 1 or 2 flight plan buffer, and is ready for flight crew review.	Review the route uplink, and execute or ERASE.
ROUTE UPLINK LOADING (U10.8A and earlier)	An FMC route uplink message is loading (after LOAD selected on the RTE page).	Wait for load to complete.
ROUTE X UPLINK LOADING (U11.0 and later)	Receipt of an ACARS non-ATC uplink message that contains route data. The route data is currently being loaded into the active or inactive RTE 1 or 2 flight plan.	Wait for load to complete.
ROUTE UPLINK READY (U10.8A and earlier)	An FMC route uplink message has been received and is available for loading on the RTE page.	Select RTE page, LOAD route, and execute or ERASE.

ALERTING MESSAGE	CAUSE	CORRECTIVE ACTION
ROUTE X UPLINK READY (U11.0 and later)	Receipt of an ACARS non-ATC uplink that contains route data, and the route data LOAD prompts are displayed on the active/inactive RTE 1 or 2 and active/inactive LEGS 1 or 2 pages.	Select the active/inactive RTE 1 or 2 page or active/inactive LEGS 1 or 2 page, LOAD route, and execute or ERASE.
RTA DATA UPLINK	An FMC RTA uplink message has been loaded on the RTA PROGRESS page, and is ready for flight crew review.	Review the RTA uplink, and execute or ERASE.
RTA UPLINK READY	An FMC RTA uplink message is has been received and is available for loading on the RTA PROGRESS page.	Select RTA PROGRESS page, LOAD RTA data, and execute or ERASE.
TAKEOFF DATA LOADED	Uplink takeoff data matching Runway (RTE page) or runway/intersection (TAKEOFF REF page) has been loaded on the TAKEOFF REF page, and is ready for flight crew review.	Select TAKEOFF REF page, accept or reject takeoff data.
TAKEOFF DATA UPLINK	An FMC takeoff data uplink message containing one or more sets of runway takeoff data has been received and loaded in FMC memory.	Enter appropriate runway (RTE page) or runway/intersection (TAKEOFF REF page) to access runway takeoff data.

FMC Data Link Advisory Messages

ADVISORY MESSAGE	CAUSE	CORRECTIVE ACTION
INVALID ALTN DEST UPLINK	An FMC alternate destinations uplink message was received, but was rejected due to errors.	Clear the message.
INVALID CRZ WIND UPLINK	An FMC cruise wind uplink message was received, but was rejected due to errors.	Clear the message.
INVALID FORECASTS UPLINK	An FMC descent forecasts uplink message was received, but was rejected due to errors.	Clear the message.
INVALID LIMITS UPLINK	An FMC performance limits uplink message was received, but was rejected due to errors.	Clear the message.
INVALID NAV DATA UPLINK	An FMC supplemental navigation data uplink message was received, but was rejected due to errors.	Clear the message.
INVALID PERF INIT UPLINK	An FMC performance initialization uplink message was received, but was rejected due to errors.	Clear the message.
INVALID ROUTE or ROUTE X UPLINK	An FMC route uplink message was received, but was rejected due to errors.	Clear the message.
INVALID RTA UPLINK	An FMC RTA uplink message was received, but was rejected due to errors.	Clear the message.

ADVISORY MESSAGE	CAUSE	CORRECTIVE ACTION
INVALID TAKEOFF UPLINK	An FMC takeoff data uplink message was received, but was rejected due to errors.	Clear the message.

Fuel Chapter 12

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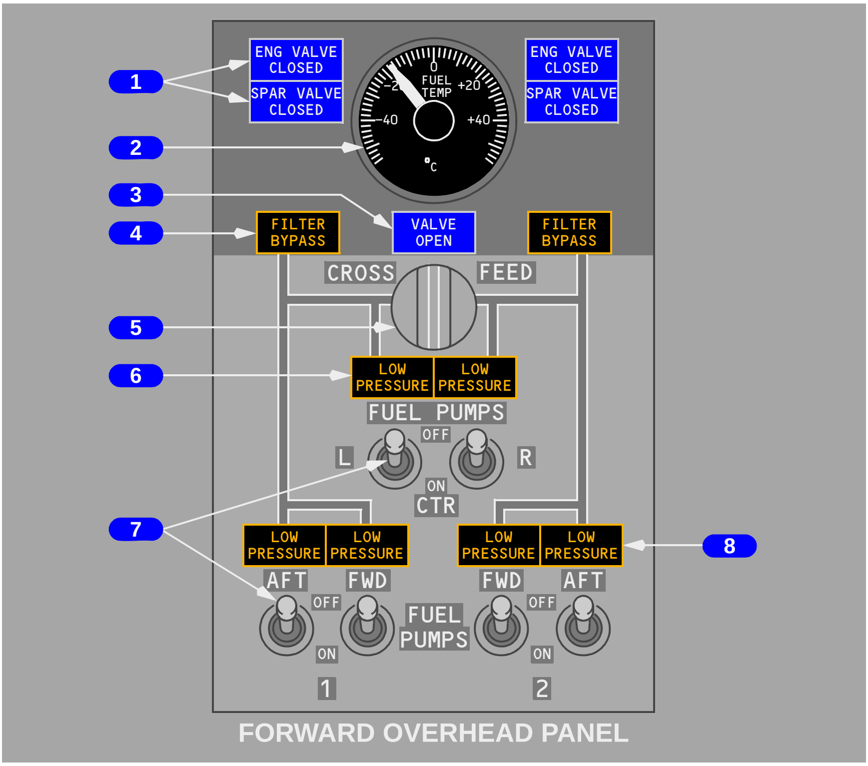
Fuel Control Panel



1 Engine Valve Closed (ENG VALVE CLOSED) and SPAR VALVE CLOSED Lights

Extinguished – related engine or spar fuel shutoff valve is open.

Illuminated (blue) –

- bright – related engine or spar fuel shutoff valve is in transit, or valve position and engine start lever or engine fire switch disagree.
- dim – related engine or spar fuel shutoff valve is closed.

2 FUEL Temperature (TEMP) Indicator

Indicates fuel temperature in No. 1 tank.

3 Crossfeed VALVE OPEN Light

Extinguished – crossfeed valve is closed.

Illuminated (blue) –

- bright – crossfeed valve is in transit, or valve position and CROSSFEED selector disagree.
- dim – crossfeed valve is open.

4 FILTER BYPASS Lights

Extinguished – fuel filter operating normally.

Illuminated (amber) – impending fuel filter bypass due to a contaminated filter.

5 CROSSFEED Selector

Controls fuel crossfeed valve.

Closed – isolates engine No. 1 and No. 2 fuel feed lines.

Open – connects engine No. 1 and No. 2 fuel feed lines.

6 Center Tank FUEL PUMP LOW PRESSURE Lights

Illuminated (amber) – fuel pump output pressure is low and FUEL PUMP switch is ON.

Note: With the Center (CTR) tank FUEL PUMP switches ON, continuous illumination of one LOW PRESSURE light for 10 seconds illuminates MASTER CAUTION and FUEL system annunciator lights.

Extinguished – fuel pump output pressure is normal, or FUEL PUMP switch is OFF.

7 FUEL PUMP Switches

ON – activates fuel pump.

OFF – deactivates fuel pump.

Note: When a center tank fuel pump switch is set to OFF, the auto shutoff logic for that pump is reset. When the center tank fuel pump switch is set to ON after being OFF, the pump will again activate until the switch is set to OFF or auto shutoff logic deactivates it.

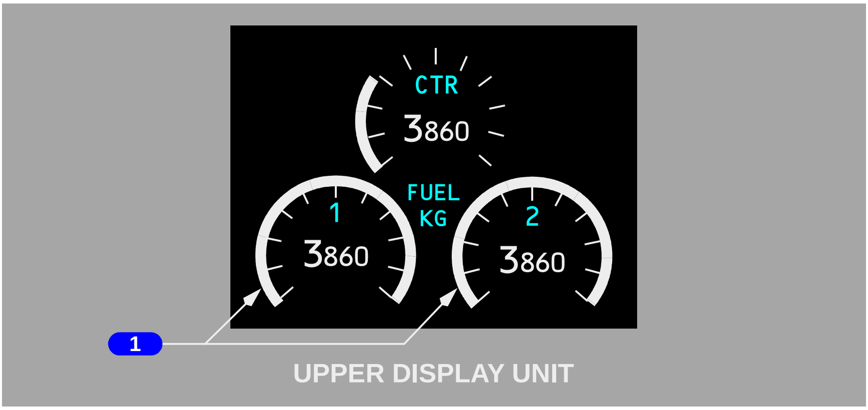
8 Main Tank FUEL PUMP LOW PRESSURE Lights

Illuminated (amber) – fuel pump output pressure is low, or FUEL PUMP switch is OFF.

Note: Two LOW PRESSURE lights illuminated in same tank illuminate MASTER CAUTION and FUEL system annunciator lights. One LOW PRESSURE light causes MASTER CAUTION and FUEL system annunciator lights to illuminate on MASTER CAUTION light recall.

Extinguished – fuel pump output pressure is normal.

Fuel Quantity Indications

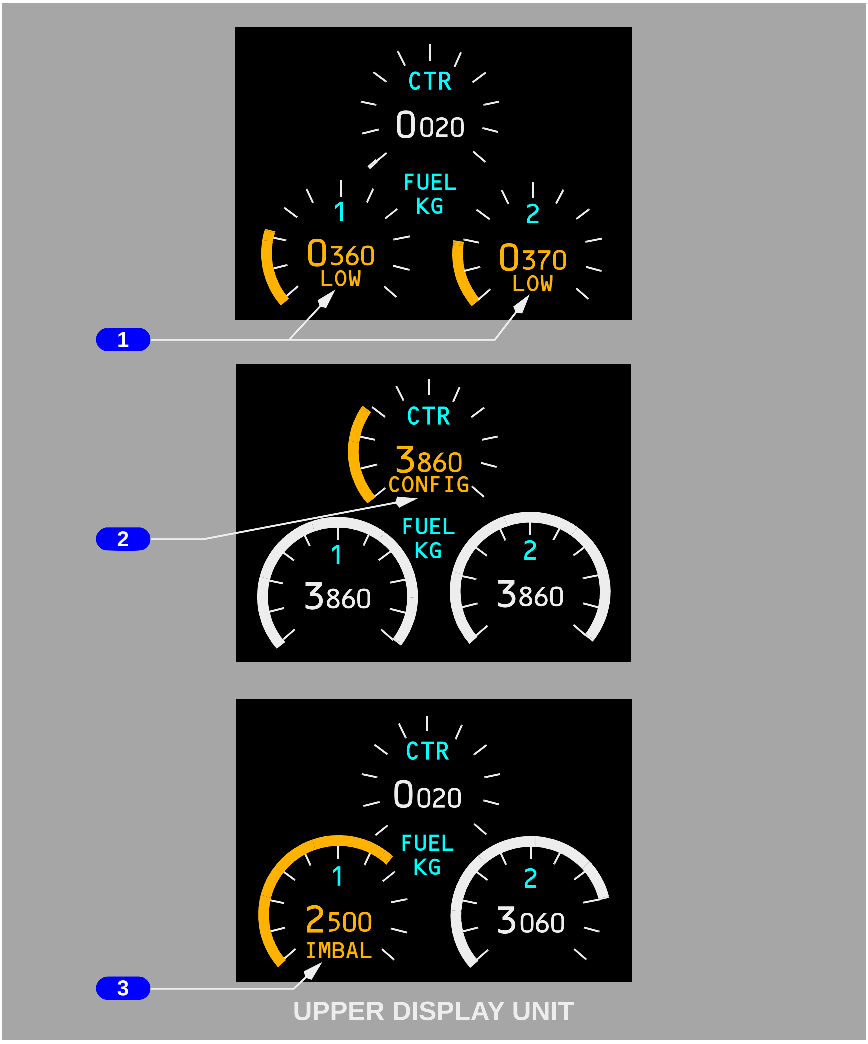


1 FUEL Quantity Indicators

Displayed (white) – indicates usable fuel in related tank:

- standby AC power is required.

Fuel Alert Indications



1 Fuel LOW Alert

Displayed (amber) –

- fuel tank quantity less than 907 kgs in related main tank
- display remains until fuel tank quantity is increased to 1134 kgs

The fuel quantity arc and digits on tank(s) with low fuel quantity turn amber.

2 Fuel Configuration (CONFIG) Alert

Displayed (amber) –

- either engine running
- center fuel tank quantity greater than 726 kgs; and
- both center fuel tank pump switches positioned OFF

The quantity arc and digits on the center tank fuel quantity indicator turn amber.

Display remains until –

- both engines not running
- center fuel tank quantity less than 363 kgs
- one center fuel tank pump switch ON

The quantity arc and digits on the center tank fuel quantity indicator return to normal.

3 Fuel Imbalance (IMBAL) Alert

Displayed (amber) –

- main tanks differ by more than 453 kgs
- displayed below main tank with lower fuel quantity

YA701 - YV750

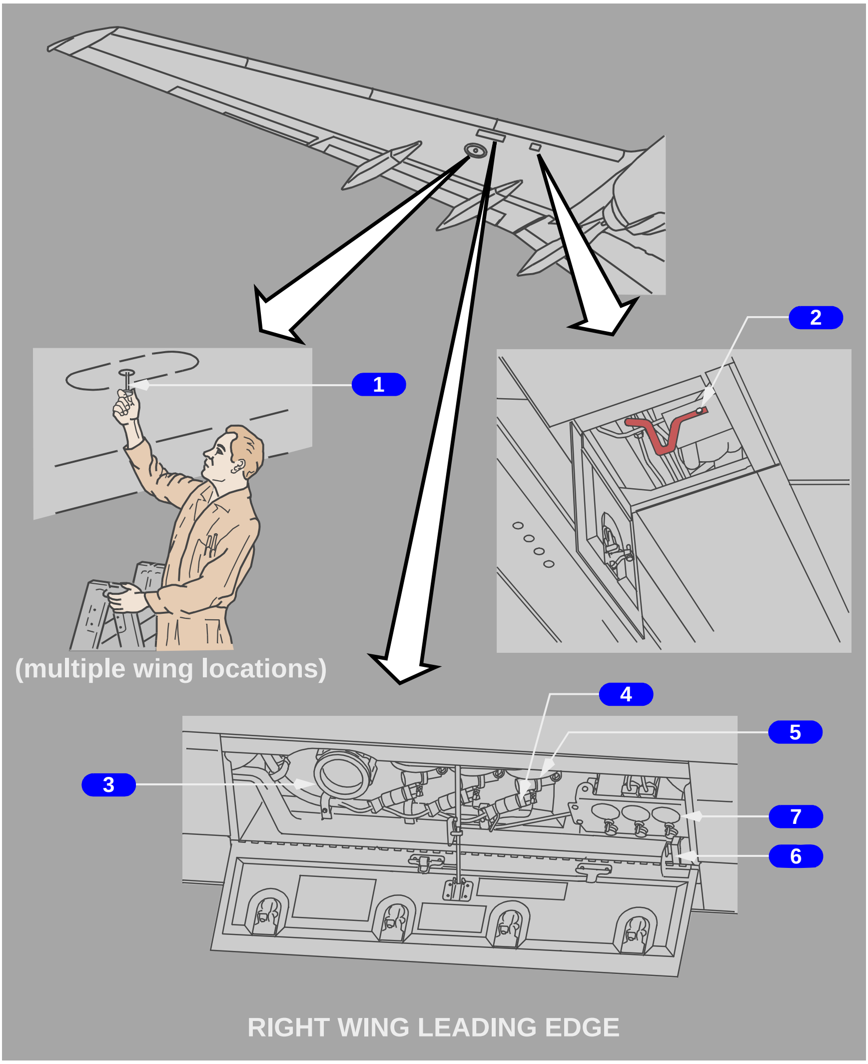
- inhibited when airplane is on the ground

YV751 - YV754

- displayed when airplane is on the ground or in the air
- inhibited by fuel LOW indication when both indications exist
- displayed until imbalance is reduced to 91 kgs

The fuel quantity arc and digits on tank with lower fuel quantity turn amber.

Fueling / Defueling / Measurement



1 Fuel Measuring Stick

Allows comparison of fuel quantity or weight as determined from measuring stick reading and fuel weight indicated by fuel quantity indicators:

- six fuel measuring sticks are installed in each main tank and four are installed in center tank
- reading is obtained by withdrawing measuring stick from tank and latching it magnetically to an internal float. Fuel depth is read where stick passes through wing skin.

2 Manual Defueling Valve

Open – interconnects engine feed system and fueling station for:

- defueling
- ground transfer of fuel.

Closed – isolates engine feed system from fueling station.

3 Fueling Receptacle

Hose connection receptacle for single point fueling.

4 Solenoid Override

Mechanically opens solenoid operated valve. Fuel valve opens if fuel pressure is available.

5 Fueling Valves

With the battery switch ON, and the refueling door open, fuel pressure opens valve.

6 Refueling Power Control Relay

Door closed – proximity sensor deactivates power to fueling system.

Door open – the fueling system is powered and panel lights illuminate.

7 Test Gages & Fueling Panel

Test Gages and Fueling Panel

YA701 - YF928, YK961 - YL077, YM482 - YV754

YK622 - YK630, YL541 - YL551

8 FUELING INDICATION TEST SWITCH

(spring–loaded to OFF position)

TEST GAGES – checks operation of fuel quantity indicators.

FUEL DOOR SWITCH BYPASS – energizes fueling panel if refueling power control relay fails.

9 Fueling VALVE POSITION LIGHTS

Extinguished –

- fueling valve switch is OPEN and related tank is full
- fueling valve switch is CLOSED.

Illuminated (blue) – fueling valve switch is OPEN and related tank is not full.

10 **Fueling Valve Switches**

OPEN – energizes fueling valve in related tank.

CLOSED – de–energizes fueling valve in related tank.

11 **FUEL Quantity (QTY) Indicators**

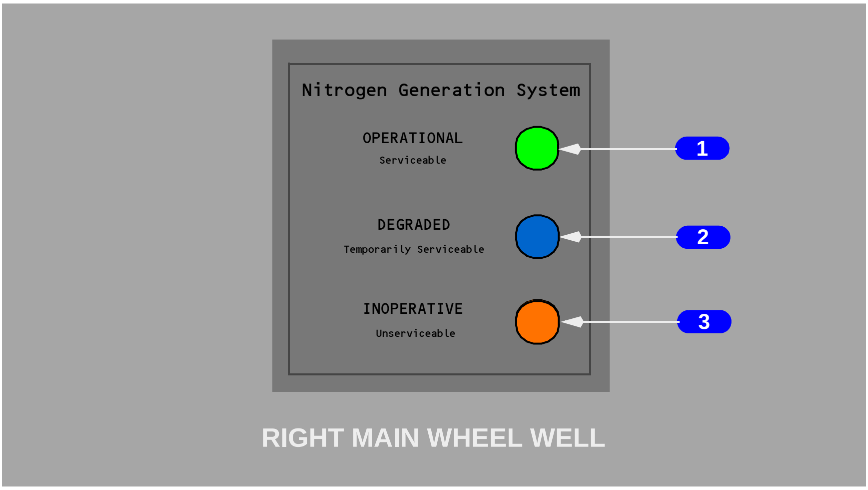
Indicates total usable fuel tank quantity in related tank.

YK622 - YK630, YL541 - YL551
12 **Fuel Quantity Selectors**

Rotate – sets total fuel quantity desired in related tank.

