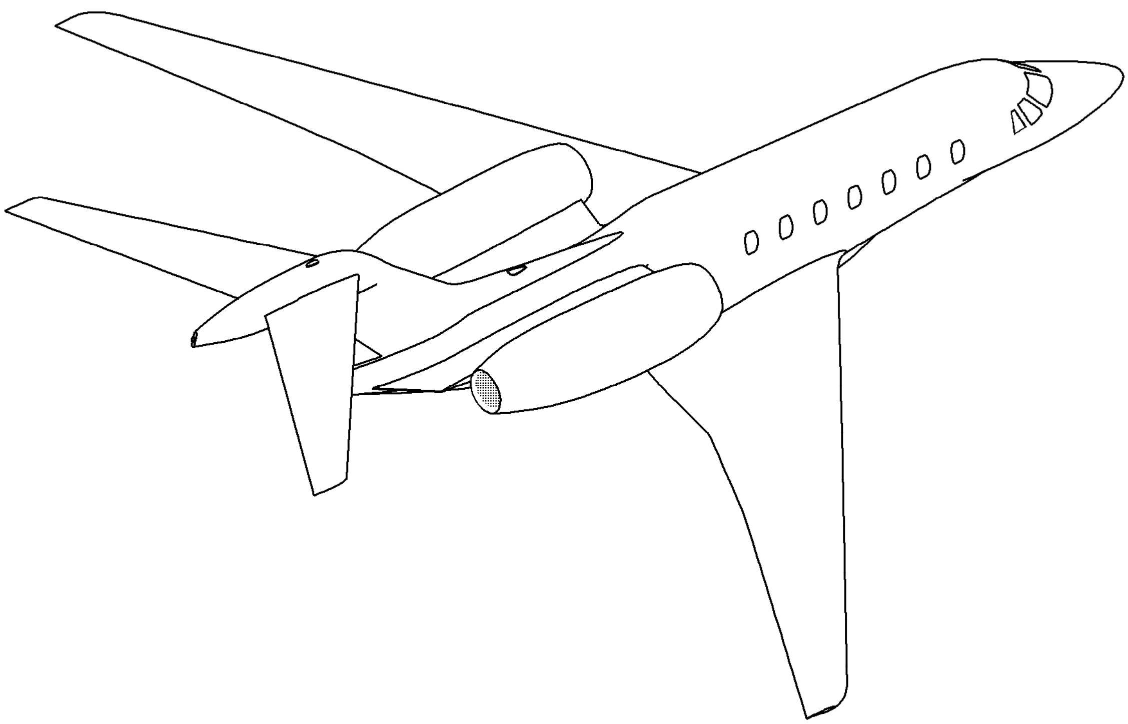
Cessna
A Textron Company

Operating Manual

MODEL 750

Citation X

AIRPLANES 750-0001 THRU -0172



Member of GAMA

1 JULY 1996

75OM-07

REVISION 7

11 OCTOBER 2002

LOG OF EFFECTIVE PAGES

Use this page to determine the currency and applicability of your Operating Manual. Determine which pages are applicable to your airplane by checking effectivity of each page, which is listed after each page entry where an airplane serialization is required. Only the pages applicable to your airplane should be retained in the Operating Manual. This manual pertains to Model 750 airplanes, units -0001 and -0172 (Citation X).

Following is a description of the Log of Effective Pages columns:

Page - Indicates current Operating Manual page numbers.
Revision Number - Indicates the revision number.
Serialization - Listed after applicable page, where airplane serialization is required for effectivity. Serialization is given by airplane unit number.

	REVISION NUMBER	DATE
Original	0	1 July 1996
Revised	1	21 February 1997
Revised	2	13 November 1997
Revised	3	15 March 1999
Revised	4	9 November 1999
Revised	5	15 November 2000
Revised	6	22 July 2002
Revised	7	11 October 2002

PAGE	REVISION NUMBER
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Effectivity-1 thru Effectivity-8	7
Introduction-1 thru Introduction-6	7
Introduction 7 thru Introduction-37/Introduction-38	6
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1-3 thru 1-4	0
1-5/1-6 (blank)	0
1-7/1-8 (blank)	1
1-9	0
1-10	1
1-11 thru 1-12	6
1-13	4
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1-15	1
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Configuration AB	
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Configuration AC	
1-17.1	6
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1-18A/1-18B	Added 5
1-19	6
1-20	6
1-21	5
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Configuration AU	
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Configuration AV	
1-23.1	6
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1-25	1
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Configuration AS	
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Configuration AL	
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For Airplanes not equipped with the split bus electrical system utilize pages 4-1 through 6-47/6-48. Discard pages 4-1A through 6-48A.

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Configuration AC 4-32	6
Configuration AB 4-32.1	6
Configuration AY 4-33	6
Configuration AZ 4-33.1	6
Configuration AL 4-34 thru 4-42	6
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Configuration AL 5-1	6
Configuration AL 5-2	5
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Configuration AL 5-72	4
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Configuration AL 5-77 thru 5-82	4
Configuration AY 5-83	6
Configuration AZ 5-83.1	6
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INTRODUCTION

COVERAGE

This manual is intended to provide an information source for familiarization, review and suggested technique to achieve maximum safety, passenger comfort and utility, and is based on experience gained in the typical transport category jet operating environment.

While the Operating Manual expands upon FAA Approved Airplane Flight Manual information, it may not be as current. The FAA approved document shall take precedence should a difference be noted.

REVISIONS

As new information becomes available, the Operating Manual will be revised.

REVISED MATERIAL INDICATORS

Two types of revised material indicators will be used in this manual.

A miniature pointing hand will be used to denote a changed figure. The miniature hand will point to the figure number; i.e., ☛ Figure x-x.

A bar will be located along the left edge of the page to indicate where text has been added, revised or deleted.

All revised pages will carry the revision number on the applicable page, opposite the page number. A list of revisions is located at the beginning of the Log of Effective Pages.

SYMBOLS USED FOR PROCEDURE DIVISION

Symbols are used to mark different parts of procedures. A decision must be made by the pilot to identify the applicable part of the procedure. After the initial choice has been made, a further division of the procedure is possible. In that case, a second choice must be made, etc. Once a choice has been made, all remaining actions, consequences, and references are listed. When the procedure is no longer required this will be indicated by "Procedure Completed".

The division symbols are identified as follows:

■ First Division

● Second Division

□ Third Division

○ Fourth Division

SERVICE BULLETIN CONFIGURATION LIST

The following is a list of Service Bulletins that are applicable to the operation of the airplane, and have been incorporated into this manual. This list contains only those Service Bulletins that are currently active.

Number	Title	Airplane Serial Effectivity	Revision Incorporated	Incorporated In Airplane
SB750-34-05	Navigation - Reduced Vertical Separation Minimum (RVSM) Operation Modification	750-0001 thru -0105	4	
SB750-78-02	Exhaust - Thrust Reverser Product Improvement	750-0001 thru -0085	4	
SB750-35-01	Oxygen - Oxygen Sequence Regulator Installation	750-0001 thru -0064	6	
SB750-31-02	Indicating/Recording Systems - Electrical System Monitor and Bleed Air Printed Circuit Board Installation	750-0001 thru -0074 and -0076 thru -0079	6	
SB750-34-14	Navigation - Honeywell Primus 2000 Performance Data Phase 6.0	750-0001 thru -0149	6	
SB750-76-02	Engine Controls - FADEC Software V7.15 Revision	750-0001 thru -0157	6	
SB750-76-05	Engine Controls - FADEC Software V8.3 Revision	750-0001 thru -0172	7	

AIRPLANE CONFIGURATION CODES

The following is a list of airplane configuration codes which appear at the bottom of each page of the basic Operating Manual, and indicate page effectivity by serial number. This list contains only the configurations which have been incorporated into this basic manual.

Configuration Code	Effectivity by Serial Number
AA	Airplanes 750-0001 thru -0172.
AB	Airplanes 750-0001 thru -0085 not incorporating SB750-78-02.
AC	Airplanes 750-0001 thru -0085 incorporating SB750-78-02 and Airplanes 750-0086 thru -0172.
AD	Airplanes 750-0001 thru -0126.
AE	Airplanes 750-0127 thru -0172.
AF	Airplanes 750-0001 thru 750-0041 not incorporating SB750-34-05.
AG	Airplanes 750-0001 thru -0041 incorporating SB750-34-05 and airplanes 750-0042 thru -0172.
AK	Airplanes 750-0001, -0075, -0080, -0085 and -0101 thru -0172 equipped with split bus electrical system.
AL	Airplanes 750-0002 thru -0074, -0076 thru -0079, -0081 thru -0084 and -0086 thru -0100 not equipped with split bus electrical system.
AM	Airplanes 750-0115 thru -0172 and Airplanes 750-0110 thru -0114 incorporating SL750-34-08.
AN	Airplanes 750-0067 thru -0172.
AO	Airplanes 750-0001 thru -0067.
AP	Airplanes 750-0080 thru -0172.

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AIRPLANE CONFIGURATION CODES (Continued)

AQ	Airplanes 750-0001 thru -0109 and Airplanes 750-0110 thru -0114 not incorporating SL750-34-08.
AR	Airplanes 750-0001 thru -0079.
AS	Airplanes 750-0150 thru -0172.
AT	Airplanes 750-0001 thru -0149.
AU	Airplanes 750-0128 thru 750-0172.
AV	Airplanes 750-0001 thru 0127.
AW	Airplanes 750-0002 thru -0074 and -0076 thru -0079 incorporating SB750-31-02 and SB750-34-14 and Airplanes 750-0001, -0075 and -0080 thru -0149 incorporating SB750-34-14 and Airplanes 750-0150 thru -0172.
AX	Airplanes 750-0002 thru -0074 and -0076 thru -0079 not incorporating SB750-31-02 or SB750-34-14 and Airplanes 750-0001, -0075 and -0080 thru -0149 not incorporating SB750-34-14.
AY	Airplanes 750-0001 thru -0085 incorporating SB750-78-02 and Airplanes 750-0002 thru -0074 and -0076 thru -0079 incorporating SB750-31-02 and SB750-34-14 and Airplanes 750-0001, -0075 and -0080 thru -0149 incorporating SB750-34-14 and Airplanes 750-0150 thru -0172.
AZ	Airplanes 750-0001 thru -0085 incorporating SB750-78-02 and Airplanes 750-0002 thru -0074 and -0076 thru -0079 not incorporating SB750-31-02 or SB750-34-14 and Airplanes 750-0001, -0075 and -0080 thru -0149 not incorporating SB750-34-14.