Nitrogen Generation System (NGS)

YF048 - YF928, YK626 - YK630, *YK962,YK969, YK970*, YK973 - YK980, YL541 - YL551, YN531 - YV754
(SB Changes YA707, YA709, YA710, YK967)



1 **OPERATIONAL Light (green)**

NGS is fully operational.

2 **DEGRADED Light (blue)**

NGS is operational, but is operating in a degraded condition.

3 **INOPERATIVE Light (amber)**

NGS is inoperative.

Note: No lights illuminated also indicates NGS is inoperative.

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Fuel Chapter 12

System Description Section 20

Introduction

The fuel system supplies fuel to the engines and the APU. Fuel is contained in three tanks located within the wings and wing center section.

Refer to Chapter 7, Engines, APU, for a description of the engine and APU fuel systems.

Fuel Feed

Both engines are normally pressure fed from the center tank until the center tank quantity decreases to near zero. The engines are normally then pressure fed from their respective main tanks. Check valves are located throughout the fuel system to ensure the proper direction of fuel flow and to prevent transfer of fuel between tanks.

Nitrogen Generation System (NGS)

YF048 - YF928, YK626 - YK630, *YK962,YK969, YK970*, YK973 - YK980, YL541 - YL551, YN531 - YV754
(SB Changes YA707, YA709, YA710, YK967)

The NGS converts bleed air to nitrogen-enriched air (NEA) during all phases of flight. The NEA is delivered to the center fuel tank to reduce flammability of the tank. The operation of the NGS is transparent to the flight crew; it does not require any flight crew action to operate the system, nor are there any flight deck indications. The NGS automatically starts operating after take-off and runs continuously through climb, cruise, descent, landing and during taxi for a short period of time. The NGS shuts down after a specified period of time or when bleed pressure is no longer available. The NGS also automatically shuts down during the following non-normal flight conditions:

- Aircraft on the ground and not in test mode
- Either engine is not running in flight
- Fire or smoke detection in the cargo or main deck areas
- Left air conditioning pack overheat
- Center tank refueling valve is open

The fuel tanks are primarily protected by precluding ignition sources; hence dispatch with the NGS inoperative is acceptable under MEL procedures.

The NGS has an operability indicator located in the main wheel well adjacent to the APU fire control panel.

Fuel Pumps

Each fuel tank uses two AC powered fuel pumps which are cooled and lubricated by fuel passing through the pump. Center tank pumps produce higher pressure than main tank pumps. This ensures that center tank fuel is used before main tank fuel, even though all fuel pumps are operating. Individual pressure sensors monitor the output pressure of each pump.

Each center tank pump will automatically shut off, after a short delay, when that pump's sensor detects low output pressure.

Note: Fuel pump LOW PRESSURE lights may flicker when tank quantity is low and the airplane is in a climb, descent, or on the ground with a nose-down attitude.

Note: Center tank fuel pump LOW PRESSURE lights may flicker when tank quantity is low and the airplane is in cruise. One pump may indicate low pressure sooner than the other due to aircraft attitude and/or slight variation between pump inlet position. Low pressure indication may occur after center tank quantity reads zero. Low pressure light flickering can continue for as long as 5 minutes before the Fuel System Annunciator light and the Master Caution lights are illuminated for the associated center tank pump.

Suction Feed

When main tank fuel pump pressure is low, each engine can draw fuel from its corresponding main tank through a suction feed line that bypasses the pumps. As the airplane climbs, dissolved air is released from the fuel in the tank due to the decrease in air pressure. This air may collect in the suction feed line and restrict fuel flow. At high altitude, thrust deterioration or engine flameout may occur as a result of the fuel flow reduction.

The dissolved air in the fuel tank will eventually deplete after reaching cruise altitude. The depletion time is dependent upon airplane altitude, fuel temperature, and type of fuel. Once the dissolved air is depleted, the engine may be capable of suction feed operation at cruise power.

The main tank bypass valves may also be used for suction defueling.

Fuel Crossfeed

The engine fuel manifolds are interconnected by use of the crossfeed valve. The valve is DC motor operated from the battery bus.

Fuel pressure can be provided from a main tank with operating fuel pumps to both engines by opening the fuel crossfeed valve. Continued crossfeed use will result in a progressive fuel imbalance.

Fuel Shutoff Valves

Spar fuel shutoff valves are located at the engine–mounting wing stations. The valves are DC motor operated from the hot battery bus. The engine fuel shutoff valves are fuel actuated, solenoid controlled valves powered from the battery bus. Both the spar fuel shutoff valve and the engine fuel shutoff valve close whenever their respective engine fire switch is pulled or engine start lever is placed to CUTOFF.

Center Tank Fuel Scavenge Jet Pump

With the main tank fuel pump No. 1 FWD Switch ON, the center tank fuel scavenge jet pump operates automatically to transfer any remaining center tank fuel to main tank No. 1. Fuel transfer begins when main tank No. 1 quantity is about one-half. Once the fuel scavenge process begins, it continues for the remainder of the flight.

Fuel Temperature

The FUEL TEMP indicator located on the fuel control panel displays fuel temperature. A sensor in main tank No. 1 allows monitoring of fuel temperature. The temperature indicating system uses AC electrical power.

APU Fuel Feed

When AC fuel pumps are operating, fuel for the APU is supplied from the left side of the fuel manifold. If the AC fuel pumps are not operating, fuel is suction fed from main tank No. 1.

Fuel Quantity Indication

The fuel quantity indication system calculates the usable fuel quantity in each tank. The fuel quantity in each tank is displayed on the upper display unit and on the fueling station panel.

Fueling/Defueling/Ground Transfer

Rapid fueling and defueling is accomplished at the single–point pressure fueling station in the right wing. The fueling station is also used for the ground transfer of fuel between tanks.

The manual defueling valve, located outboard of engine No. 2, interconnects the engine feed system and the fueling station. It is opened for defueling and tank to tank transfer operations.

A shutoff system is used during fueling to automatically close the fueling valve in each fuel tank when the tank is full.

Fuel Tank Location and Capacities (Usable Fuel)

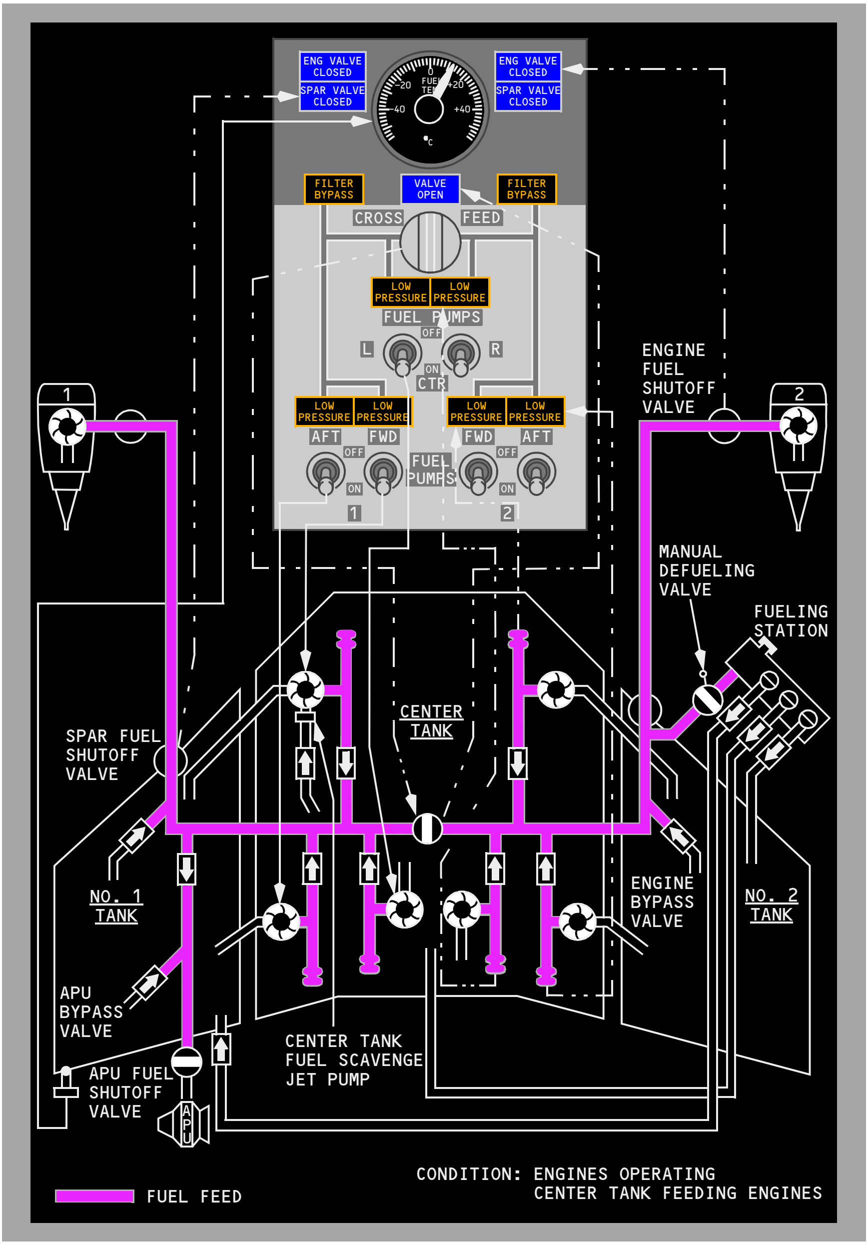
Main tanks No. 1 and No. 2 are integral with the wing structure. The center tank lies between the wing roots within the fuselage area and extends out into the wing structure.

These figures represent approximate amounts of usable fuel. The appropriate weight and balance control and loading manual gives exact figures for all conditions.

TANK	LITERS	KILOGRAMS*
NO. 1	4,876	3,915
NO. 2	4,876	3,915
CENTER	16,273	13,066
TOTAL	26,025	20,896

* Usable fuel at level attitude, fuel density = 0.8029 kilograms per liter

Fuel Schematic



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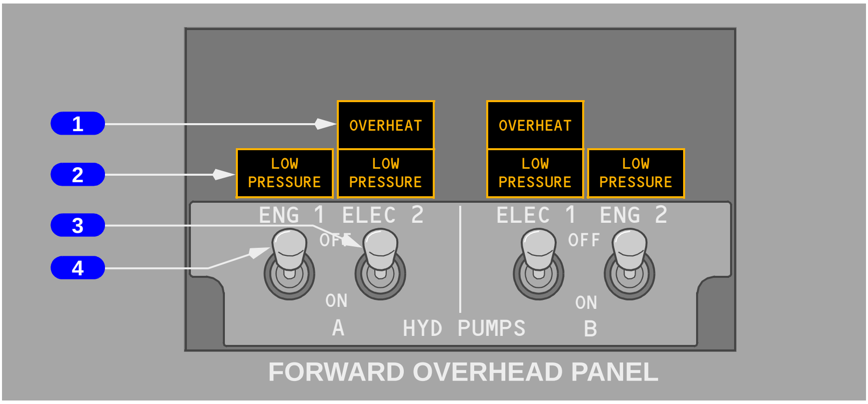
Hydraulics — Chapter 13

Controls and Indicators — Section 10

Hydraulic Panel



1 Electric Hydraulic Pump OVERHEAT Lights

Illuminated (amber) – Hydraulic fluid used to cool and lubricate the corresponding electric motor driven pump has overheated or the pump itself has overheated.

2 Hydraulic Pump LOW PRESSURE Lights

Illuminated (amber) – output pressure of associated pump is low.

Note: When an engine fire switch is pulled, the low pressure light is deactivated.

3 ELECTRIC HYDRAULIC PUMPS Switches

ON – provides power to associated electric motor–driven pump.

OFF – electrical power removed from pump.

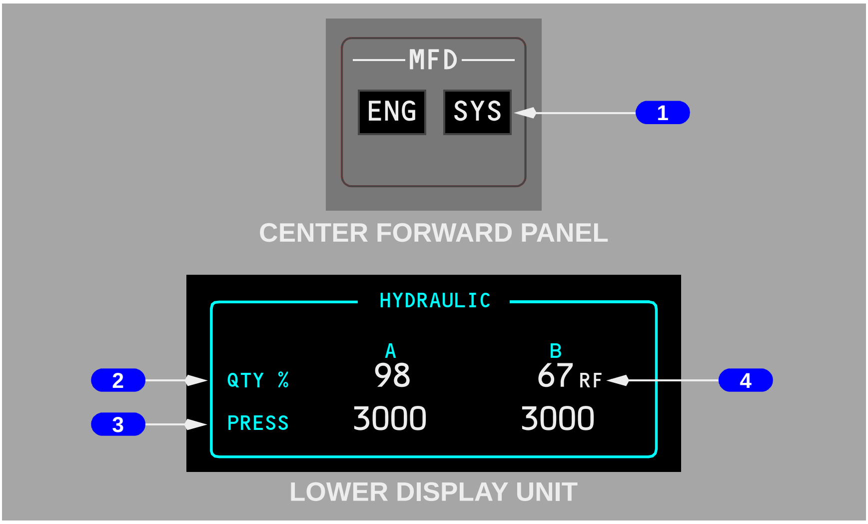
4 ENGINE HYDRAULIC PUMPS Switches

ON – de–energizes blocking valve in pump to allow pump pressure to enter system.

Note: Should remain ON at shutdown to prolong solenoid life.

OFF – energizes blocking valve to block pump output.

Hydraulic Indications



1 MFD System (SYS) Switch

Push – SYS

- displays hydraulic indications on lower DU; or the inboard DU if the MAIN PANEL DUs switch is placed to the INBD MFD position.
- second push removes indications from the respective DU.

2 HYDRAULIC System QUANTITY Indications (white)

Indicates digital percentage (0% to 106%) of hydraulic quantity.

Note: Quantity also displayed at each reservoir.

3 HYDRAULIC System PRESSURE Indications (white)

Indicates system pressure:

- Normal pressure – 3000 psi
- Maximum pressure – 3500 psi.

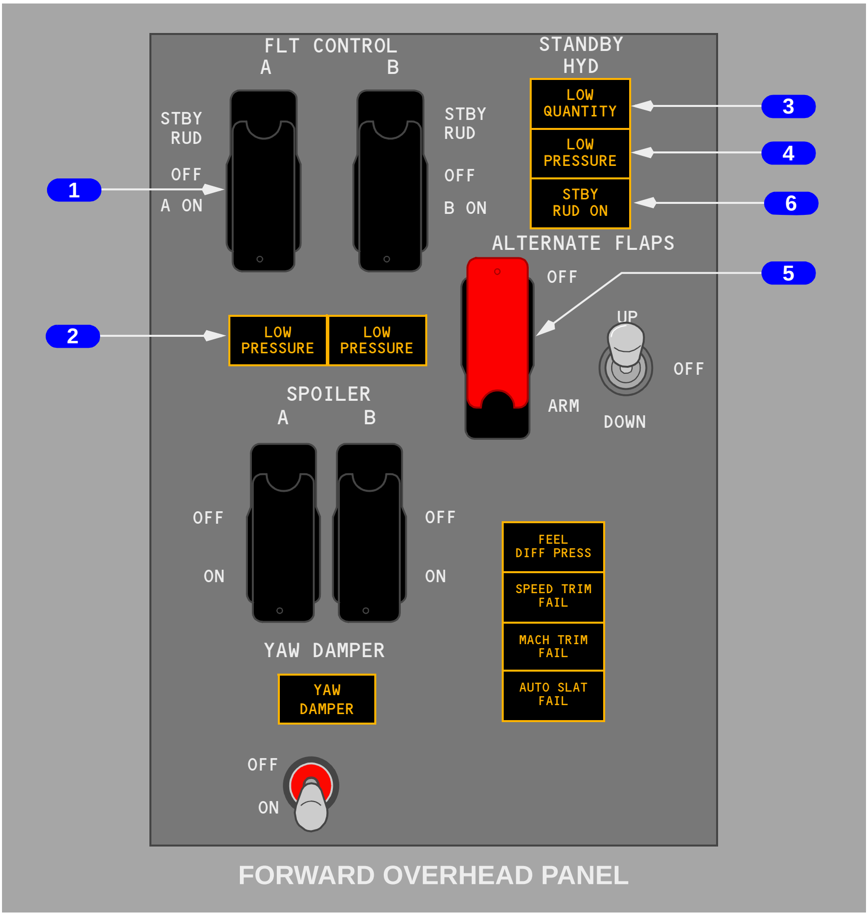
Note: When both pumps for a system are OFF, the indication may read hydraulic system reservoir pressure, normally less than 100 psi.

4 REFILL Indication (RF) (white)

Illuminated (white) – hydraulic quantity below 76%.

Note: Valid only when airplane is on ground with both engines shutdown or after landing with flaps up during taxi–in.

Flight Control Panel



1 FLIGHT CONTROL Switches

STBY RUD – activates standby pump and opens standby rudder shutoff valve to pressurize standby rudder power control unit.

OFF – closes flight control shutoff valve isolating ailerons, elevators and rudder from associated hydraulic system pressure.

ON (guarded position) – normal operating position.

2 Flight Control LOW PRESSURE Lights

Illuminated (amber) –

- indicates low hydraulic system (A or B) pressure to ailerons, elevator and rudder
- deactivated when associated FLIGHT CONTROL switch is positioned to STBY RUD and standby rudder shutoff valve opens.

3 STANDBY HYDRAULIC LOW QUANTITY Light

Illuminated (amber) –

- indicates low quantity in standby hydraulic reservoir
- always armed.

4 STANDBY HYDRAULIC LOW PRESSURE Light

Illuminated (amber) –

- indicates output pressure of standby pump is low
- armed only when standby pump operation has been selected or automatic standby function is activated.

5 ALTERNATE FLAPS Master Switch

OFF (guarded position) – normal operating position.

ARM – closes trailing edge flap bypass valve, activates standby pump, and arms ALTERNATE FLAPS position switch.

6 STBY RUD ON Light

Illuminated (amber) - indicates the standby hydraulic system is commanded on to pressurize the standby rudder power control unit.

Introduction

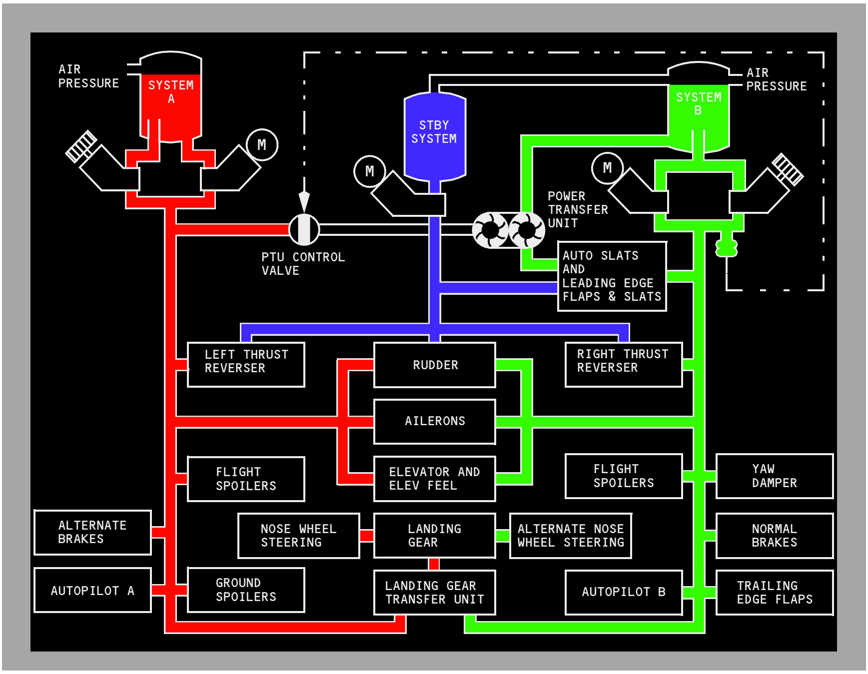
The airplane has three hydraulic systems: A, B and standby. The standby system is used if system A and/or B pressure is lost. The hydraulic systems power the following airplane systems:

- flight controls
- leading edge flaps and slats
- trailing edge flaps
- landing gear
- wheel brakes
- nose wheel steering
- thrust reversers
- autopilots.

Either A or B hydraulic system can power all flight controls with no decrease in airplane controllability.

Each hydraulic system has a fluid reservoir located in the main wheel well area. System A and B reservoirs are pressurized by bleed air. The standby system reservoir is connected to the system B reservoir for pressurization and servicing. Pressurization of all reservoirs ensures positive fluid flow to all hydraulic pumps.

Hydraulic Power Distribution Schematic



A and B Hydraulic Systems

Components powered by hydraulic systems A and B are:

System A

- ailerons
- rudder
- elevator and elevator feel
- flight spoilers (two on each wing)
- ground spoilers
- alternate brakes
- No. 1 thrust reverser
- autopilot A
- normal nose wheel steering
- landing gear
- power transfer unit (PTU).

System B

- ailerons
- rudder
- elevator and elevator feel
- flight spoilers (two on each wing)
- leading edge flaps and slats
- trailing edge flaps
- normal brakes
- No. 2 thrust reverser
- autopilot B
- alternate nose wheel steering
- landing gear transfer unit
- autoslats
- yaw damper.

A and B Hydraulic System Pumps

Both A and B hydraulic systems have an engine–driven pump and an AC electric motor–driven pump. The system A engine–driven pump is powered by the No. 1 engine and the system B engine–driven pump is powered by the No. 2 engine. An engine–driven hydraulic pump supplies approximately 6 times the fluid volume of the related electric motor–driven hydraulic pump.

The ENG 1 (system A) or ENG 2 (system B) pump ON/OFF switch controls the engine–driven pump output pressure. Positioning the switch to OFF isolates fluid flow from the system components. However, the engine–driven pump continues to rotate as long as the engine is operating. Pulling the engine fire switch shuts off the fluid flow to the engine–driven pump and deactivates the related LOW PRESSURE light.

The ELEC 2 (system A) or ELEC 1 (system B) pump ON/OFF switch controls the related electric motor–driven pump. If an overheat is detected in either system, the related OVERHEAT light illuminates.

Note: Loss of an engine-driven hydraulic pump and a high demand on the system may result in an intermittent illumination of the LOW PRESSURE light for the remaining electric motor-driven hydraulic pump. The flight control LOW PRESSURE light, Master Caution light, and the FLT CONT and HYD system annunciator lights also illuminate.

Hydraulic fluid used for cooling and lubrication of the pumps passes through a heat exchanger before returning to the reservoir. The heat exchanger for system A is located in main fuel tank No. 1 and for system B is in main fuel tank No. 2.

CAUTION: Minimum fuel for ground operation of electric motor-driven pumps is 760 Kgs in the related main tank.

Pressure switches, located in the engine–driven and electric motor–driven pump output lines, send signals to illuminate the related LOW PRESSURE light if pump output pressure is low. A check valve, located in each output line, isolates the related pump from the system. The related system pressure transmitter sends the combined pressure of the engine–driven and electric motor–driven pump to the related hydraulic system pressure indication.

System A Hydraulic Leak

If a leak develops in the engine–driven pump or its related lines, a standpipe in the reservoir prevents a total system fluid loss. With fluid level at the top of the standpipe, the reservoir quantity displayed indicates approximately 20% full. System A hydraulic pressure is maintained by the electric motor–driven pump.

If a leak develops in the electric motor–driven pump or its related lines, or components common to both the engine and electric motor–driven pumps, the quantity in the reservoir steadily decreases to zero and all system pressure is lost.

System B Hydraulic Leak

If a leak develops in either pump, line or component of system B, the quantity decreases until it indicates approximately zero and system B pressure is lost. The system B reservoir has one standpipe which supplies fluid to both the engine–driven pump and the electric motor–driven pump. However, with fluid level at the top of the standpipe, fluid remaining in the system B reservoir is sufficient for power transfer unit operation.

A leak in system B does not affect the operation of the standby hydraulic system.

Power Transfer Unit

The purpose of the PTU is to supply the additional volume of hydraulic fluid needed to operate the autoslats and leading edge flaps and slats at the normal rate when system B engine–driven hydraulic pump volume is lost. The PTU uses system A pressure to power a hydraulic motor–driven pump, which pressurizes system B hydraulic fluid. The PTU operates automatically when all of the following conditions exist:

- system B engine–driven pump hydraulic pressure drops below limits
- airborne

YA701 - YT521, YV741 - YV754

- flaps are less than 15 but not up.

YV604, YV605

- flaps not up.

Landing Gear Transfer Unit

The purpose of the landing gear transfer unit is to supply the volume of hydraulic fluid needed to raise the landing gear at the normal rate when system A engine–driven pump volume is lost. The system B engine–driven pump supplies the volume of hydraulic fluid needed to operate the landing gear transfer unit when all of the following conditions exist:

- airborne
- No. 1 engine RPM drops below a limit value
- landing gear lever is positioned UP
- either main landing gear is not up and locked.

Standby Hydraulic System

The standby hydraulic system is provided as a backup if system A and/or B pressure is lost. The standby system can be activated manually or automatically and uses a single electric motor–driven pump to power:

- thrust reversers
- rudder
- leading edge flaps and slats (extend only)
- standby yaw damper.

Manual Operation

Positioning either FLT CONTROL switch to STBY RUD:

- activates the standby electric motor–driven pump
- shuts off the related hydraulic system pressure to ailerons, elevators and rudder by closing the flight control shutoff valve
- opens the standby rudder shutoff valve
- deactivates the related flight control LOW PRESSURE light when the standby rudder shutoff valve opens
- allows the standby system to power the rudder and thrust reversers.
- illuminates the STBY RUD ON, Master Caution, and Flight Controls (FLT CONT) lights.

Positioning the ALTERNATE FLAPS master switch to ARM, (refer to Chapter 9, Flight Controls for a more complete explanation):

- activates the standby electric motor–driven pump
- closes the trailing edge flap bypass valve

- arms the ALTERNATE FLAPS position switch
- allows the standby system to power the leading edge flaps and slats and thrust reversers.

Automatic Operation

Automatic operation is initiated when the following conditions exist:

- loss of system A or B, and
- flaps extended, and
- airborne, or wheel speed greater than 60 kts, and
- FLT CONTROL switch A or B Hydraulic System ON

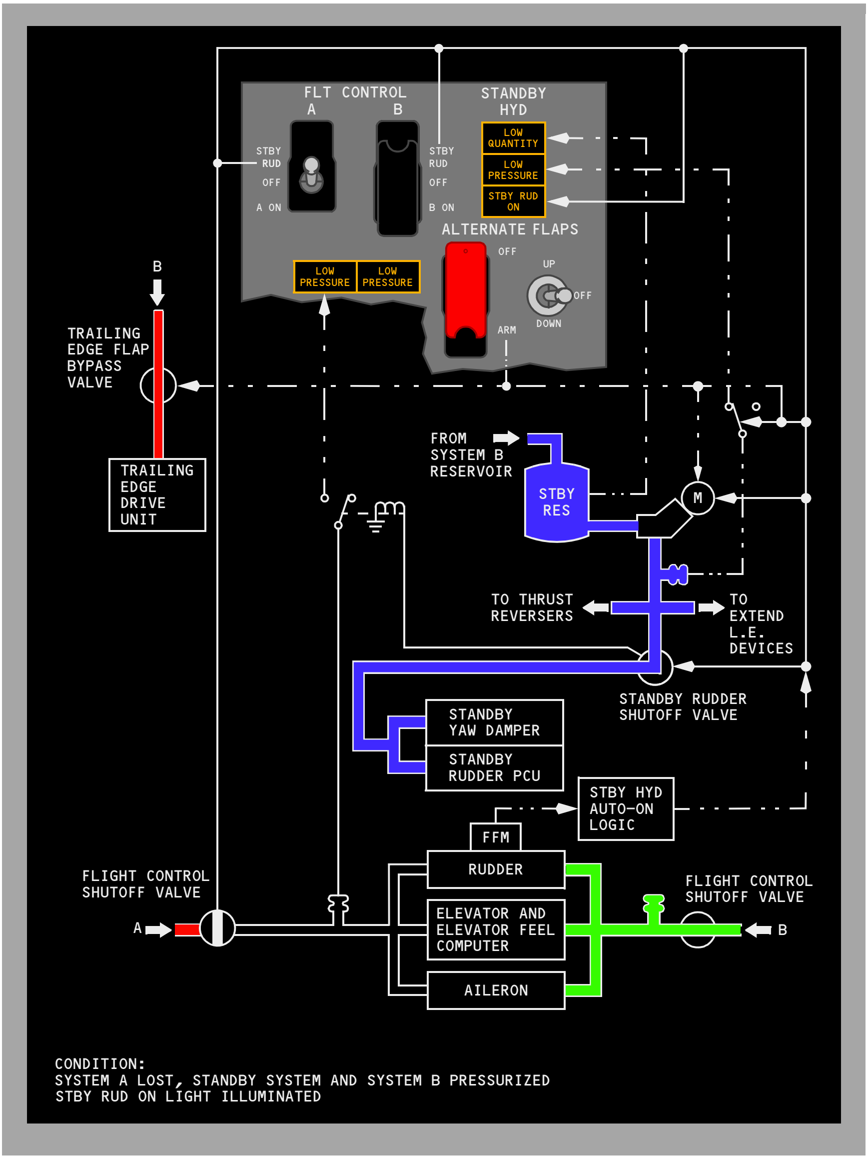
OR:

- the main PCU Force Fight Monitor (FFM) trips

Automatic operation:

- activates the standby electric motor–driven pump
- opens the standby rudder shutoff valve
- allows the standby system to power the rudder and thrust reversers.
- illuminates the STBY RUD ON, Master Caution, and Flight Controls (FLT CONT) lights.

Standby Hydraulic System Schematic



Standby Hydraulic System Leak

If a leak occurs in the standby system, the standby reservoir quantity decreases to zero. The LOW QUANTITY light illuminates when the standby reservoir is approximately half empty. System B continues to operate normally, however, the system B reservoir fluid level indication decreases and stabilizes at approximately 72% full.

Variations in Hydraulic Quantity Indications

During normal operations, variations in hydraulic quantity indications occur when:

- the system becomes pressurized after engine start
- raising or lowering the landing gear or leading edge devices
- cold soaking occurs during long periods of cruise.

These variations have little effect on systems operation.

If the hydraulic system is not properly pressurized, foaming can occur at higher altitudes. Foaming can be recognized by pressure fluctuations and the blinking of the related LOW PRESSURE lights. The MASTER CAUTION and HYD annunciator lights may also illuminate momentarily.

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Landing Gear — Chapter 14

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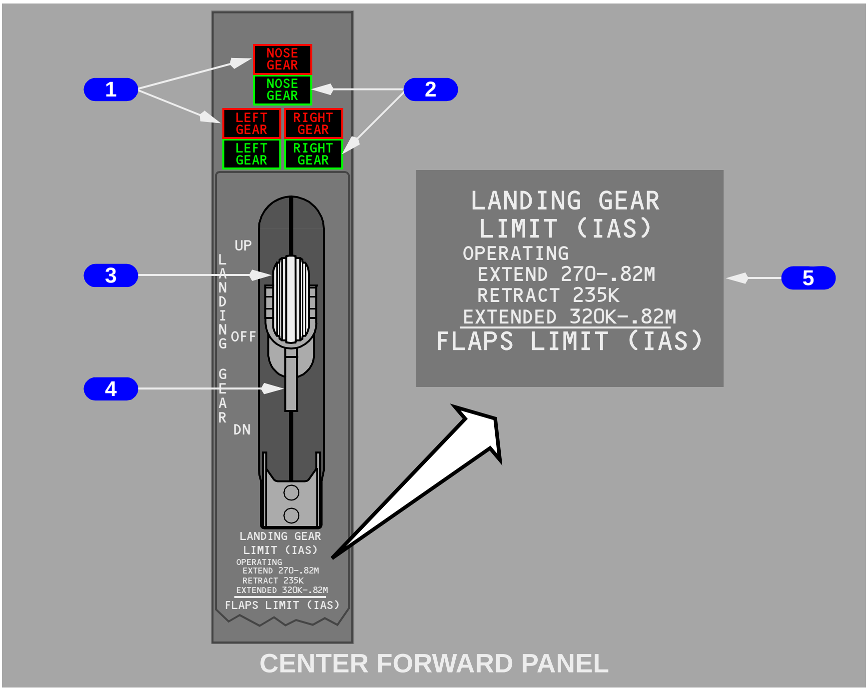
Landing Gear Panel



1 Landing Gear Indicator Lights (top)

Illuminated (red) –

- landing gear is not down and locked (with either or both forward thrust levers retarded to idle, and below 800 feet AGL).
- related landing gear is in disagreement with LANDING GEAR lever position (in transit or unsafe).

Extinguished -

- landing gear is up and locked with landing gear lever UP or OFF
- landing gear is down and locked with landing gear lever DN.

2 Landing Gear Indicator Lights (bottom)

Illuminated (green) – related gear down and locked.

Note: Landing gear warning horn is deactivated with all gear down and locked.

Note: Landing gear is down and locked as long as one green landing gear indicator light (center panel or overhead panel) for each gear is illuminated.

Extinguished – landing gear is not down and locked.

3 LANDING GEAR Lever

UP – landing gear retract.

OFF – hydraulic pressure is removed from landing gear system.

DN – landing gear extend.

4 Override Trigger

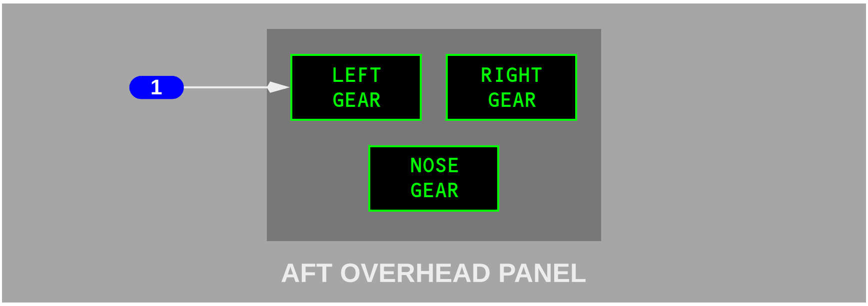
Allows LANDING GEAR lever to be raised, bypassing the landing gear lever lock.

5 LANDING GEAR LIMIT Speed Placard

Indicates maximum speed while operating landing gear and after gear extension.

Landing Gear Indicator Lights

This is a redundant but separate set of landing gear indicator circuits and lights.



1 Landing Gear Indicator Lights (overhead)

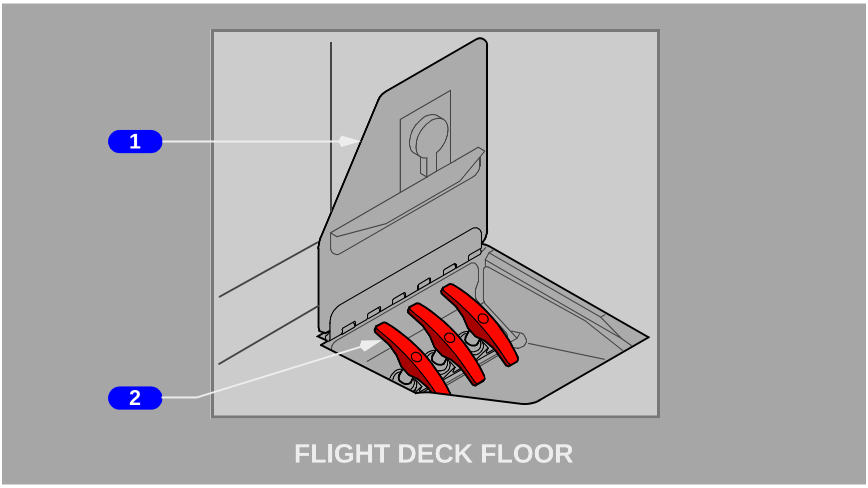
Illuminated (green) – related gear down and locked.

Note: Landing gear warning horn is deactivated with all gear down and locked.

Note: Landing gear is down and locked as long as one green landing gear indicator light (center panel or overhead panel) for each gear is illuminated.

Extinguished – landing gear is not down and locked.

Manual Gear Extension



1 Manual Extension Access Door

Open –

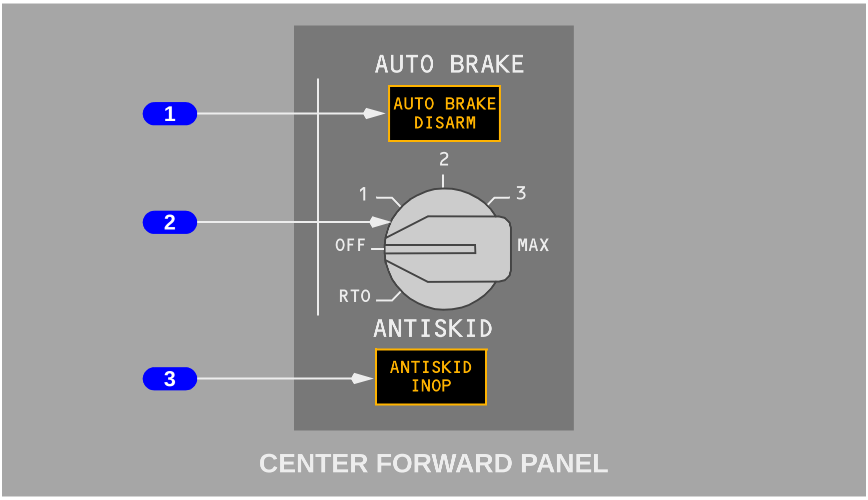
- manual landing gear extension is possible with landing gear lever in any position
- normal landing gear extension is still possible if hydraulic system A pressure is available
- landing gear retraction is disabled.

Closed – landing gear operate normally.

2 Manual Gear Extension Handles

Right main, nose, left main – Each landing gear uplock is released when related handle is pulled to its limit, approximately 24 inches (61 cm).

Autobrake and Antiskid Controls



1 AUTO BRAKE DISARM Light

Illuminated (amber) –

- SPEED BRAKE lever moved to down detent during RTO or landing
- manual brakes applied during RTO or landing
- thrust lever(s) advanced during RTO or landing
  - except during first 3 seconds after touchdown for landing
- landing made with RTO selected
- RTO mode selected on ground
  - illuminates for one to two seconds then extinguishes
- a malfunction exists in automatic braking system.

Extinguished –

- AUTO BRAKE select switch set to OFF
- autobrake armed.

2 AUTO BRAKE Select Switch

OFF – autobrake system deactivated.

1, 2, 3, or MAX –

- selects desired deceleration rate for landing
- switch must be pulled out to select MAX deceleration.

RTO – automatically applies maximum brake pressure when thrust levers are retarded to idle at or above 90 knots.