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AIRPLANE CONFIGURATION CODES (Continued)

BA	Airplanes 750-0002 thru -0074 and -0076 thru -0079 not incorporating SB750-78-02 but incorporating SB750-31-02 and SB750-34-14 and Airplanes 750-0001, -0075 and -0080 not incorporating SB750-78-02 but incorporating SB750-34-14 and Airplanes 750-0081 thru -0085 not incorporating SB750-78-02 but incorporating SB750-34-14 and Airplanes 750-0086 thru -0149 incorporating SB750-34-14.
BB	Airplanes 750-0001 thru -0085 not incorporating SB750-78-02 and Airplanes 750-0002 thru -0074 and -0076 thru -0079 not incorporating SB750-31-02 or SB750-34-14 and Airplanes 750-0001, -0075 and -0080 thru -0149 not incorporating SB750-34-14.
BC	Airplanes 750-0001 thru -0157 incorporating SB750-76-02 and Airplanes 750-0158 thru -0172. Airplanes -0001 thru -0172 not incorporating SB750-76-05.
BD	Airplanes 750-0001 thru -0157 not incorporating SB750-76-02. Airplanes -0001 thru -0157 not incorporating SB750-76-05.
BE	Airplanes 750-0001 thru -0027 and -0029 thru -0172.
BF	Airplane 750-0028.
BG	Airplanes 750-0001 thru -0127 incorporating SB750-34-14.
BH	Airplanes 750-0001 thru -0127 not incorporating SB750-34-14.
BI	Airplanes 750-0128 thru -0149 incorporating SB750-34-14 and Airplanes 750-0150 thru -0172.
BJ	Airplanes 75-0128 thru -0149 not incorporating SB750-34-14.
BK	Airplanes -0001 thru -0172 incorporating SB750-76-05.

AIRPLANE CONFIGURATION CODES (Continued)

BL	Airplanes 750-0001 thru -0085 not incorporating SB750-78-02.
BM	Airplanes 750-0001 thru -0085 incorporating SB750-78-02 and Airplanes 750-0086 thru -0172.

DEFINITIONS AND ABBREVIATIONS

AC:	Alternating Current.
Accelerate-Stop Distance:	The distance required to accelerate to V_1 and abort the takeoff and come to a complete stop with maximum braking applied at V_1.
ADC:	Air Data Computer.
ADF:	Automatic Direction Finding.
ADI:	Attitude Director Indicator.
AHRS:	Attitude and Heading Reference System.
AIA:	Anti-Icing Additive.
Altitude:	All altitudes used in this manual are pressure altitudes unless otherwise stated.
AM or AME:	Amplitude modulation.
Anti-Ice Systems:	The following systems comprise the Anti-Ice Systems: a. Windshield Electrical Anti-Ice. b. Wing Anti-Ice and Horizontal Stabilizer Anti-Ice. c. Engine Anti-Ice.

NOTE

Performance, when referred to ANTI-ICE ON, is based on these three systems being operated at the same time.

d. Windshield Anti-Ice.
e. Pitot Static Anti-Ice (including RAT and AOA probes).

APU:	Onboard Auxiliary Power Unit.
Arm:	The horizontal distance from the reference datum to the center of gravity (C.G.) of an item.
ATC:	Air Traffic Control.
Basic Empty Weight:	Standard empty weight plus installed optional equipment.
°C:	Temperature in degrees Celsius.
Calibrated Airspeed (KCAS):	Indicated airspeed (knots) corrected for position error and assumes zero instrument error.
CAS:	Calibrated Airspeed. The indicated airspeed corrected for installation error. Calibrated airspeed is equal to true airspeed at sea level in an international standard atmosphere.
CAS:	Crew Alerting System (Part of EICAS system).
Calibrated Mach Number:	The displayed Mach Number value with position error removed.
CAT II:	Category II Operation. A straight-in ILS approach to the runway of an airport under a Category II ILS instrument approach procedure.
CB:	Circuit Breaker.