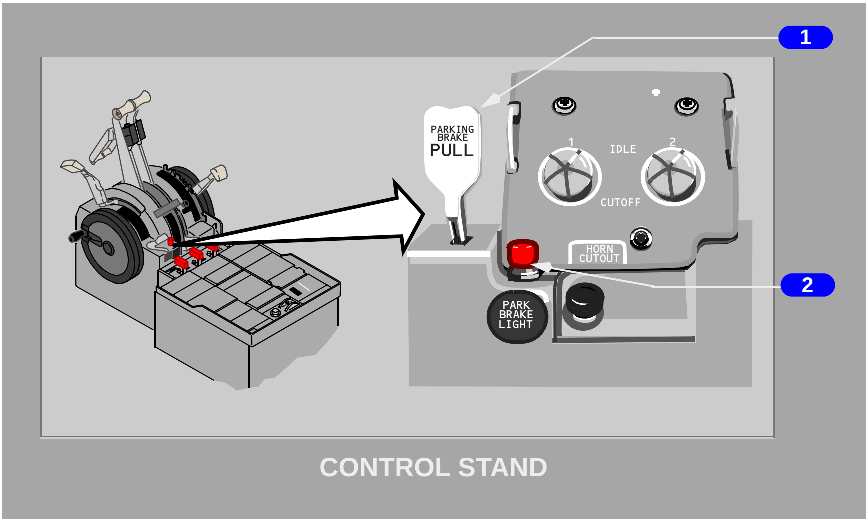
3 Antiskid Inoperative (ANTISKID INOP) Light

Illuminated (amber) – a system fault is detected by antiskid monitoring system.

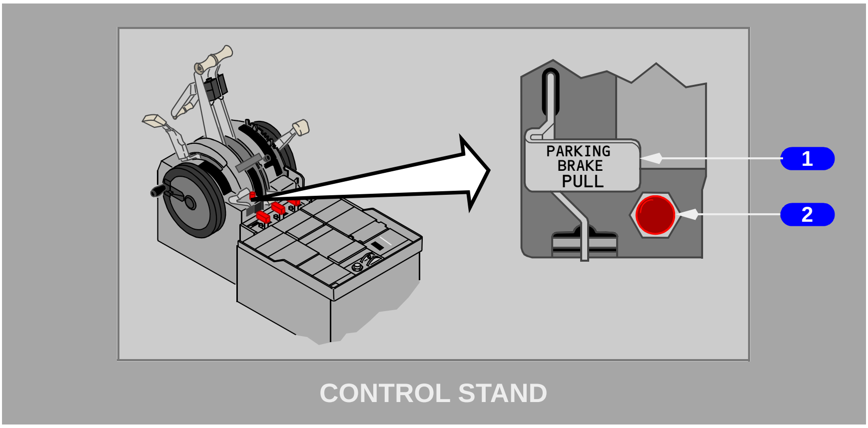
Extinguished – antiskid system operating normally.

Parking Brake

YT512 - YV754



YA701 - YT511



1 PARKING BRAKE Lever

Forward – parking brakes released.

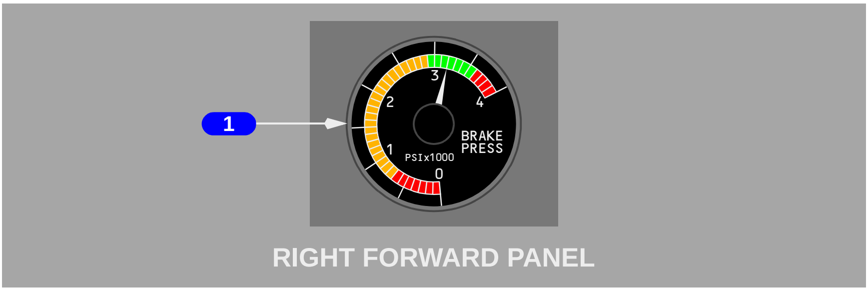
Aft – sets parking brakes when either Captain's or First Officer's brake pedals are fully depressed.

2 Parking Brake Warning Light

Illuminated (red) – parking brake is set (light operates from battery power).

Extinguished – parking brake is released.

Hydraulic Brake Pressure Indicator



1 Hydraulic Brake Pressure (HYD BRAKE PRESS) Indicator

Indicates brake accumulator pressure:

- normal pressure – 3000 psi
- maximum pressure – 3500 psi
- normal precharge – 1000 psi.

Brake Temperature Indicator

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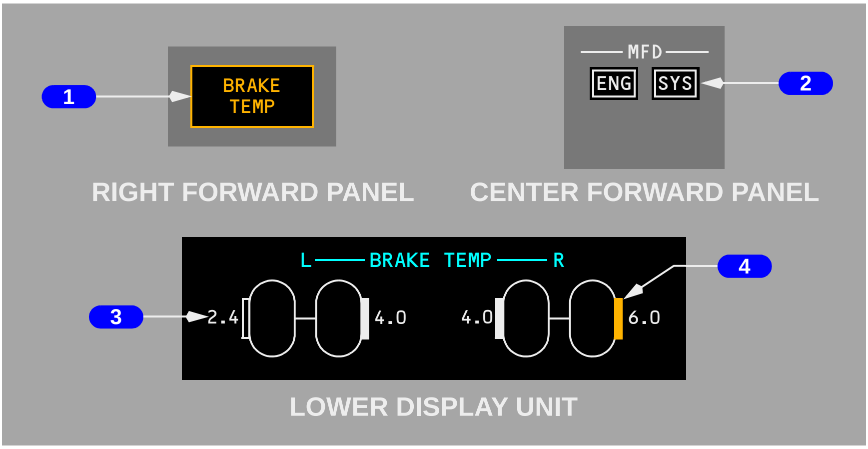


1 Brake Temperature (BRAKE TEMP) Light

Illuminated (amber) -

- temperature of one or more brakes exceed 4.9
- extinguishes when a hot brake condition is no longer indicated on the display unit.

2 MFD System (SYS) Switch

Push – SYS

- displays brake temperature indications on lower DU; or the inboard DU if the MAIN PANEL DUs switch is placed to the INBD MFD position.
- second push removes indications from the respective DU.

3 Brake Temperature

Indicates a relative value of wheel brake temperature

- values range from 0.0 to 9.9
- displayed (white) - normal brake temperature range, 0.0 to 4.9
- displayed (amber) - high brake temperature, exceeds 4.9.

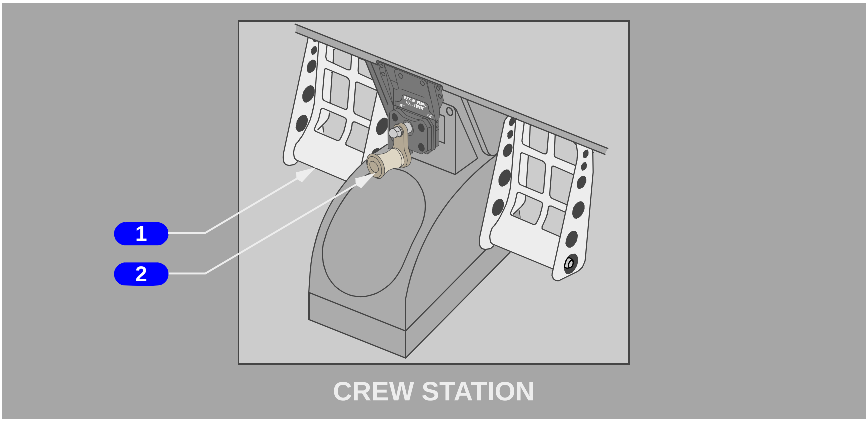
4 Brake Symbol

Displayed (blank) - indicates any brake less than 2.5.

Displayed (solid white) - indicates the hottest brake on each main gear truck, within the range of 2.5 to 4.9.

Displayed (solid amber) - indicates brake overheat condition on each wheel within the range of 5.0 to 9.9. Symbol remains until value is less than 3.5.

Rudder/Brake Pedals



1 Rudder/Brake Pedals

Push full pedal – turns nose wheel up to 7 degrees in either direction.

Push top of pedal only – activates wheel brakes.

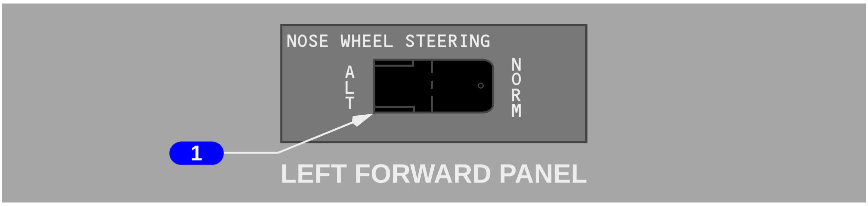
Refer to Chapter 9 Flight Controls for rudder description.

2 RUDDER PEDAL ADJUSTMENT Crank

AFT (counter–clockwise) – adjusts rudder pedals aft.

FWD (clockwise) – adjusts rudder pedals forward.

Nose Wheel Steering Switch

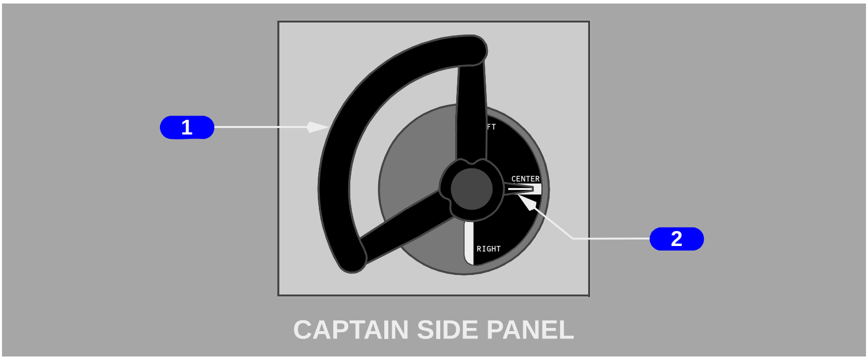


1 NOSE WHEEL STEERING Switch

ALT – hydraulic system B provides power for nose wheel steering.

NORM (guarded position) – hydraulic system A provides power for nose wheel steering.

Nose Wheel Steering Wheel



1 Nose Wheel Steering Wheel

Rotate –

- turns nose wheel up to 78 degrees in either direction.

  Note: Refer to Chapter 1 for effective steering angle and turning radius.

- overrides rudder pedal steering.

2 Nose Wheel Steering Indicator

LEFT – indicates nose wheel steering displacement left of center position.

CENTER – normal straight ahead position.

RIGHT – indicates nose wheel steering displacement right of center position.

Introduction

The airplane has two main landing gear and a single nose gear. Each main gear is a conventional two–wheel landing gear unit. The nose gear is a conventional steerable two–wheel unit.

Hydraulic power for retraction, extension, and nose wheel steering is normally supplied by hydraulic system A. A manual landing gear extension system and an alternate source of hydraulic power for nose wheel steering are also provided.

The normal brake system is powered by hydraulic system B. The alternate brake system is powered by hydraulic system A. Antiskid protection is provided on both brake systems, but the autobrake system is available only with the normal brake system.

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A brake temperature monitoring system displays each main landing gear brake temperature on the lower DU.

Landing Gear Operation

The landing gear are normally controlled by the LANDING GEAR lever. On the ground, a landing gear lever lock, prevents the LANDING GEAR lever from moving to the up position. An override trigger in the lever may be used to bypass the landing gear lever lock. In flight, the air/ground system energizes a solenoid which opens the lever lock.

Landing Gear Retraction

When the LANDING GEAR lever is moved to UP, the landing gear begins to retract. During retraction, the brakes automatically stop rotation of the main gear wheels. After retraction, the main gear are held in place by mechanical uplocks. Rubber seals and oversized hubcaps complete the fairing of the outboard wheels.

The nose wheels retract forward into the wheel well and nose wheel rotation is stopped by snubbers. The nose gear is held in place by an overcenter lock and enclosed by doors which are mechanically linked to the gear.

Hydraulic pressure is removed from the landing gear system with the LANDING GEAR lever in the OFF position.

If a main landing gear tire is damaged during takeoff, it is possible that braking of the main gear wheels during retraction may be affected. A spinning tire with a loose tread must be stopped prior to entering the wheel well or it can cause damage to wheel well components. When a spinning tire with loose tread impacts a fitting in the wheel well ring opening, that gear stops retracting and free falls back to the down position. The affected gear cannot be retracted until the fitting is replaced.

Landing Gear Transfer Unit

Hydraulic system B pressure is available for raising the landing gear through the landing gear transfer unit. Hydraulic system B supplies the volume of hydraulic fluid required to raise the landing gear at the normal rate when all of the following conditions exist:

- airborne
- No. 1 engine RPM drops below a limit value
- LANDING GEAR lever is positioned UP
- either main landing gear is not up and locked.

Landing Gear Extension

When the LANDING GEAR lever is moved to DN, hydraulic system A pressure is used to release the uplocks. The landing gear extends by hydraulic pressure, gravity and air loads. Overcenter mechanical and hydraulic locks hold the gear at full extension. The nose wheel doors remain open when the gear is down.

Landing Gear Manual Extension

If hydraulic system A pressure is lost, the manual extension system provides another means of landing gear extension. Manual gear releases on the flight deck are used to release uplocks that allow the gear to free–fall to the down and locked position. The forces that pull the gear down are gravity and air loads.

With the manual extension access door open:

- manual landing gear extension is possible with the LANDING GEAR lever in any position
- normal landing gear extension is possible if hydraulic system A pressure is available
- landing gear retraction is disabled.

Following a manual extension, the landing gear may be retracted normally by accomplishing the following steps:

- close the manual extension access door
- move the LANDING GEAR lever to DOWN with hydraulic system A pressure available, and then
- position the LANDING GEAR lever to UP.

Nose Wheel Steering

Nose wheel steering is available when the nose gear is in the down position and compressed by weight of the airplane. Positioning the landing gear control lever to down makes system A hydraulic pressure available to the steering metering valve. Alternate nose wheel steering can be activated to provide system B pressure to the nose wheels when the NOSE WHEEL STEERING switch is placed to ALT, normal quantity is in the system B reservoir, and the airplane is on the ground. In the event of a hydraulic leak downstream of the Landing Gear Transfer Unit, resulting in a loss of hydraulic system B fluid in the reservoir, a sensor closes the Landing Gear Transfer Valve and alternate steering will be lost.

Primary steering is controlled through the nose wheel steering wheel. Limited steering control is available through the rudder pedals. A pointer on the nose steering wheel assembly shows nose wheel steering position relative to the neutral setting. Rudder pedal steering is deactivated as the nose gear strut extends.

A lockout pin may be installed in the towing lever to depressurize nose wheel steering. This allows airplane pushback or towing without depressurizing the hydraulic systems.

Brake System

Each main gear wheel has a multi–disc hydraulic powered brake. The brake pedals provide independent control of the left and right brakes. The nose wheels have no brakes. The brake system includes:

- normal brake system
- alternate brake system
- brake accumulator
- antiskid protection
- autobrake system
- parking brake

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- brake temperature indication

Normal Brake System

The normal brake system is powered by hydraulic system B.

Alternate Brake System

The alternate brake system is powered by hydraulic system A. If hydraulic system B is low or fails, hydraulic system A automatically supplies pressure to the alternate brake system.

Brake Accumulator

The brake accumulator is pressurized by hydraulic system B. If both normal and alternate brake system pressure is lost, trapped hydraulic pressure in the brake accumulator can still provide several braking applications or parking brake application.

Antiskid Protection

Antiskid protection is provided in the normal and alternate brake systems.

The normal brake hydraulic system provides each main gear wheel with individual antiskid protection. When the system detects a skid, the associated antiskid valve reduces brake pressure until skidding stops. The alternate brake hydraulic system works similar to the normal system however antiskid protection is applied to main gear wheel pairs instead of individual wheels.

Both normal and alternate brake systems provide skid, locked wheel, touchdown and hydroplane protection.

Antiskid protection is available even with loss of both hydraulic systems.

Autobrake System

The autobrake system uses hydraulic system B pressure to provide maximum deceleration for rejected takeoff and automatic braking at preselected deceleration rates immediately after touchdown. The system operates only when the normal brake system is functioning. Antiskid system protection is provided during autobrake operation.

Rejected Takeoff (RTO)

The RTO mode can be selected only when on the ground. Upon selection, the AUTO BRAKE DISARM light illuminates for one to two seconds and then extinguishes, indicating that an automatic self–test has been successfully accomplished.

To arm the RTO mode prior to takeoff the following conditions must exist:

- airplane on the ground
- antiskid and autobrake systems operational
- AUTO BRAKE select switch positioned to RTO
- wheel speed less than 60 knots
- forward thrust levers positioned to IDLE.

With RTO selected, if the takeoff is rejected prior to wheel speed reaching 90 knots autobraking is not initiated, the AUTO BRAKE DISARM light does not illuminate and the RTO autobrake function remains armed. If the takeoff is rejected after reaching a wheel speed of 90 knots, maximum braking is applied automatically when the forward thrust levers are retarded to IDLE.

The RTO mode is automatically disarmed when both air/ground systems indicate the air mode. The AUTO BRAKE DISARM light does not illuminate and the AUTO BRAKE select switch remains in the RTO position. To reset or manually disarm the autobrake system, position the selector to OFF. If a landing is made with RTO selected (AUTO BRAKE select switch not cycled through OFF), no automatic braking action occurs and the AUTO BRAKE DISARM light illuminates two seconds after touchdown.

Landing

When a landing autobrake selection is made, the system performs a turn–on– self–test. If the turn–on–self–test is not successful, the AUTO BRAKE DISARM light illuminates and the autobrake system does not arm.

Four levels of deceleration can be selected for landing. However, on dry runways, the maximum autobrake deceleration rate in the landing mode is less than that produced by full pedal braking.

After landing, autobrake application begins when:

- both forward thrust levers are retarded to IDLE
- the main wheels spin–up.

Note: Landing autobrake settings may be selected after touchdown prior to decelerating through 30 kts of ground speed. Braking initiates immediately if the above conditions are met.

To maintain the selected landing deceleration rate, autobrake pressure is reduced as other controls, such as thrust reversers and spoilers, contribute to total deceleration. The deceleration level can be changed (without disarming the system) by rotating the selector. The autobrake system brings the airplane to a complete stop unless the braking is terminated by the pilot.

Autobrake – Disarm

The pilots may disarm the autobrake system by moving the selector switch to the OFF position. This action does not cause the AUTO BRAKE DISARM light to illuminate. After braking has started, any of the following pilot actions disarm the system immediately and illuminate the AUTO BRAKE DISARM light:

- moving the SPEED BRAKE lever to the down detent
- advancing the forward thrust lever(s), except during the first 3 seconds after touchdown for landing
- applying manual brakes.

Parking Brake

The parking brake can be set with either A or B hydraulic systems pressurized. If A and B hydraulic systems are not pressurized, parking brake pressure is maintained by the brake accumulator. Accumulator pressure is shown on the HYD BRAKE PRESS indicator.

The parking brake is set by depressing both brake pedals fully, while simultaneously pulling the PARKING BRAKE lever up. This mechanically latches the pedals in the depressed position and commands the parking brake valve to close.

The parking brake is released by depressing the pedals until the PARKING BRAKE lever releases. A fault in the parking brake system may cause the ANTISKID INOP light to illuminate.

The TAKEOFF CONFIG lights illuminate and the takeoff configuration warning horn sounds if either forward thrust lever is advanced for takeoff with the parking brake set.

Air/Ground System

In flight and ground operation of various airplane systems are controlled by the air/ground system.

The system receives air/ground logic signals from six sensors, two on each landing gear. These signals are used to configure the airplane systems to the appropriate air or ground status.

Air/Ground System Logic Table

SYSTEMS	NORMAL INFLIGHT OPERATION	NORMAL ON GROUND OPERATION	REFER TO CH
Emergency Exit Doors	Flight locks engaged when either engine N2 is more than 50% and 3 or more Entry/Service doors are closed.	Flight locks disengaged when either thrust lever is set below approximately 53 degrees.	1
Pack Valves	With one pack operating, regulates to high flow with flaps up.	With one pack operating, regulates to high flow only when pack is operating from the APU and both engine bleed switches are OFF.	2

SYSTEMS	NORMAL INFLIGHT OPERATION	NORMAL ON GROUND OPERATION	REFER TO CH
Pressurization	Allows programmed pressurization in the automatic modes.	Allows pressurization only at high power settings.	2
Ram Air	Ram Air fans operate whenever air conditioning packs operate.	Ram Air fans operate whenever air conditioning packs operate. Deflectors are extended.	2
Wing Anti–ice	Control valves open when switch is ON. Thrust setting and duct temperature logic is bypassed.	With switch ON, valves cycle open and closed. Switch trips to OFF at lift–off.	3
Autothrottle	Enables go–around below 2000 ft radio altitude.	Disengaged 2 seconds after landing. Takeoff mode enabled.	4
TO/GA switch	Flight director engages go–around mode.	Flight director engages takeoff mode.	4
ACARS	Sends out signal on strut extension for takeoff signal.	Sends out signal on strut compression for landing signal.	5
Voice Recorder	Prevents tape erasure.	Allows tape erasure when parking brake is set.	5
Engine Idle Control	Enables minimum flight idle.	Enables minimum ground idle.	7
Thrust Reverser	Thrust reverse disabled.	Thrust reverse enabled.	7
APU Fire Horn	Wheel well horn disabled.	Wheel well horn enabled.	8
Cargo Fire Protection	Second extinguishing bottle timer enabled.	Second extinguishing bottle timer disabled.	8

SYSTEMS	NORMAL INFLIGHT OPERATION	NORMAL ON GROUND OPERATION	REFER TO CH
Speed Brake Lever Actuator	Can be armed to raise ground spoilers for landing.	Activates SPEED BRAKE lever on landing if armed. Rejected take–off feature available. Drives to DOWN when thrust lever advanced.	9

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Auto Slat	System enabled with flaps 1, 2, or 5 selected. PTU available if system B pressure is lost.	System disabled.	9

YV604, YV605

Auto Slat	System enabled with flaps 1, 2, 5, 10, 15 or 25 selected. PTU available if system B pressure is lost.	System disabled.	9

Flight Recorder	Operates anytime electrical power is available.	Operates anytime electrical power is available and either engine is operating.	10
FMC	FMC position updated from GPS, DME or VOR/DME.	FMC position updated from GPS.	11
Standby Hydraulic	Pump automatic operation with flaps extended and A or B pressure lost.	Wheel speed must be greater than 60 knots for automatic operation.	13
Antiskid	Releases normal or alternate brakes for touchdown protection.	Allows normal antiskid braking after wheel spin–up.	14

SYSTEMS	NORMAL INFLIGHT OPERATION	NORMAL ON GROUND OPERATION	REFER TO CH
Autobrake	Allows selection of landing mode.	RTO mode available and landing mode may be selected after touchdown if wheel speed is greater than 30 knots.	14
Landing Gear Lever Lock	Lever lock solenoid released.	Lever lock solenoid latched.	14
Landing Gear Transfer Unit	Enabled.	Disabled.	14
Stall Warning	Enabled.	Disabled.	15
Takeoff Warning	Disabled.	Enabled.	15

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Warning Systems Chapter 15
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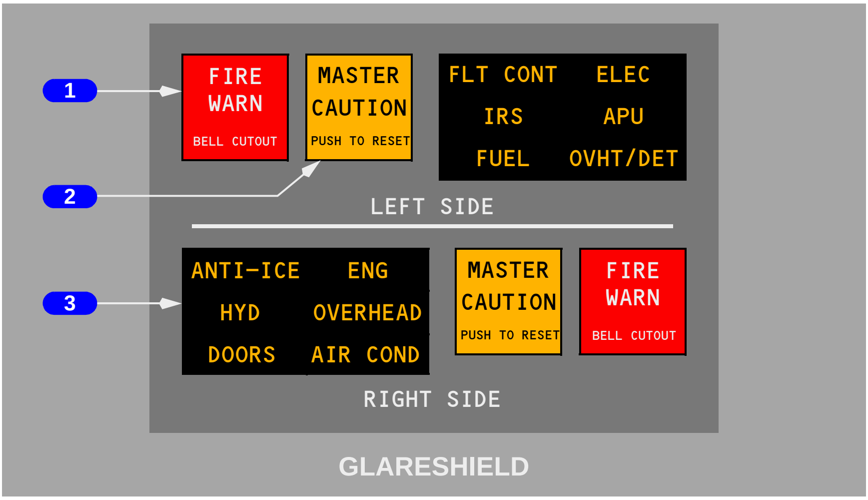
Fire Warning and Master Caution System



1 Master Fire Warning (FIRE WARN) Lights

Illuminated (red) – indicates a fire warning (or system test) in one or more of the following:

- engine
- APU
- main wheel well
- cargo

Associated aural alarms include:

- fire warning bell
- if on ground, remote APU fire warning horn.

Push – extinguishes both master FIRE WARN lights

- silences fire warning bell
- silences remote APU fire warning horn
- resets system for additional warnings.

Note: Pushing fire warning bell cutout switch on overheat/fire protection panel results in the same actions.

2 MASTER CAUTION Lights

Illuminated (amber) – a system annunciator light has illuminated.

Push – extinguishes both MASTER CAUTION lights

- system annunciator light(s) extinguish
- resets system for additional master caution conditions.

3 System Annunciator Panel

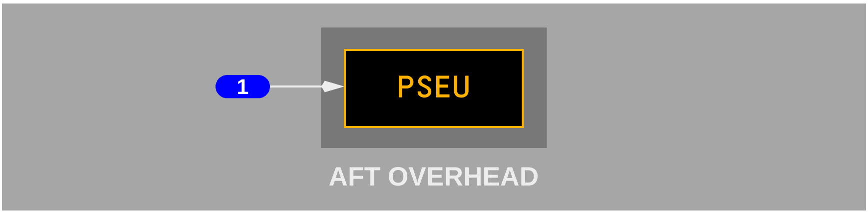
Illuminated (amber) – an amber light, relating to illuminated system annunciator, has illuminated on forward overhead, aft overhead or overheat/fire protection panel.

To extinguish – push either MASTER CAUTION light.

To recall – push and release either system annunciator panel

- if a master caution condition exists, appropriate system annunciator(s) and MASTER CAUTION lights illuminate
- a single fault in certain redundant systems, or some simple faults, cause the system annunciator light to illuminate during a recall. The system annunciator light will extinguish when the MASTER CAUTION light is pushed.

Proximity Switch Electronic Unit Light

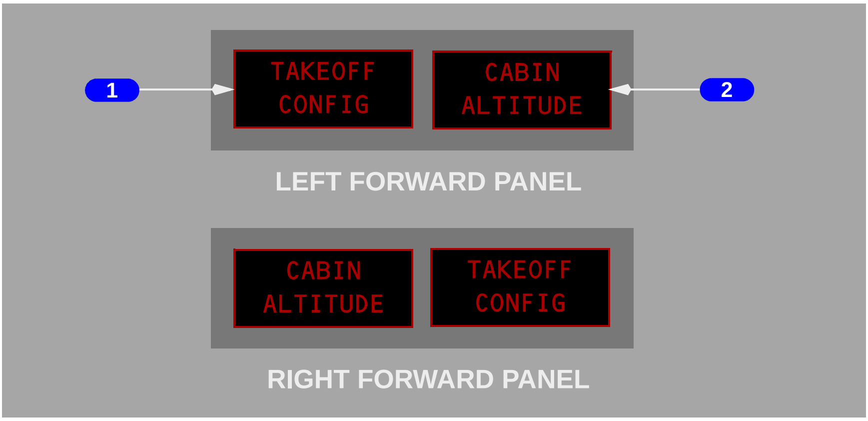


1 Proximity Switch Electronic Unit (PSEU) Light

Illuminated (amber) –

- on the ground –
  - a fault is detected in the PSEU.
  - or, an overwing exit flight lock fails to disengage when commanded.
- in-flight –
  - inhibited from thrust lever advance for takeoff until 30 seconds after landing.

Takeoff Configuration and Cabin Altitude Warning Lights



1 Takeoff Configuration Warning Light

Illuminated (red) –

- activates on the ground as the throttles are advanced if the airplane is not configured correctly for takeoff
- activation is simultaneous with aural warning intermittent horn for TAKEOFF CONFIGURATION alert.

2 Cabin Altitude Warning Light

Illuminated (red) –

- illuminates when cabin altitude exceeds 10,000 feet
- activation is simultaneous with aural warning intermittent horn for CABIN ALTITUDE alert
- extinguishes when cabin altitude descends below 10,000 feet.

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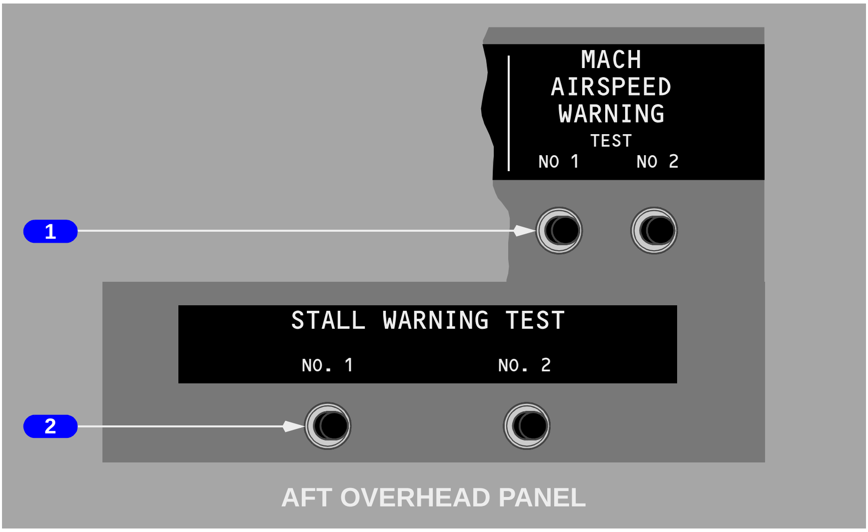
Note: Operation of the High Altitude Landing Switch changes the altitude at which the cabin altitude warning light illuminates and extinguishes. See Chapter 2.10, Cabin Altitude Panel, and Chapter 15.20, Intermittent Cabin Altitude/Configuration Warning for more information.

Mach/Airspeed Warning and Stall Warning Test Switches



1 MACH AIRSPEED WARNING TEST Switches

Push – tests respective mach/airspeed warning system

- clacker sounds
- inhibited while airborne.

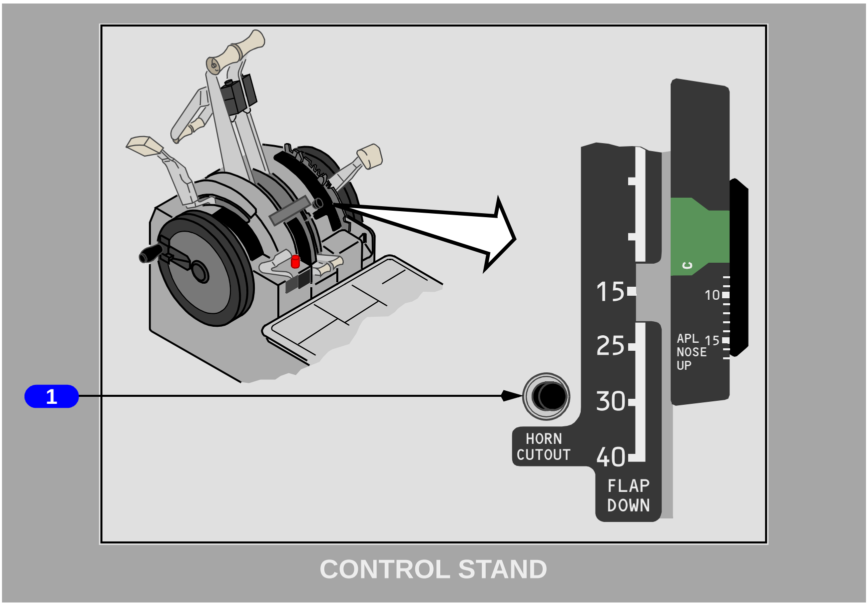
2 STALL WARNING TEST Switches

Push – on ground with AC power available: each test switch tests its respective stall management yaw damper (SMYD) computer. No.1 SMYD computer shakes Captain's control column, No.2 SMYD computer shakes First Officer's control column. Vibrations can be felt on both columns

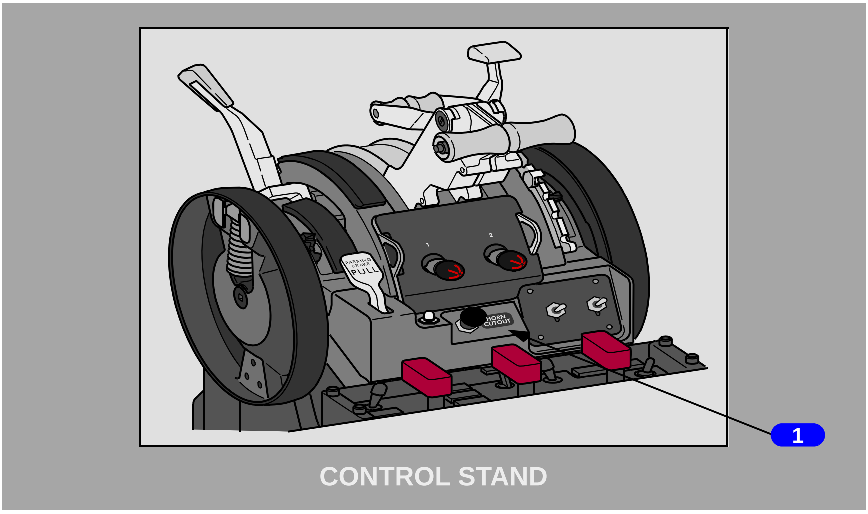
- inhibited while airborne.

Landing Gear Warning Cutout Switch

YA701 - YT511



YT512 - YV754

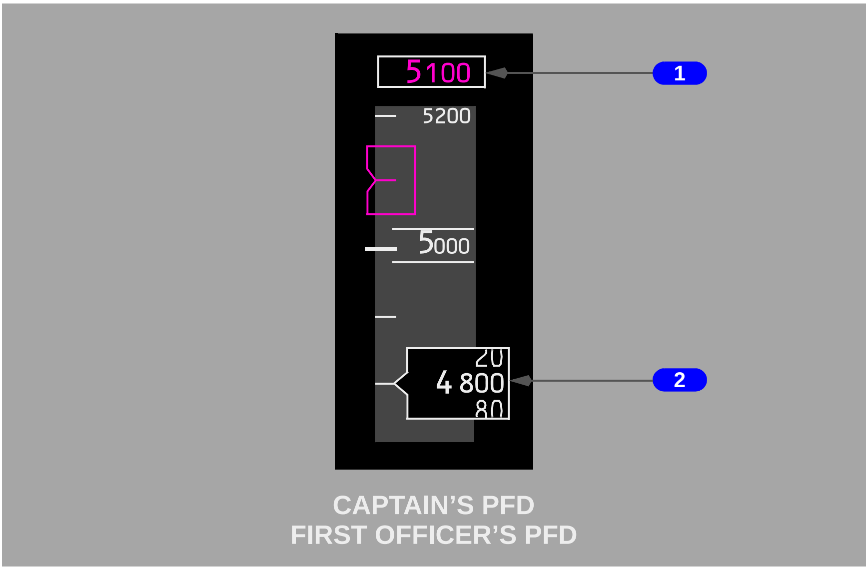


1 Landing Gear Warning Cutout Switch

Push – silences landing gear configuration warning aural indication at flaps up through 10 and above 200 feet RA.

Note: The aural indication cannot be silenced with the cutout switch at flaps greater than 10.

Altitude Alert



1 Selected Altitude Alert

A white box shows around the selected altitude display between 900 feet and 300 feet before reaching the selected altitude.

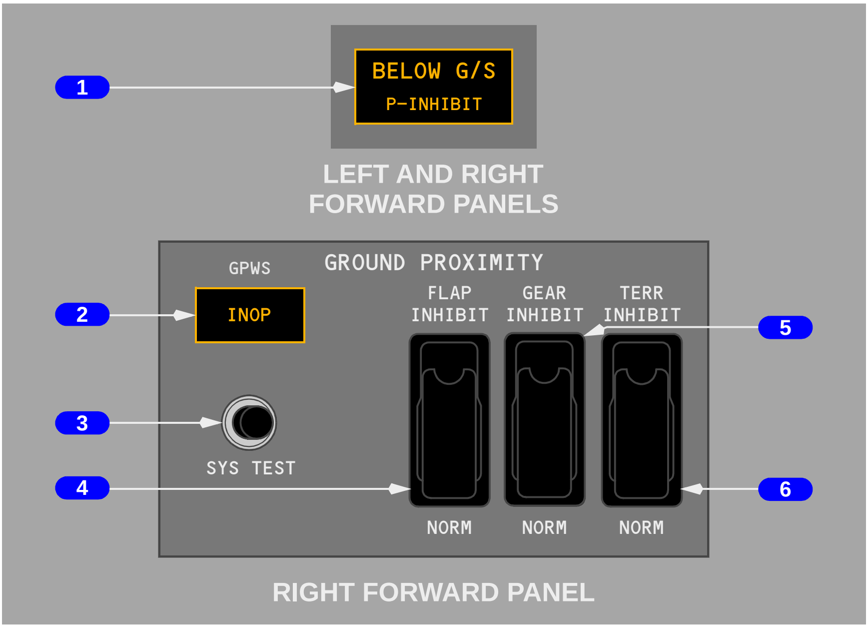
2 Current Altitude Alert

The white box around the current altitude display becomes bold between 900 feet and 300 feet before reaching the selected altitude.

The box turns amber and flashes for 300 feet to 900 feet deviation from the selected altitude.

Ground Proximity Warning System (GPWS)

GPWS Controls



1 BELOW Glideslope (G/S) light

Illuminated (amber) – below glideslope alert is active.

Push – inhibits ground proximity GLIDESLOPE alert when below 1,000 feet radio altitude.

2 Inoperative (INOP) light

Illuminated (amber) – GPWS computer malfunction or power loss

- invalid inputs are being received from radio altimeter, ADIRU, ILS receiver, IRS, FMC, stall management computers, or EFIS control panel.

YV751 - YV754

Note: In the event of a DEU failure, the GPWS INOP light will illuminate, and the EBAW/ROLL AUTHORITY aural alert will not function; however, the visual alert, if triggered, will be valid if displayed on the PFD.