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DEFINITIONS AND ABBREVIATIONS (Continued)

CDI:	Course Deviation Indicator.
Center-of-Gravity (C.G.):	The point at which an airplane would balance if suspended.
C.G. Arm:	The arm obtained by adding the airplane's individual moments and dividing the sum by the total weight.
C.G. Limits:	The extreme center-of-gravity locations within which the airplane must be operated at a given weight.
Climb Gradient:	The ratio of the change in height during a portion of a climb, to the horizontal distance transversed in the same time interval.
Cruise Climb Power:	Power recommended for optimum enroute climb.
DC:	Direct Current.
Demonstrated Crosswind:	The demonstrated crosswind velocity of 21 knots (measured at 10 meters above the runway surface) is the velocity of the crosswind component for which adequate control of the airplane during takeoff and landing was actually demonstrated during certification tests. This is not limiting.
DG:	Directional Gyro.
DH:	Decision Height.
DME:	Distance Measuring Equipment.
EICAS:	Engine Indicating and Crew Alerting System. A comprehensive electronic engine indicating and aircraft systems annunciating system.
Engine Cycle:	Any operational sequence involving engine start, power to 80 percent N_1 or above and engine shutdown.
Engine Out Accelerate-Go Distance:	The horizontal distance from brake release to reference zero on a takeoff during which an engine is recognized to have failed at V_1 and the take off is continued.
°F:	Temperature in degrees Fahrenheit.
FAA:	Federal Aviation Administration.
FADEC:	Full Authority Digital Engine Controls. The FADEC is the controlling computer of the engine control system.
Flameout:	Unintentional loss of engine during operation.
FM:	Frequency Modulation.

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DEFINITIONS AND ABBREVIATIONS (Continued)

G:	Acceleration due to gravity. One G equals the pull of gravity with no acceleration.
Gross Climb Gradient:	The climb gradient that the airplane can actually achieve with ideal ambient conditions (smooth air).
HF:	High Frequency.
Hot Start:	An engine start, or attempted start which results in an interstage turbine temperature exceeding 890°C.
Hr:	Hour.
HSI:	Horizontal Situation Indicator.
Hz:	Hertz.
IFR:	Instrument Flight Rules.
Indicated Airspeed (KIAS):	Airspeed indicator readings (knots). Zero instrument error is assumed.
Indicated Mach Number (IMN):	The displayed Mach number value which includes position error.
In. Hg:	Inches of Mercury.
IRS:	Inertial Reference System.
ISA:	International Standard Atmosphere.
ITT:	Interstage Turbine Temperature. Engine operating temperature taken between the high and low pressure turbine sections.
Jack Point:	One of three points on the airplane designed to rest on a jack.
KCAS:	Calibrated airspeed expressed in knots.
KHz:	Kilohertz.
KIAS:	Indicated airspeed expressed in knots.
KTAS:	True airspeed expressed in knots.

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DEFINITIONS AND ABBREVIATIONS (Continued)

Landing Distance:	The distance from a point 50 feet above the runway surface to the point at which the airplane would come to a full stop on the runway.
Lb:	Pound.
LH:	Left Hand.
Lb/hr:	Pounds-per-hour.
LSA:	Low Speed Awareness.
LSB:	Lower Side Band.
Mach Number:	The ratio of true airspeed to the speed of sound.
MAC:	Mean Aerodynamic Chord. The chord of an imaginary airfoil which, throughout the flight range, will have the same force vectors as those of the wing.
Manual Mode Operation:	Occurs when the engine electronic fuel control (FADEC) is inoperative or turned off. Manual mode dispatch is prohibited in the Model 750.
Maximum Brake Energy Speed:	The maximum speed from which a stop can be accomplished within the energy capabilities of the brakes.
Maximum Climb Power (Multiengine Climb or Single Engine Climb):	The maximum power setting for normal climb, per the appropriate power chart, not to exceed 850°C ITT or 100 percent N_1 RPM.
Maximum Continuous Power:	The power developed per the appropriate power chart, not to exceed 850°C ITT or 100 percent N_1 RPM. It is the maximum power setting without a time limit.
Maximum Cruise Power:	The maximum power setting for use during cruise operation, not to exceed 850°C ITT or 100 percent N_1 RPM.
Maximum Landing Weight:	Maximum weight approved for landing touchdown.
Maximum Ramp Weight:	Maximum weight approved for ground maneuver. It includes engine start and taxi fuel.
Maximum Zero Fuel Weight:	Maximum weight exclusive of usable fuel.
Mb:	Millibars.
Moment:	The product of the weight of an item multiplied by its arm. (Moment divided by a constant is used to simplify balance calculations by reducing the number of digits.)
MHz:	Megahertz.

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DEFINITIONS AND ABBREVIATIONS (Continued)

N_1:	Low pressure turbine speed. The fan is attached to the low pressure turbine.
N_2:	High pressure turbine speed.
Net Climb Gradient:	The gross climb gradient reduced by 0.8% during the takeoff phase and 1.1% during enroute. This conservatism is required by FAR Part 25 for terrain clearance determination to account for variables encountered in service.
Normal Mode Operation:	The electronic mode of operation where fuel scheduling is electronically controlled.
OAT or TEMP:	Outside Air Temperature or Ambient Air Temperature. The free air static temperature, obtained either from ground meteorological sources or from inflight temperature indications adjusted for instrument error and compressibility effects.
PAC	A self contained unit, such as an environmental control unit PAC.
Payload:	Weight of occupants, cargo and baggage.
Position Correction:	A correction applied to indicated airspeed or altitude to eliminate the effect of the location of the static pressure source on the instrument reading.
Power Lever:	Engine power control; synonymous with throttle in same terminology.
Pressure Altitude:	Altitude measured from standard sea level pressure (29.92 inches Hg) (standard datum plane) by a pressure or barometric altimeter. It is the indicated pressure altitude corrected for position and instrument error. In this manual, altimeter instrument errors are assumed to be zero.
PSI:	Pounds-per-Square Inch.
PSIG:	Pounds-per-Square Inch Gage.
Pt_2 :	Engine air inlet total pressure.
Pt_2 Probe:	A pressure probe in the engine inlet which provides pressure input to the electronic fuel control.
RAT:	Ram Air Temperature. RAT as read from the EICAS. RAT is outside temperature as affected by ram rise due to airspeed.
REF:	Reference.
Reference Datum:	An imaginary vertical plane from which all horizontal distances are measured for center-of-gravity purposes. In the Model 750, it is 30 inches forward of the airplane nose.