3 Ground Proximity System Test (SYS TEST) Switch

Push –

- momentarily on ground:
  - BELOW G/S and GPWS INOP lights illuminate
  - TERR FAIL and TERR TEST show on navigation displays
  - PULL UP and WINDSHEAR alerts illuminate
  - GLIDESLOPE, PULL UP, and WINDSHEAR aurals sound
  - terrain display test pattern shows on navigation displays
  - CAUTION TERRAIN aural sounds and TERRAIN caution message shows on navigation displays.
  - AIRSPEED LOW (airplanes with AIRSPEED LOW aural).
- until self-test aurals begin, on ground, above indications always occur first, followed by these additional aurals, as described in section 15-20:
  - radio altitude based alerts
  - bank angle alert
  - approach callouts
  - windshear alert
  - look ahead terrain alerts
- system test inhibited in-flight.

4 Ground Proximity FLAP INHIBIT Switch

FLAP INHIBIT – inhibits ground proximity TOO LOW FLAPS alert.

NORM (guarded position) – Normal TOO LOW FLAPS alert active.

5 Ground Proximity GEAR INHIBIT Switch

GEAR INHIBIT – inhibits ground proximity TOO LOW GEAR alert.

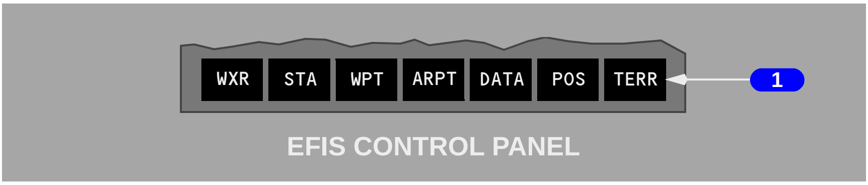
NORM (guarded position) – Normal TOO LOW GEAR alert active.

6 Ground Proximity Terrain Inhibit (TERR INHIBIT) Switch

TERR INHIBIT – inhibits look–ahead terrain alerts and terrain display.

NORM (guarded position) – Normal terrain alerts and terrain display active.

GPWS Terrain Display Select Switch



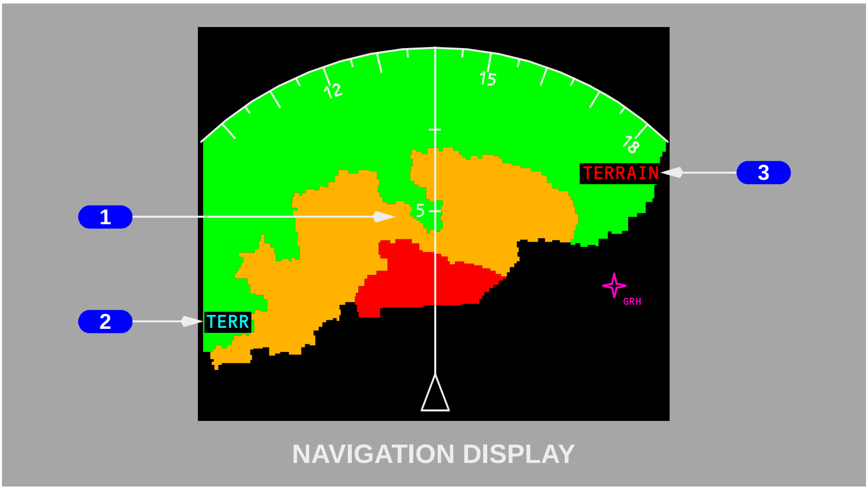
1 Terrain (TERR) Display Select Switch

Push –

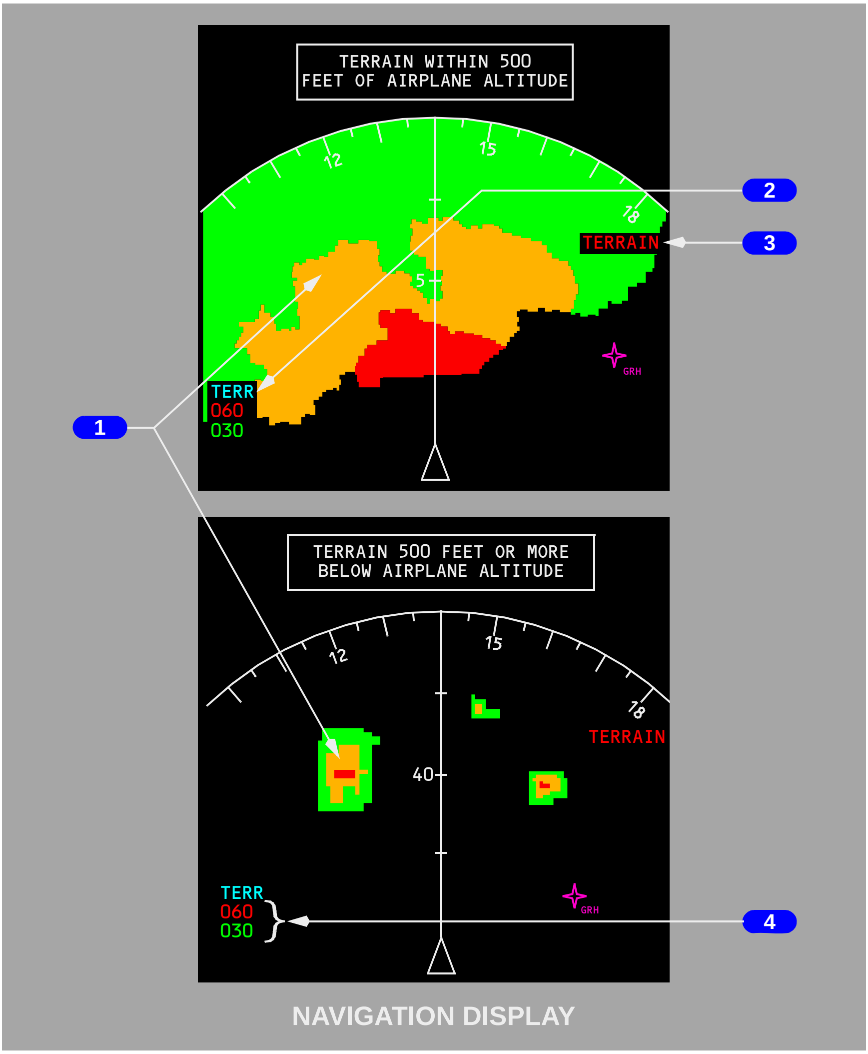
- shows terrain data in expanded MAP, center MAP, expanded VOR, and expanded APP modes
- arms terrain data in PLN, center VOR, and center APP modes
- deselects weather radar display regardless of mode selector position
- second push deselects terrain display.

Terrain Display (PFD/ND)

YA701 - YA710, YK622 - YK625, YK961 - YK971, YL076, YL077, YM482 - YM484



YF048 - YF928, YK626 - YK630, YK973 - YK980, YL541 - YL551, YN531 - YV754



1 Terrain Display

YA701 - YA710, YK622 - YK625, YK961 - YK971, YL076, YL077, YM482 - YM484

Graphical representation of surrounding terrain. Color and density vary based on terrain elevation vs. airplane altitude:

- Solid red: Look-ahead terrain warning active
- Solid amber: Look-ahead terrain caution active
- Dotted red: Terrain more than 2,000 feet above airplane’s current altitude
- Dotted amber: Terrain 500 feet (250 feet with gear down) below to 2,000 feet above the airplane’s current altitude
- Dotted green: Terrain from 2,000 feet below to 500 feet (250 feet with gear down) below the airplane’s current altitude
- Black: No significant terrain
- Dotted magenta: No terrain data available

YF048 - YF928, YK626 - YK630, YK973 - YK980, YL541 - YL551, YN531 - YV754

Graphical representation of surrounding terrain and obstacles.

When the airplane is **500 feet or more** above the highest terrain in the selected display range, terrain is depicted in green, and color density varies based on terrain elevation:

- Solid green: Highest elevation terrain
- High-density dotted green: Intermediate elevation terrain
- Low-density dotted green: Lowest elevation terrain
- Black: No significant terrain

When the airplane is **less than 500 feet** above the highest terrain in the selected display range, color and density vary based on terrain elevation vs. airplane altitude:

- Solid red: Look-ahead terrain warning active
- Solid amber: Look-ahead terrain caution active
- Dotted red: Terrain more than 2,000 feet above airplane's current altitude
- Dotted amber: Terrain 500 feet (250 feet with gear down) below to 2,000 feet above the airplane's current altitude
- Dotted green: Terrain from 2,000 feet below to 500 feet (250 feet with gear down) below the airplane's current altitude
- Black: No significant terrain
- Dotted magenta: No terrain data available

Note: In areas without terrain data, look-ahead terrain alerting and display functions are not available. Radio altitude based terrain alerts function normally.

YA701 - YA710

Note: Terrain more than 2,000 feet below airplane altitude or within 400 feet of nearest airport runway elevation does not show.

YK622 - YK625, YK961 - YK971, YL076, YL077, YM482 - YM484

Note: Terrain more than 2,000 feet below airplane altitude or within 200 feet of nearest airport runway elevation does not show.

YS151 - YS179, YS191 - YS194

Note: Terrain within 400 feet of the nearest airport runway elevation does not show.

YF048 - YF928, YK626 - YK630, YK973 - YK980, YL541 - YL551, YN531 - YN534, YS180 - YS190, YT501 - YV754

Note: Terrain within 200 feet of the nearest airport runway elevation does not show.

Automatically shows when:

- a look-ahead terrain alert occurs, and
- neither pilot has the terrain display selected, and
- in expanded MAP, center MAP, expanded VOR, or expanded APP modes.

Updates with a display sweep, similar to weather radar display.

2 Terrain Mode Annunciation

TERR (cyan) – Terrain display enabled (manual or automatic display).

3 Look-Ahead Alert

Shows in all navigation display modes.

TERRAIN

- Red – look-ahead terrain warning alert active.
- Amber – look-ahead terrain caution alert active.

YF048 - YF928, YK626 - YK630, YK973 - YK980, YL541 - YL551, YN531 - YV754

OBSTACLE

- Red – obstacle warning alert active.
- Amber – obstacle caution alert active.

YF048 - YF928, YK626 - YK630, YK973 - YK980, YL541 - YL551, YN531 - YV754

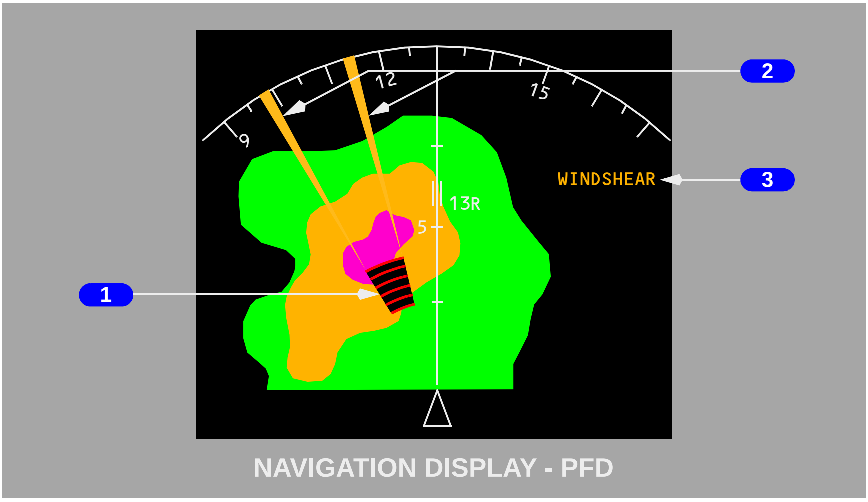
4 TERR (Terrain) Elevation Number

Displays elevation of highest and lowest terrain. The color of the elevation number corresponds to the terrain elevation:

- Green – terrain elevation is more than 500 ft below airplane altitude.
- Amber – terrain elevation is between 500 ft below and 2000 ft above airplane altitude
- Red – terrain elevation is more than 2000 ft above airplane altitude

Note: Values displayed are applicable to terrain that is generally ahead of the airplane flight path. Terrain near the left and right margins of the display may not be included in the calculations.

Predictive Windshear Display and Annunciations



1 Predictive Windshear Symbol

Displayed (red and black) – Predictive windshear alert active.

Shows windshear location and approximate geometric size (width and depth).

Symbol, radials, and weather radar returns automatically show when:

- predictive windshear alert occurs, and
- neither pilot has WXR display selected, and
- in expanded MAP, center MAP, VOR, or APP modes.

When terrain display is active, weather radar display replaces terrain display.

2 Predictive Windshear Symbol Radials

Displayed (amber) – Predictive windshear alert active.

Extend from predictive windshear symbol to help identify location of windshear event

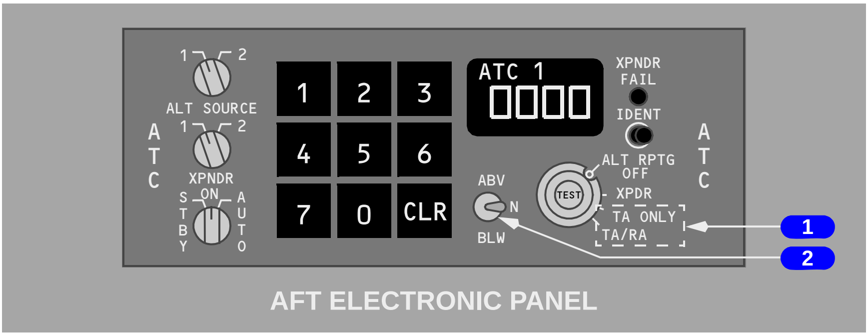
3 WINDSHEAR Annunciation

WINDSHEAR (amber) – predictive windshear caution active.

WINDSHEAR (red) – predictive windshear warning active.

Shows in all navigation display modes.

TCAS Controls (Transponder Panel)



1 Transponder Mode Selector

TA (traffic advisory) ONLY – enables the display of traffic advisory (TA) targets.

TA/RA (resolution advisory) – enables the display of traffic advisory (TA) and resolution advisory (RA) targets.

2 Altitude Range Switch

Allows shifting of TCAS coverage up and down from baseline:

- Above (ABV)– sets TCAS display at upper elevation limits
- Normal (N) – sets TCAS display for normal elevation
- Below (BLW)– sets TCAS display at lower elevation limits.

Intentionally
Blank

Warning Systems Chapter 15

System Description Section 20

Introduction

Aural, tactile and visual warning signals alert the flight crew to conditions requiring action or caution in the operation of the airplane. The character of the signals varies, depending upon the degree of urgency or hazards involved. Aural, tactile, and visual signals are used singularly or in combination to simultaneously provide both warnings and information regarding the nature of the condition.

Mach/airspeed warnings, landing gear warnings, takeoff configuration warnings, windshear warnings, and ground proximity warnings are discussed in this section. Cabin altitude warning is discussed in this section and in the Air Systems chapter, and autopilot and autothrottle disconnect warnings are discussed in the Automatic Flight chapter. The conditions which excite the fire warning bell are discussed in the Fire Protection chapter.

YK622 - YK625, YS179 - YS190
Many of the flight instrument display symbols and annunciations listed in this chapter also appear on the Head-Up Display (HUD) System. Refer to Chapter 10, Flight Instruments, for HUD display symbol descriptions.

Conditions which require the immediate attention of the flight crew are indicated by red warning lights located in the area of the pilots' primary field of vision. These lights indicate engine, wheel well, cargo, or APU fires; autopilot, autothrottle disconnects; and landing gear unsafe conditions.

Conditions which require the timely attention of the flight crew are indicated by amber caution lights.

Blue lights inform the flight crew of electrical power availability, valve position, equipment status, and flight attendant or ground communications. Blue lights are for information and do not require immediate flight crew attention. Some system blue lights indicate a transitional state by illuminating bright as valves or components reposition, then returning to a dim blue when the required configuration is reached.

Green lights indicate a fully extended configuration, e.g., landing gear and leading edge devices.

For specific information regarding red, amber, blue, and green lights refer to the appropriate systems chapters.

Stall warning is provided by a control column shaker on each control column.

Various aural signals call attention to warnings and cautions. An aural warning for airspeed limits is given by a clacker, the autopilot disconnect by a warning tone, takeoff configuration and cabin altitude by an intermittent horn, and landing gear positions by a steady horn. The fire warning by a fire warning bell. Ground proximity warnings and alerts, and windshear warnings and alerts are given by voice warnings.

Generally, aurals automatically silence when the associated non–normal condition no longer exists.

Master Fire Warning Lights

Two master FIRE WARN lights illuminate when any fire warning condition occurs. The lights remain illuminated as long as the condition exists. Pushing either master FIRE WARN light or fire warning bell cutout switch extinguishes both lights, silences the fire warning bell and resets the system for future warnings. Further information appears in the Fire Protection chapter.

Master Caution Lights

Two MASTER CAUTION lights illuminate when any caution occurs outside the normal field of vision of the flight crew. The lights remain illuminated as long as the caution condition exists, or until the crew resets the system. Pushing either MASTER CAUTION light extinguishes both lights and resets the master caution system for further cautions. Pushing either annunciator light panel recalls all existing fault annunciations.

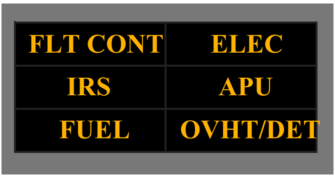
A single fault in certain redundant systems, also known as a "simple fault," does not illuminate the MASTER CAUTION and system annunciator lights. However, this type of fault is stored in the master caution system. Pushing the system annunciator recalls the simple fault on the system annunciator panel.

When the MASTER CAUTION recall is pressed, all twelve system lights should illuminate while the press-to-test feature is held. If a system annunciator light does not illuminate, refer to the *MEL*.

System Annunciator Lights

Two system annunciator light panels are located on the glare shield. The annunciator light panels include only those systems located on the forward overhead, aft overhead, and fire control panels. If a caution condition exists, the appropriate system annunciator(s) and MASTER CAUTION lights illuminate.