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DEFINITIONS AND ABBREVIATIONS (Continued)

Reference Zero:	The point in the takeoff flight path at which the airplane is 35 feet (dry runway) or 15 feet (wet runway) above the takeoff surface and at the end of the takeoff distance required.
Residual Fuel:	The undrainable fuel remaining when the airplane is defueled in a specific attitude by the normal means and procedures specified for draining the tanks.
Reverse Thrust:	The thrust produced when the thrust reverser deflectors are deployed into the engine exhaust stream.
RH:	Right Hand.
RMI:	Radio Magnetic Indicator.
RNAV:	Area Navigation.
RPM:	Revolutions-per-Minute, normally expressed as a percentage of maximum engine speed.
R/T:	Receiver Transmitter.
SAT:	Static Air Temperature as read from the EICAS. The temperature of the air undisturbed by the presence or motion of the airplane. SAT and OAT are similar terms.
SSB:	Single Side Band.
Standard Empty Weight:	Weight of a standard airplane including unusable fuel, full oil and full operating fluids.
Station:	A location along the airplane fuselage given in terms of distance from the reference datum plane.
STD:	Standard.
Tachometer:	Indicates the speed of the engine in percent of maximum RPM. Tachometers are provided for N_1 (fan RPM) and N_2 (turbine RPM).
Takeoff Field Length:	The Takeoff Field Length given for each combination of gross weight, ambient temperature, altitude, wind and runway gradients is the greatest of the following: a. 115 percent of the two-engine horizontal takeoff distance from start to a height of 35 feet above runway surface. b. Accelerate-stop distance wet or dry runway as appropriate. c. The engine-out accelerate-go distance to 35 feet for dry runways or 15 feet for wet runways. No specific identification is made on the charts as to which of these distances governs a specific case.

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DEFINITIONS AND ABBREVIATIONS (Continued)

Takeoff Power:	Power setting used for takeoff, limited to 5 minutes duration, not to exceed 888°C ITT or 100 percent N_1 RPM.
TAS:	True Airspeed. The airspeed relative to undisturbed air which is the CAS corrected for altitude, temperature and compressibility factor.
TAT:	Total Air Temperature. Air which has had its temperature increased due to adiabatic compression caused by the speed of the airplane.
Temperature Compressibility Effects:	An error in the indication of temperature caused by airflow over the temperature probe. The error varies depending on altitude and airspeed.
TLA:	Throttle Lever Angle. TLA is measured from throttle cutoff position, which is established at 0°.
Tower Wind:	Wind measured at a height of 30 feet above the runway, used for computation of takeoff and landing data.
True Airspeed (KTAS):	TAS expressed in knots.
True Mach Number (TMN):	The displayed mach number with position error removed.
TT_2:	Engine inlet total air temperature.
TT_2 Sensor:	A temperature sensor that measures the engine inlet temperature and transmits it to the electronic fuel control.
UHF:	Ultra High Frequency.
Unusable Fuel:	Fuel remaining after fuel runout tests have been completed in accordance with governmental regulations.
U.S.:	United States.
Usable Fuel:	Fuel available for flight planning.
USB:	Upper Side Band.
V_1:	Takeoff decision speed. The distance to continue the takeoff to reference zero will not exceed the scheduled takeoff field length if recognition occurred at V_1 (accelerate-go). The distance to bring the airplane to a full stop (accelerate-stop) will not exceed the scheduled takeoff field length provided that the brakes are applied at V_1.
V_2:	Takeoff Safety Speed. This climb speed is the actual speed at 35 feet above the runway surface as demonstrated in flight during takeoff with one engine inoperative.

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DEFINITIONS AND ABBREVIATIONS (Continued)

V_{35}:	This climb speed is the actual speed at 35 feet above the runway surface as demonstrated in flight during takeoff with both engines operating.
V_A:	The maneuvering speed is the maximum speed at which application of full available aerodynamic control will not overstress the airplane.
V_{APP}:	The landing approach airspeed (1.3 V_{S1}) with 5° or 15° flap position, landing gear UP.
V_{BE}:	Maximum Brake Energy Speed. The maximum speed from which a stop can be accomplished within the energy capabilities of the brakes.
V_{ENR}:	Single-engine enroute climb speed.
V_{FE}:	Maximum flap extended speed. The highest speed permissible with wing flaps in a prescribed extended position.
V_{LE}:	Maximum landing gear extended speed. The maximum speed at which an airplane can be safely flown with the landing gear extended.
V_{LO}:	Maximum landing gear operating speed. The maximum speed at which the landing gear can be safely extended or retracted.
V_{MCA}:	Minimum airspeed in the air at which directional control can be maintained, when one engine is suddenly made inoperative. V_{MCA} is a function of engine thrust which varies with altitude and temperature. The following V_{MCA}s were determined for maximum thrust: 5° Flaps - 118 KIAS 15° Flaps - 110 KIAS
V_{MCG}:	Minimum airspeed on the ground at which directional control can be maintained, when one engine is suddenly made inoperative, using only aerodynamic controls. V_{MCG} is a function of engine thrust which varies with altitude and temperature. The following V_{MCG} was determined for maximum thrust: 109 KIAS
V_{MCL}:	Minimum airspeed in the air, landing configuration, at which directional control can be maintained, when one engine is suddenly made inoperative. V_{MCL} is a function of engine thrust which varies with altitude and temperature. The following V_{MCL}s were determined for maximum thrust: 15° Flaps - 113 KIAS Full Flaps - 106 KIAS

(Continued Next Page)

DEFINITIONS AND ABBREVIATIONS (Continued)

V_{MO}/M_{MO}:	Maximum operating limit speed.
V_R:	The rotation speed is the speed at which rotation is initiated during takeoff to attain the V_2 climb speed at or before a height of 35 feet above runway surface has been reached.
V_{REF}:	The airspeed equal to the landing 50-foot point speed (1.3 V_{SO}) with flaps in landing position (FULL or 15-degrees) and landing gear extended.
V_{SO}:	The stalling speed or the minimum steady flight speed in the landing configuration.
$V_{S1:}$	The stalling speed or the minimum steady flight speed obtained in a specified configuration.
$V_{X:}$	Best Angle-of-Climb Speed. The airspeed which delivers the greatest gain of altitude in the shortest possible horizontal distance.
V_Y:	Best Rate-of-Climb Speed. The airspeed which delivers the greatest gain of altitude in the shortest possible time.
V_{YSE}:	Best Single-Engine Rate-of-Climb Speed. The airspeed which delivers the greatest gain of altitude in the shortest possible time with one engine operating.
VA:	Volt Amperes.
VAC:	Volts Alternating Current.
VG:	Vertical Gyro.
VHF:	Very High Frequency.
VLF:	Very Low Frequency.
VNAV:	Vertical Navigation.
VOR:	Very High Frequency Omnidirectional Radio Range.
VOT:	Very High Frequency Omnidirectional Test.
Visible Moisture:	Visible moisture includes, but is not limited to, the following conditions: fog with visibility less than one mile, wet snow and rain.
Wet Runway:	A runway is considered wet when there is sufficient moisture on the surface to appear reflective, but without significant areas of standing water.
Wind:	The wind velocities recorded as variables on the charts of this manual are to be understood as the headwind or tailwind components of the actual winds at 30 feet above the runway surface (tower winds).
Windmill:	Engine turbine rotation from airstream inputs.

STANDARD SYSTEM SYMBOLS

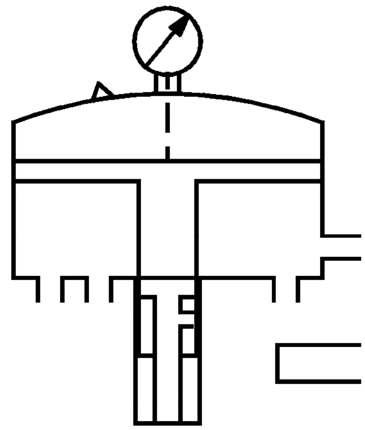
Standard System Symbols have been developed and utilized in illustrated system diagrams throughout the Operating Manual. Included are symbols for components within the hydraulic/pneumatic systems, fuel systems, bleed air, deice and vacuum systems and oxygen systems.

Symbols utilized in electrical schematics follow the Standard System Symbols.

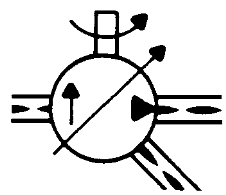
HYDRAULIC/PNEUMATIC SYSTEM SYMBOLS

A34273

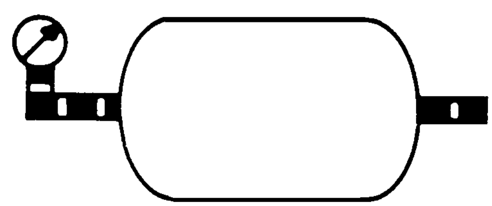
HYDRAULIC RESERVOIR (BOOTSTRAP PRESSURE OPERATED)