System Annunciators and Related Amber Lights – Left Side

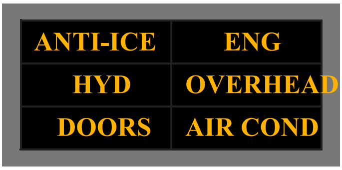


LEFT SIDE
GLARESHIELD

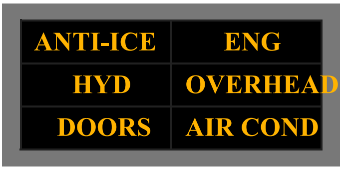
FLT CONT	ELEC
LOW QUANTITY LOW PRESSURE FEEL DIFF PRESS SPEED TRIM FAIL MACH TRIM FAIL AUTO SLAT FAIL YAW DAMPER STBY RUD ON	DRIVE STANDBY PWR OFF TRANSFER BUS OFF SOURCE OFF TR UNIT BAT DISCHARGE ELEC
IRS	APU
FAULT ON DC DC FAIL GPS	LOW OIL PRESSURE FAULT OVERSPEED
FUEL	OVHT/DET
LOW PRESSURE FILTER BYPASS	ENGINE 1 OVERHEAT ENGINE 2 OVERHEAT APU DET INOP

System Annunciators and Related Amber Lights – Right Side

YA701 - YA710, YM482 - YN534

ANTI–ICE		ENG
WINDOW OVERHEAT PROBE HEAT COWL ANTI–ICE		REVERSER EEC ALTN MODE ENGINE CONTROL
HYD		OVERHEAD
OVERHEAT LOW PRESSURE	 RIGHT SIDE GLARESHIELD	EQUIP COOLING–OFF EMER EXIT LIGHTS–NOT ARMED FLIGHT RECORDER–OFF PASS OXY–ON PSEU ELT **YM482 - YM484** LAVATORY–SMOKE
DOORS		AIR COND
FWD/AFT ENTRY EQUIP FWD/AFT CARGO FWD/AFT SERVICE LEFT/RIGHT OVERWING		DUAL BLEED WING–BODY OVERHEAT BLEED TRIP OFF AUTO FAIL OFF SCHED DESCENT DUCT OVERHEAT PACK TRIP OFF **YN531 - YN534** HIGH ALTITUDE LANDING - INOP

YF048 - YL551, YS151 - YV754

ANTI–ICE		ENG
WINDOW OVERHEAT PROBE HEAT COWL ANTI–ICE		REVERSER EEC ALTN MODE ENGINE CONTROL
HYD	 RIGHT SIDE GLARESHIELD	OVERHEAD
OVERHEAT LOW PRESSURE		EQUIP COOLING–OFF EMER EXIT LIGHTS–NOT ARMED FLIGHT RECORDER–OFF PASS OXY–ON PSEU ELT
DOORS		AIR COND
FWD/AFT ENTRY EQUIP FWD/AFT CARGO FWD/AFT SERVICE LEFT/RIGHT OVERWING		DUAL BLEED WING–BODY OVERHEAT BLEED TRIP OFF AUTO FAIL OFF SCHED DESCENT ZONE TEMP PACK

Warning Systems
Intermittent Cabin Altitude/Configuration Warning

Takeoff configuration warning is armed when the airplane is on the ground and either or both forward thrust levers are advanced for takeoff. Takeoff configuration warning activates if:

- trailing edge flaps are not in the flaps 1 through 25 takeoff range, or
- trailing edge flaps are in a skew or asymmetry condition, or have uncommanded motion, or
- leading edge devices are not configured for takeoff or have uncommanded motion, or
- speed brake lever is not in the DOWN position, or
- spoiler control valve is open providing pressurized hydraulic fluid to the ground spoiler interlock valve, or
- parking brake is set, or
- stabilizer trim not set in the takeoff range.

An intermittent warning horn sounds and the TAKEOFF CONFIG warning light illuminates when takeoff configuration warning activates.

Cabin altitude warning activates when cabin altitude exceeds 10,000 feet. An intermittent warning horn sounds and the CABIN ALTITUDE warning light illuminates. The warning horn may be silenced by momentarily pressing the ALT HORN CUTOUT switch on the Cabin Altitude Panel. The warning light remains illuminated until the cabin altitude descends below 10,000 feet.

YN531 - YN534
If the High Altitude Landing Switch is selected ON, cabin altitude warning activates when the cabin altitude exceeds 15,200 feet. All other characteristics of cabin altitude warning remain the same.

WARNING: The Cabin Altitude and Takeoff Configuration Warnings use the same intermittent tone when activated.

Landing Gear Configuration Warnings

Visual indications and aural warnings of landing gear position are provided by the landing gear indicator lights and landing gear warning horn.

Visual Indications

The landing gear indication lights are activated by signals from each gear, the LANDING GEAR lever, and the forward thrust lever position as follows:

Green light illuminated – landing gear is down and locked.

Red light illuminated –

- landing gear is in disagreement with LANDING GEAR lever position (in transit or unsafe).
- landing gear is not down and locked (with either or both forward thrust levers retarded to idle, and below 800 feet AGL).

All lights extinguished – landing gear is up and locked with the LANDING GEAR lever UP or OFF.

Aural Indications

A steady warning horn is provided to alert the flight crew whenever a landing is attempted and any gear is not down and locked. The landing gear warning horn is activated by forward thrust lever and flap position as follows:

Flaps up through 10 –

- altitude below 800 feet RA, when either forward thrust lever set between idle and approximately 20 degrees thrust lever angle, or an engine is not operating and the other thrust lever is less than 34 degrees. The landing gear warning horn can be silenced (reset) with the landing gear warning HORN CUTOUT switch
- if the airplane descends below 200 feet RA, the warning horn cannot be silenced by the warning HORN CUTOUT switch.

Flaps 15 through 25 –

- either forward thrust lever set below approximately 20 degrees, or an engine not operating and the other thrust lever is less than 34 degrees. The landing gear warning horn cannot be silenced with the landing gear warning HORN CUTOUT switch.

Flaps greater than 25 –

- regardless of forward thrust lever position. The landing gear warning horn cannot be silenced with the landing gear warning HORN CUTOUT switch.

The warning indication is cancelled when the configuration error is corrected.

Proximity Switch Electronic Unit (PSEU)

The PSEU monitors the following systems:

- takeoff configuration warnings
- landing configurations warnings
- landing gear
- air/ground sensing.

The PSEU, its sensors, and its input signals are monitored for internal faults. When designated faults are detected, a PSEU light on the aft overhead panel illuminates, and the OVERHEAD system annunciator light and MASTER CAUTION lights illuminate. The PSEU light can be reset following a maintenance BITE check or repair of the cause of the fault.

YA701 - YA710, YK622, YK623, YK961, YK962, YM482 - YM484
The PSEU light and OVERHEAD system annunciator do not illuminate for a single fault in certain redundant systems, also known as a "simple fault." However, if the system annunciator panel is pushed for recall, then the PSEU light and OVERHEAD system annunciator will illuminate for a simple fault; in this case, resetting the MASTER CAUTION system extinguishes the PSEU light.

YF048 - YF928, YK624 - YK630, YK963 - YL551, YN531 - YV754
The PSEU light, OVERHEAD system annunciator and Master Caution illuminate automatically for a single fault in certain redundant systems, also known as a "simple fault." However, in this case these lights will illuminate only after a landing. The PSEU light extinguishes when a parking brake is set or when both engines are turned off.

The PSEU light is inhibited:

- in flight
- when the thrust levers are advanced toward takeoff power
- for 30 seconds after landing.

Mach/Airspeed Warning System

Two independent Mach/airspeed warning systems provide a distinct aural warning, a clacker, any time the maximum operating airspeed of Vmo/Mmo is exceeded. The warning clackers can be silenced only by reducing airspeed below Vmo/Mmo.

The airspeed indicator displays red and black warning bands indicating maximum and minimum allowable airspeeds. The ends of the amber bands indicate maximum and minimum maneuver speeds.

When either an overspeed condition or a system test occurs, the ADIRU transmits a signal to the aural warning module, sounding the clacker. The system can only be tested on the ground.

Stall Warning System

Natural stall warning (buffet) usually occurs at a speed prior to stall. In some configurations the margin between stall and natural stall warning is less than desired. Therefore, an artificial stall warning device, a stick shaker, is used to provide the required warning.

The stall warning "stick shaker" consists of two eccentric weight motors, one on each control column. They are designed to alert the pilots before a stall develops. The warning is given by vibrating both control columns. The system is armed in flight at all times. The system is deactivated on the ground.

Two independent, identical stall management yaw damper (SMYD) computers determine when stall warning is required based upon:

- alpha vane angle of attack outputs
- ADIRU outputs
- anti–ice controls
- wing configurations
- air/ground sensing
- thrust
- FMC outputs.

The SMYD computers provide outputs for all stall warning to include stick shaker and signals to the pitch limit indicator and airspeed displays and the GPWS windshear detection and alert.

Two test switches are installed in the aft overhead panel. Pushing either of these initiates a self–test of the respective stall warning channel. The No.1 activates the Captain stick shaker, and the No. 2 activates the F/O stick shaker. Either stick shaker vibrates both columns through column interconnects.

Altitude Alerting System

Altitude alerting occurs when approaching or departing the MCP–selected altitude. Altitude alerting is inhibited when trailing edge flaps are extended to 25 or greater, or while G/S is captured.

PFD/ND

Acquisition Alerting

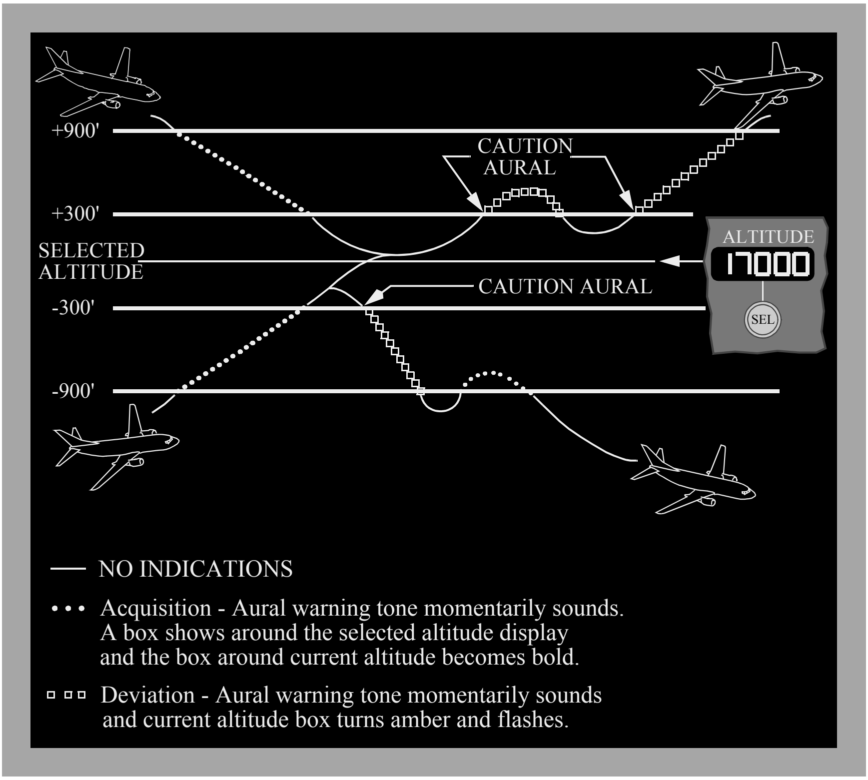
900 feet before reaching the selected altitude, a white box shows around the selected altitude display and the box around the current altitude becomes bold. A momentary tone sounds. At 300 feet from selected altitude, the selected altitude box no longer shows.

Deviation Alerting

When deviating by 300 feet from the selected altitude, a momentary tone sounds and the current altitude box turns amber and begins to flash. The amber flashing continues until:

- altitude deviation becomes less than 300 feet
- altitude deviation becomes more than 900 feet
- a new altitude is selected.

Altitude Alert Profile



— NO INDICATIONS

• • • Acquisition - Aural warning tone momentarily sounds. A box shows around the selected altitude display and the box around current altitude becomes bold.

▫ ▫ ▫ Deviation - Aural warning tone momentarily sounds and current altitude box turns amber and flashes.

Ground Proximity Alerts

The GPWS provides alerts for potentially hazardous flight conditions involving imminent impact with the ground.

The GPWS provides alerts based on radio altitude and combinations of barometric altitude, airspeed, glideslope deviation, and airplane configuration. The alerts are for:

- excessive descent rate
- excessive terrain closure rate
- altitude loss after takeoff or go-around
- unsafe terrain clearance when not in the landing configuration
- excessive deviation below an ILS glideslope

These alerts are “radio altitude based alerts.”

In addition to providing the functions of the basic GPWS, the EGPWS monitors terrain proximity using an internal world wide terrain data base. Proximate terrain data shows on the navigation display. If there is a potential terrain conflict, alerts are provided based on estimated time to impact. These alerts are "look-ahead terrain alerts."

Ground proximity alerts are accompanied by voice aural alerts and the PULL UP annunciation on the attitude indicators or, for deviation below glideslope alert, the BELOW G/S light.

Note: Terrain ahead of the airplane may exceed available climb performance. A ground proximity alert does not guarantee terrain clearance.

Look-ahead terrain alerts and radio altitude based alerts are prioritized based on the level of hazard and the required flight crew reaction time. Look-ahead terrain alerts and radio altitude based alerts are inhibited by an actual windshear warning (airplane in windshear).

Look–Ahead Terrain Alerting

The EGPWS terrain data base contains detailed terrain data near major airports, and data in lesser detail for areas between airports. Terrain within 2,000 feet of airplane barometric altitude shows on the navigation display. The terrain data is not designed to be an independent navigation aid.

YA701 - YA710, YK622 - YK625, YK961 - YK971, YL076, YL077, YM482 - YM484

Note: The EGPWS terrain data base, look-ahead terrain alerting, and terrain display do not account for man made obstructions.

The terrain display is generated from a data base contained in the EGPWS computer and correlated to GPS position.

Terrain and weather radar cannot show together on a display. If one pilot selects terrain and the other pilot selects weather radar, each display updates on alternating sweeps. All other displays (TCAS, LNAV routing, etc.) can show with terrain data.

Look-ahead terrain alerts are based on the airplane's position, barometric altitude, vertical flight path, and ground speed.

Look Ahead Terrain Alerts

AURAL ALERT	VISUAL ALERT	DESCRIPTION
TERRAIN TERRAIN, PULL UP	PULL UP on both attitude indicators Red TERRAIN message on navigation display (all modes) Solid red terrain on navigation display	20 to 30 seconds from projected impact with terrain shown solid red on the navigation display (in expanded MAP, center MAP, expanded VOR, or expanded APP modes only). Moving the ground proximity terrain inhibit switch to TERRAIN INHIBIT inhibits the alert.
CAUTION TERRAIN	Amber TERRAIN message on navigation display (all modes) Solid amber terrain on navigation displays	40 to 60 seconds from projected impact with terrain shown solid amber on the navigation display (in expanded MAP, center MAP, expanded VOR, or expanded APP modes only). Moving the ground proximity terrain inhibit switch to TERRAIN INHIBIT inhibits the alert.
TOO LOW, TERRAIN	PULL UP on both attitude indicators	Descent below unsafe radio altitude while too far from any airport in the terrain database. Moving the ground proximity terrain inhibit switch to TERRAIN INHIBIT inhibits the alert.

Radio Altitude Based Alerts

AURAL ALERT	VISUAL ALERT	DESCRIPTION
PULL UP	PULL UP on both attitude indicators	Follows SINK RATE alert if excessive descent rate continues or increases. Follows radio altitude based TERRAIN alert if excessive terrain closure rate continues and landing gear and/or flaps are not in landing configuration.
TERRAIN	PULL UP on both attitude indicators	Excessive terrain closure rate.
DON’T SINK	PULL UP on both attitude indicators	Excessive altitude loss after takeoff or go–around.
GLIDESLOPE	BELOW G/S P–INHIBIT lights	Deviation below glideslope. Volume and repetition rate increase as deviation increases. Pushing the ground proximity BELOW G/S P-INHIBIT light cancels or inhibits the alert below 1,000 feet RA.
SINK RATE	PULL UP on both attitude indicators	Excessive descent rate.
TOO LOW, FLAPS	PULL UP on both attitude indicators	Unsafe terrain clearance at low airspeed with flaps not in a normal landing position. Pushing the ground proximity flap inhibit switch to FLAP INHIBIT inhibits the alert.
TOO LOW, GEAR	PULL UP on both attitude indicators	Unsafe terrain clearance at low airspeed with landing gear not down. Pushing the ground proximity gear inhibit switch to GEAR INHIBIT inhibits the alert.

AURAL ALERT	VISUAL ALERT	DESCRIPTION
TOO LOW, TERRAIN	PULL UP on both attitude indicators	Unsafe terrain clearance at high airspeed with either landing gear not down or flaps not in landing position. Follows DON'T SINK if another descent is initiated after initial alert, before climbing to the altitude where the initial descent began.

Obstacle Alerts

YF048 - YF928, YK626 - YK630, YK973 - YK980, YL541 - YL551, YN531 - YV754

Obstacle display and alerting provides caution and warning level alerts for man-made obstacles 100 feet and higher.

Aural Alert	Visual Alert	Description
OBSTACLE OBSTACLE, PULL UP	PULL UP on both attitude indicators Red OBSTACLE message on ND (all modes) Solid red terrain on ND	20 to 30 seconds from projected impact with obstacle shown solid red on the ND (in MAP, MAP CTR, VOR, or APP modes only). Moving the ground proximity terrain inhibit switch to TERRAIN INHIBIT inhibits the alert.
CAUTION OBSTACLE	Amber OBSTACLE message on ND (all modes) Solid amber terrain on ND	40 to 60 seconds from projected impact with obstacle shown solid amber on the ND (in MAP, MAP CTR, VOR, or APP modes only). Moving the ground proximity terrain inhibit switch to TERRAIN INHIBIT inhibits the alert.

Windshear Alerts

Windshear alerts are available during takeoff, approach, and landing:

- The GPWS provides a warning when the airplane is in a windshear.
- The weather radar provides alerts for excessive windshear ahead of the airplane. These are “predictive windshear alerts.”

Windshear warnings are accompanied by a red WINDSHEAR message on the attitude indicators and voice aural alerts.

Windshear cautions are accompanied by a voice aural alert.

Windshear alerts are prioritized based on the level of hazard and the required flight crew reaction time. Predictive windshear alerts are inhibited by an actual windshear warning (airplane in windshear), look-ahead terrain alerts, or radio altitude based alerts.

Windshear Warning (Airplane in Windshear)

AURAL ALERT	VISUAL ALERT	DESCRIPTION
Two–tone siren followed by WINDSHEAR	Red WINDSHEAR on both attitude indicators.	Excessive windshear at the current airplane position detected by GPWS. Enabled below 1,500 feet RA. GPWS Windshear detection begins at rotation.

Predictive Windshear Alerts

The weather radar uses radar imaging to detect disturbed air prior to entering a windshear.

Note: The weather radar provides windshear alerts for windshear events containing some level of moisture or particulate matter.

Note: The weather radar detects microbursts and other windshears with similar characteristics. The weather radar does not provide alerting for all types of windshear. The flight crew must continue to rely on traditional windshear avoidance methods.

AURAL ALERT	VISUAL ALERT	DESCRIPTION
WINDSHEAR AHEAD	Red WINDSHEAR on both attitude indicators RED windshear symbol on navigation display Red WINDSHEAR message on navigation display (all modes)	Windshear close to and directly ahead of the airplane detected by the weather radar. Enabled during takeoff, below 1,200 feet RA. Predictive windshear symbol on the navigation display shows windshear position (expanded MAP, center MAP, expanded VOR or expanded APP modes only).
GO AROUND, WINDSHEAR AHEAD	Red WINDSHEAR on both attitude indicators RED windshear symbol on navigation display Red WINDSHEAR message on navigation display (all modes)	Windshear within 1.5 miles and directly ahead of the airplane detected by the weather radar. Enabled during approach, below 1,200 feet RA. Predictive windshear symbol on the navigation display shows windshear position (expanded MAP, center MAP, expanded VOR or expanded APP modes only).
MONITOR RADAR DISPLAY	RED windshear symbol on navigation display Amber WINDSHEAR message on navigation display (all modes)	Windshear within 3 miles and ahead of the airplane detected by the weather radar. Enabled during takeoff and approach, below 1,200 feet RA. Predictive windshear symbol on the navigation display shows windshear position (expanded MAP, center MAP, expanded VOR or expanded APP modes only).

The weather radar automatically begins scanning for windshear when:

- thrust levers set for takeoff, even if engine is off or IRS not aligned, or
- in flight below 2,300 feet RA (predictive windshear alerts are issued below 1,200 feet RA).