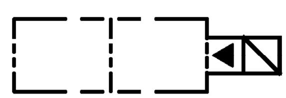
HYDRAULIC PUMP ENGINE DRIVEN OR ELECTRIC MOTOR DRIVEN



PNEUMATIC RESERVOIR (BOTTLE) WITH PRESSURE GAGE



VALVE, PILOT ACTUATED



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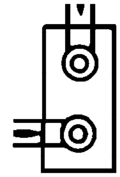
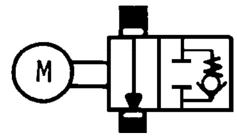
HYDRAULIC/PNEUMATIC SYSTEM SYMBOLS (Continued)

A34277

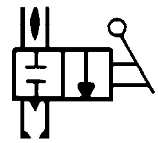
GROUND SERVICE, EXTERNAL QUICK DISCONNECTS



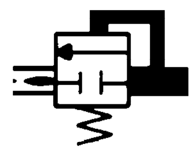
SHUTOFF VALVE WITH PRESSURE RELIEF TWO POSITION - 2-WAY (MOTOR ACTUATED)



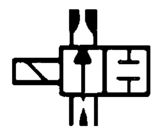
SHUTOFF VALVE WITH TWO-POSITION - 2-WAY (MANUALLY ACTUATED)



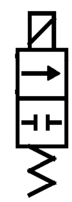
SHUTOFF VALVE TWO POSITION - 2-WAY (PRESSURE OPERATED)



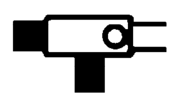
SHUTOFF VALVE TWO POSITION - 2-WAY (SOLENOID OPERATED)



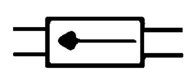
CHECK/SHUTOFF VALVE (PNEUMATIC) TWO POSITION - 2-WAY (SOLENOID OPERATED)



SHUTTLE VALVE



CHECK VALVE



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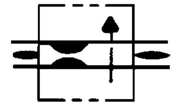
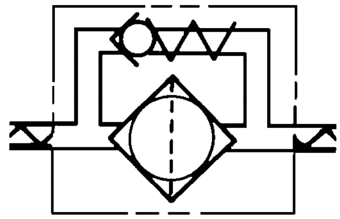
HYDRAULIC/PNEUMATIC SYSTEM SYMBOLS (Continued)

A34283

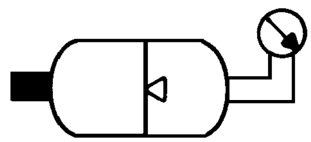
FLOW REGULATOR



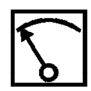
FILTER WITH BYPASS



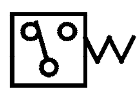
HYDROPNEUMATIC
ACCUMULATOR
WITH PRESSURE GAGE



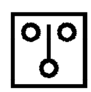
PRESSURE TRANSDUCER



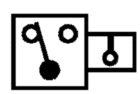
PRESSURE SWITCH



DIFFERENTIAL
PRESSURE SWITCH

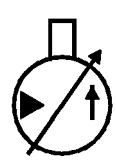


TEMPERATURE SWITCH



RESTRICTOR

FAN MOTOR
(HYDRAULIC DRIVEN)



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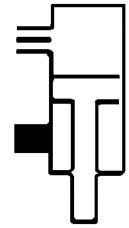
HYDRAULIC/PNEUMATIC SYSTEM SYMBOLS (Continued)

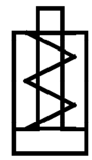
A34288

ACTUATOR

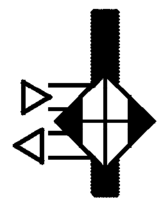


CHECK RELIEF VALVE

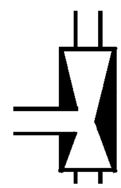
BRAKE ACTUATOR



HEAT EXCHANGER

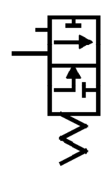


MIXER ASSEMBLY



VENTURI

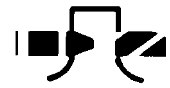
CONFLUENCE BOX



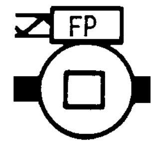
FUEL SYSTEM SYMBOLS

A34290

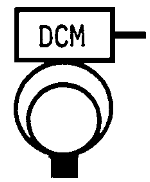
PUMP (EJECTOR)



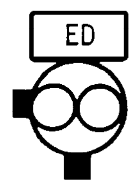
PUMP, PISTON (FLUID PRESSURE
(FP) DRIVEN)



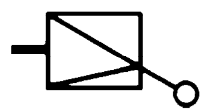
PUMP, CENTRIFUGAL
(DC MOTOR (DCM) DRIVEN)



PUMP, GEAR
(ENGINE DRIVEN (ED))

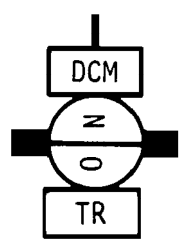


FLOAT SWITCH

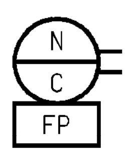


FILTER WITH BYPASS
RELIEF VALVE

SHUTOFF VALVE - NORMAL OPEN
(DC MOTOR (DCM) DRIVEN)
WITH THERMAL/PRESSURE RELIEF



VALVE - NORMAL CLOSED
(FLUID PRESSURE (FP) ACTUATED)