YF048 - YL551, YN531 - YV754

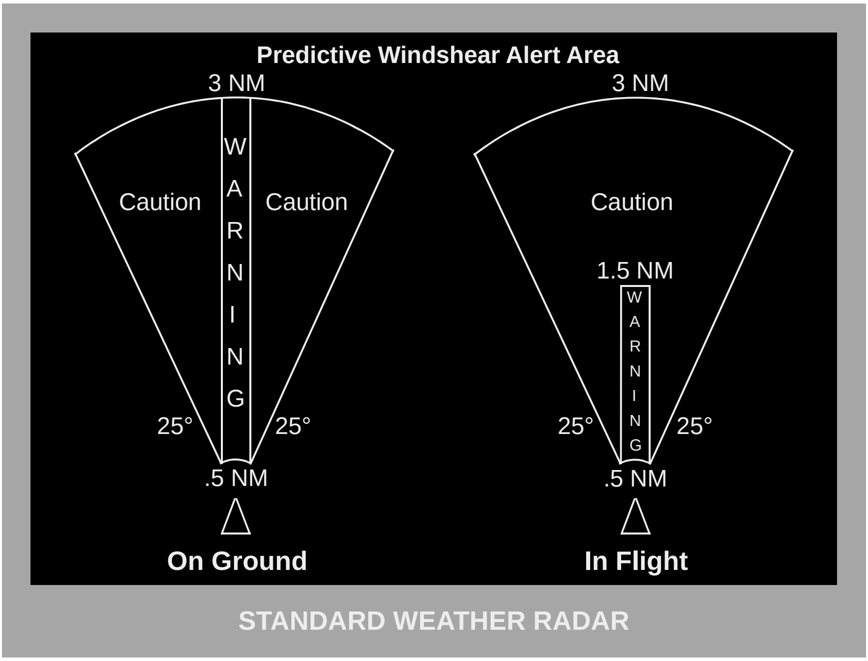
Alerts are available approximately 12 seconds after the weather radar begins scanning for windshear. Predictive windshear alerts can be enabled prior to takeoff by pushing the EFIS control panel WXR switch.

YA701 - YA710, YM482 - YM484

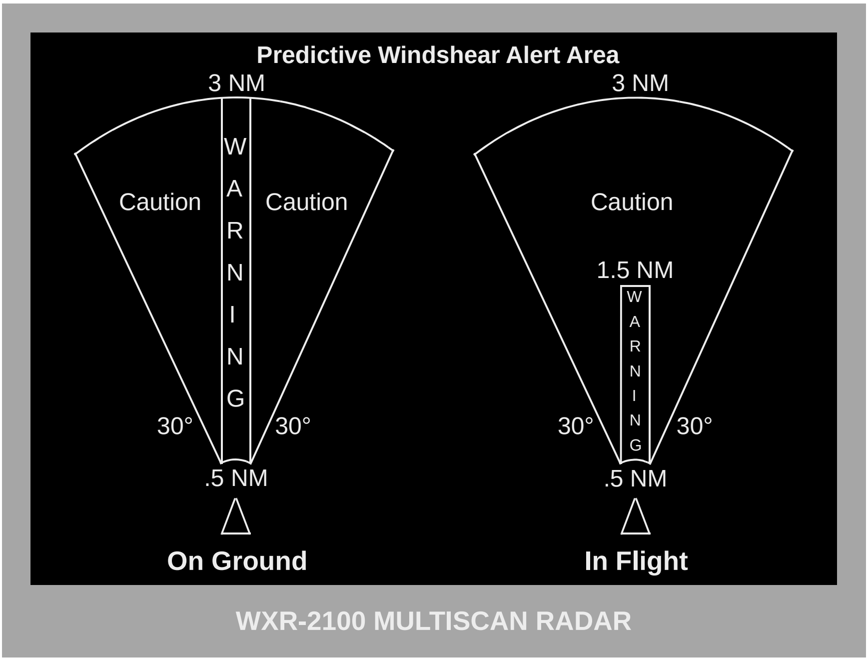
Alerts are available approximately 12 seconds after the weather radar begins scanning for windshear. Predictive windshear alerts can be enabled prior to takeoff by pushing the EFIS control panel WXR switch. When PWS is enabled, radar antenna scan sweep is reduced.

If windshear is not detected, weather radar returns show only after pushing the EFIS control panel WXR switch.

YA701 - YA710, YM482 - YM484



YF048 - YL551, YN531 - YV754



Predictive Windshear Inhibits

During takeoff and landing, new predictive windshear caution alerts are inhibited between 80 knots and 400 feet RA, and new warning alerts between 100 knots and 50 feet RA. These inhibits do not remove existing predictive windshear alerts. If a warning/caution event occurs before those boundaries, it will remain on the display and the complete aural callout will be annunciated.

Bank Angle Alert

The GPWS provides the aural alert BANK ANGLE, BANK ANGLE when roll angle exceeds 35 degrees, 40 degrees, and 45 degrees. Once sounded, the alert is silent for that bank angle (35, 40, or 45 degrees) until the system is reset by decreasing bank angle to 30 degrees or less.

YV751 - YV754

Roll/Yaw Asymmetry Alert

When the autopilot has reached 75% of its total roll authority:

- An amber alert, ROLL/YAW ASYMMETRY appears on the Primary Flight Display (PFD);
- the bank pointer and slip/skid indicator become outlined in amber;
- if the slip/skid indicator is deflected greater than 25% of its width, the slip/skid indicator becomes solid amber.

Roll Authority Alert

When the autopilot has reached 100% of its total roll authority:

- The amber alert, ROLL AUTHORITY appears on the PFD;
- an aural alert, "ROLL AUTHORITY, ROLL AUTHORITY," annunciates;
- the bank pointer and slip/skid indicator outlines in amber;
- if the bank angle exceeds 15 degrees, the bank pointer becomes solid amber;
- if the slip/skid indicator is deflected greater than 25% of its width, the slip/skid indicator becomes solid amber.

Enhanced Bank Angle Warning

The Enhanced Bank Angle Warning provides a time-critical warning in case of an roll upset greater than 45 degrees of bank. The alert consists of a curved red arrow on the PFD as well as a GPWS dirived aural alert. The roll command arrow and voice aural alerts indicate the shortest direction to return the airplane to wings level. If the airplane is banked beyond 45 degrees to the right(left), the arrow appears pointing to the left(right), and the aural repeats "ROLL LEFT(RIGHT)...ROLL LEFT(RIGHT)." The voice aural repeats at intervals of 5 seconds. The alert stops when the bank angle decreases below 35 degrees for at least 2 seconds, or immediately when the bank angle decreases to less than 10 degrees.

There are a number of inputs and inhibited conditions for the Enhanced Bank Angle Warning:

- At pitch angles less than 25 degrees nose up, the ROLL LEFT (RIGHT) warning triggers at 45 degrees of bank, replacing the standard 45 degree BANK ANGLE alert.
- When pitch attitude exceeds 25 degrees nose up, the ROLL LEFT(RIGHT) warning alert is suppressed until 65 degrees of bank. This feature is called the Pitch Attitude Latch.

- The Pitch Attitude Latch is deactivated when the pitch attitude exceeds 25 degrees nose up and bank angle is less than 60 degrees, or the pitch attitude decreases below 10 degrees nose up.
- When the warning is displayed, the flight director is removed from the display.
- When the warning is displayed, TCAS resolution advisories will not appear on the display.
- If stick shaker is activated, the Enhanced Bank Angle Warning is suppressed.
- If the roll attitude comparator detects a difference between IRS inputs, the Enhanced Bank Angle Warning is inhibited.

The roll command arrow points in the shortest direction to wings level. If the bank angle passes 180 degrees, the roll command arrow points in the new shortest direction to wings level.

The roll command arrow is removed when the bank angle is less than 35 degrees for two seconds, allowing the flight crew to return to a 30 degree bank, if desired. If the crew continues to roll quickly towards wings level, the roll command arrow is removed immediately at 10 degrees of bank, in order to prevent overbanking in the other direction.

Alerts and Messages

Alert	Description
ROLL/YAW ASYMMETRY on PFD. Amber outline around bank pointer. Amber outline around slip/skid indicator	Slow-onset roll condition. The autopilot has reached 75% of its total roll authority.
ROLL/YAW ASYMMETRY on PFD. Amber outline around bank pointer. Solid amber slip/skid indicator	Slow-onset roll condition. The autopilot has reached 75% of its total roll authority. Excessive yaw (slip/skid indicator deflected greater than 25% of its width).

ROLL AUTHORITY on PFD. Amber outline around bank pointer. Amber outline around slip/skid indicator. "ROLL AUTHORITY, ROLL AUTHORITY" aural.	Fast-onset roll condition. The autopilot has reached 100% of its total roll authority.
ROLL AUTHORITY on PFD. Amber outline around bank pointer. Solid amber slip/skid indicator. "ROLL AUTHORITY, ROLL AUTHORITY" aural.	Fast-onset roll condition. The autopilot has reached 100% of its total roll authority. Excessive yaw (slip/skid indicator deflected greater than 25% of its width).

ROLL AUTHORITY on PFD. Solid amber bank pointer. Amber outline around slip/skid indicator. "ROLL AUTHORITY, ROLL AUTHORITY" aural.	Fast-onset roll condition. The autopilot has reached 100% of its total roll authority. Excessive uncommanded bank (greater than 15 degrees of bank).
ROLL AUTHORITY on PFD. Solid amber bank pointer. Solid amber slip/skid indicator. "ROLL AUTHORITY, ROLL AUTHORITY" aural.	Fast-onset roll condition. The autopilot has reached 100% of its total roll authority. Excessive uncommanded bank (greater than 15 degrees of bank). Excessive yaw (slip/skid indicator deflected greater than 25% of its width).

Red roll command arrow. Solid red bank pointer. Solid red slip/skid indicator. "ROLL RIGHT, ROLL RIGHT ("ROLL LEFT, ROLL LEFT") aural.	Pitch angle less than 25 degrees, airplane has reached 45 degrees of bank angle. Pitch angle greater than 25 degree, airplane has reached 60 degrees of bank angle.

Airspeed Low Alert

On airplanes with Airspeed Low aural, an alert "AIRSPEED LOW, AIRSPEED LOW" provides the flight crew with low airspeed awareness. The aural annunciates when the current airspeed decreases into the minimum maneuver speed amber bar.

The aural coincides with the low airspeed alert on the airspeed indication.

Approach Callouts

Radio Altitude Callouts

The GPWS provides the following altitude callouts during approach:

- 500 feet – FIVE HUNDRED
- 400 feet – FOUR HUNDRED
- 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.

Smart 500 Radio Altitude Callout

YA707 - YA710

The Smart 500 Callout annunciates FIVE HUNDRED during a non-ILS or non-GLS approach. Activation of this callout is dependent only on lack of an ILS or GLS. However, if flying an ILS or GLS approach, and there is excessive flight path deviation, the GPWS will conclude a non-ILS or non-GLS approach is being flown. This feature functions with or without any of the normal altitude callouts.

When descending below 500 feet radio altitude on approach, a FIVE HUNDRED callout is given if:

- an approach other than ILS (the ILS frequency is not tuned) or GLS is used, or
- a backcourse approach is detected, or
- Glideslope Cancel is selected, or
- the flight path is not within +/- 2 dots of a valid localizer beam (excessive ILS or GLS flightpath deviation), or
- the flight path is not within +/- 2 dots of a valid glideslope (excessive ILS or GLS flightpath deviation)

The Smart 500 Callout will override the normal 500 foot radio altitude callout. Therefore, a FIVE HUNDRED callout is given only if one or more of the previously listed conditions are true. An airplane on an ILS or GLS approach will not get a FIVE HUNDRED callout, unless it is outside the localizer beam or glideslope as outlined above.

DH/MDA Callouts

The GPWS provides height callouts based on the altitude set by the Captain’s Minimums selector.

Callouts are based on radio altitude when the MINS selector is set to RADIO. Callouts are based on barometric altitude when the MINS selector is set to BARO:

- at DH/MDA – MINIMUMS

Traffic Alert and Collision Avoidance System (TCAS)

TCAS alerts the crew to possible conflicting traffic. TCAS interrogates operating transponders in other airplanes, tracks the other airplanes by analyzing the transponder replies, and predicts the flight paths and positions. TCAS provides advisory and traffic displays of the other airplanes to the flight crew. Neither advisory, guidance, nor traffic display is provided for other airplanes which do not have operating transponders. TCAS operation is independent of ground–based air traffic control.

To provide advisories, TCAS identifies a three dimensional airspace around the airplane where a high likelihood of traffic conflict exists. The dimensions of this airspace are based upon the closure rate with conflicting traffic.

TCAS equipment interrogates the transponders of other airplanes to determine their range, bearing, and altitude. A traffic advisory (TA) is generated when the other airplane is approximately 40 seconds from the point of closest approach. If the other airplane continues to close, a resolution advisory (RA) is generated when the other airplane is approximately 25 seconds from the point of closest approach. The RA provides aural warning and guidance as well as maneuver guidance to maintain or increase separation from the traffic.

Non–transponder equipped airplanes are invisible to TCAS. RAs can be generated if the other airplane has a mode C transponder. Coordinated RAs require both airplanes to have TCAS.

Advisories and Displays

Annunciations associated with TCAS and the traffic displays are discussed further in Chapter 10.

TAs are indicated by the aural “TRAFFIC, TRAFFIC” which sounds once and is then reset until the next TA occurs. The TRAFFIC annunciation appears on the navigation display. The TA symbol appears at the proper range and relative bearing of the other airplane. Altitude and vertical motion are included with the symbol if the other airplane is using transponder mode S or C.

RAs are indicated by one or more aural listed in the RA aural table. The TRAFFIC annunciation and RA symbol which depicts the traffic’s relative bearing, range, altitude, and vertical motion are on the navigation display similar to the TA symbol.

Additional symbols are proximate traffic and other traffic. Proximate traffic is within six miles and 1200 feet vertically, but is not expected to cause a TA or RA alert. Other traffic is beyond the six mile and 1200 feet vertical criteria. Traffic symbols are revised as the TCAS system constantly reevaluates the motion of other airplanes.

If the range of the navigation display does not permit the display of a TA or RA an OFFSCALE annunciation appears on the navigation display.

TA or RA traffic detected by TCAS which do not provide a bearing generate a no–bearing text block beneath the TRAFFIC text on the navigation display. The text block contains distance, altitude, and vertical motion information.

Vertical motion information is indicated by an arrow depicting a climb or descent if a change of greater than 500 feet per minute is detected.

TCAS display automatically shows when:

- the transponder mode selector is in TA ONLY or TA/RA, and
- a TCAS TA or RA occurs, and
- neither pilot has the TCAS (TFC) display selected, and
- in MAP, center MAP, VOR, or APP modes.

Inhibits

INCREASE DESCENT RAs are inhibited below approximately 1,500 feet radio altitude.

DESCEND RAs are inhibited below approximately 1,100 feet radio altitude.

RAs are inhibited below approximately 1,000 feet radio altitude. Below 1,000 feet when the TA/RA mode is selected on the transponder panel, TA only mode is enabled automatically and the TCAS message TA ONLY displays on the ND.

All TCAS voice annunciations are inhibited below approximately 500 feet radio altitude.

All TCAS alerts are inhibited by GPWS and windshear warnings.

Mode Control

The TCAS operating mode is controlled from the TCAS/ATC transponder panel. TCAS is normally operated in the TA/RA mode. However, sometimes it is necessary to operate in the TA ONLY mode to prevent undesired RAs. For example, TA ONLY may be selected when intentionally operating near other airplanes such as might be found in VFR conditions at a busy airport, or on parallel approach.

ATC transponders on TCAS equipped airplanes communicate to provide appropriate coordinated avoidance maneuvers. When performance is limited, such as with an inoperative engine, select TA ONLY to prevent receiving RAs beyond the airplane’s capabilities, and to prevent communicating to other airplanes an ability to perform a RA maneuver.

Resolution Advisory Aurals

The following table(s) identifies the possible callouts associated with RAs and the vertical restrictions or maneuver recommended in each case.

YA701 - YS178, YS191 - YS194

AURAL ALERTS	VERTICAL RESTRICTIONS/MANEUVER
MONITOR VERTICAL SPEED	Present pitch attitude is outside the RA pitch command area. Keep pitch attitude away from red area.
MAINTAIN VERTICAL SPEED, MAINTAIN	
MAINTAIN VERTICAL SPEED, CROSSING MAINTAIN	
CLIMB, CLIMB	Climb at the displayed pitch
DESCEND, DESCEND	Descend at the displayed pitch
ADJUST VERTICAL SPEED, ADJUST	Reduce climb or descent rate
CLIMB, CROSSING CLIMB, CLIMB, CROSSING CLIMB	Climb at displayed pitch. Airplane climbs through traffic’s altitude.
DESCEND, CROSSING DESCEND DESCEND, CROSSING DESCEND	Descend at displayed pitch. Airplane descends through traffic’s altitude.
INCREASE CLIMB, INCREASE CLIMB	Increase climb rate from initial pitch attitude.
INCREASE DESCENT, INCREASE DESCENT	Increase descent rate from initial pitch attitude.
CLIMB – CLIMB NOW, CLIMB – CLIMB NOW	Reversal maneuver from initial descent RA.
DESCEND – DESCEND NOW, DESCEND – DESCEND NOW	Reversal maneuver from initial climb RA.
CLEAR OF CONFLICT	RA encounter terminated. Maneuver guidance no longer displayed.

YS179 - YS190, YT501 - YV754

AURAL ALERTS	VERTICAL RESTRICTIONS/MANEUVER
MONITOR VERTICAL SPEED	Present pitch attitude is outside the RA pitch command area. Keep pitch attitude away from red area.
MAINTAIN VERTICAL SPEED, MAINTAIN	
MAINTAIN VERTICAL SPEED, CROSSING MAINTAIN	
CLIMB, CLIMB	Climb at the displayed pitch
DESCEND, DESCEND	Descend at the displayed pitch
LEVEL OFF, LEVEL OFF	Reduce climb or descent rate to 0 feet per minute.
CLIMB, CROSSING CLIMB, CLIMB, CROSSING CLIMB	Climb at displayed pitch. Airplane climbs through traffic’s altitude.
DESCEND, CROSSING DESCEND DESCEND, CROSSING DESCEND	Descend at displayed pitch. Airplane descends through traffic’s altitude.
INCREASE CLIMB, INCREASE CLIMB	Increase climb rate from initial pitch attitude.
INCREASE DESCENT, INCREASE DESCENT	Increase descent rate from initial pitch attitude.
CLIMB – CLIMB NOW, CLIMB – CLIMB NOW	Reversal maneuver from initial descent RA.
DESCEND – DESCEND NOW, DESCEND – DESCEND NOW	Reversal maneuver from initial climb RA.
CLEAR OF CONFLICT	RA encounter terminated. Maneuver guidance no longer displayed.

Tail Skid

YF048 - YL551, YS151 - YV754

The tail skid assembly consists of a cartridge assembly, tail skid, fairing (skirt) and shoe. The fairing provides an enclosure for the actual tail skid structure. The shoe is fitted to the bottom of the fairing.

The cartridge assembly consists of a crushable honeycomb material. When the tail skid strikes the runway the skid moves upward and the honeycomb material crushes. The tail skid is serviceable when the cartridge warning decal shows both green and red. The green disappears gradually as the cartridge is crushed. When the warning decal is all red, the cartridge must be replaced.

The shoe is what contacts the runway in the event of an over rotation. The shoe surface displays “wear dimples” which serve as a reference for shoe replacement.

CAUTION: Cartridge assembly warning placard must be checked as soon as possible after the tail strike. The tail skid skirt fairing may re-extend due to gravity as time passes resulting in a reading error on the warning placard decal.

Tail Skid Detail