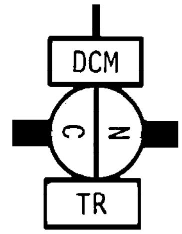


(Continued Next Page)

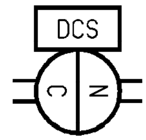
FUEL SYSTEM SYMBOLS (Continued)

A34291

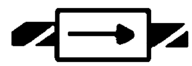
SHUTOFF VALVE - NORMAL CLOSED
(DC MOTOR (DCM) DRIVEN)
WITH THERMAL/PRESSURE RELIEF



VALVE - NORMAL CLOSED
(DC SOLENOID (DCS) ACTUATED)

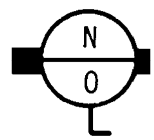


CHECK VALVE

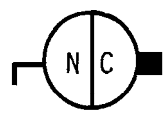


RELIEF VALVE

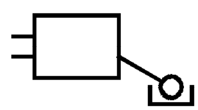
SHUTOFF VALVE - NORMAL OPEN
(MANUALLY OPERATED)



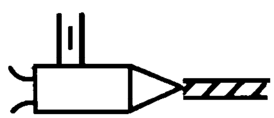
SHUTOFF VALVE - NORMAL CLOSED
(MANUALLY OPERATED)



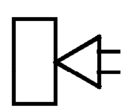
LEVEL CONTROL PILOT VALVE WITH
PRECHECK (FLOAT ACTUATED)



LEVEL CONTROL VALVE



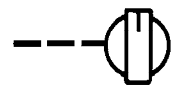
REFUEL/DEFUEL ADAPTER



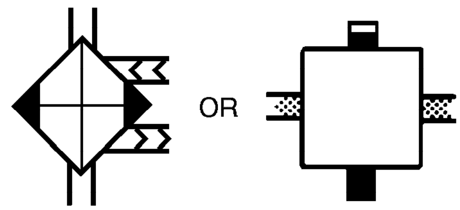
BLEED AIR/ANTI-ICE AND VACUUM SYSTEM SYMBOLS

A34292

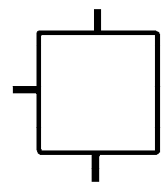
CONTROL



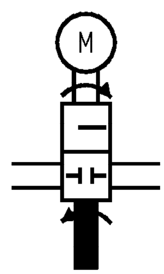
HEAT EXCHANGER



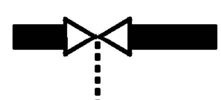
TEMPERATURE CONTROL UNIT



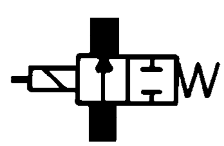
TEMPERATURE CONTROL VALVE
TWO POSITION - 2-WAY
(MOTOR (M) ACTUATED)



MANUAL SHUTOFF VALVE
TWO POSITION - 2-WAY
(MANUALLY (M) ACTUATED)



PRESSURE REGULATING AND SHUTOFF VALVE
TWO POSITION - 2-WAY
(SOLENOID OPERATED)



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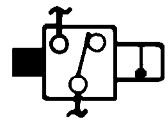
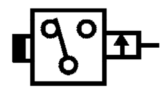
BLEED AIR/ANTI-ICE AND VACUUM SYSTEM SYMBOLS (Continued)

A34293

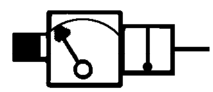
TEMPERATURE SWITCH



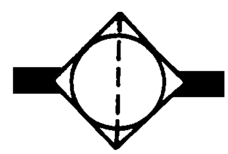
PRESSURE SWITCH



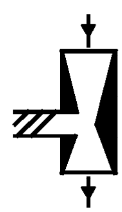
TEMPERATURE SENSOR



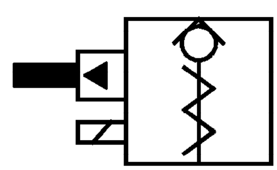
FILTER



SERVICE AIR EJECTOR
(VENTURI)



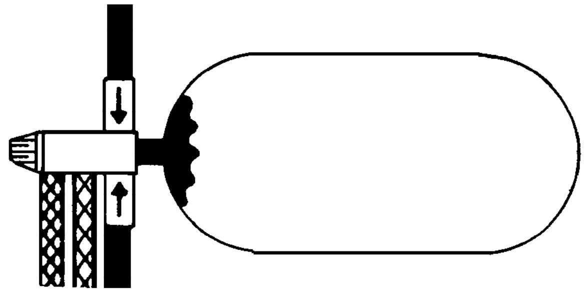
VACUUM OUTFLOW VALVE
(SOLENOID OPERATED)



OXYGEN SYSTEM SYMBOLS

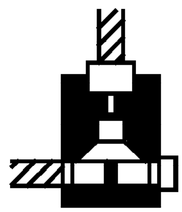
A34294

OXYGEN CYLINDER

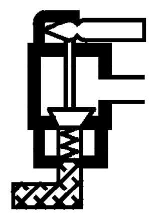


GAGE

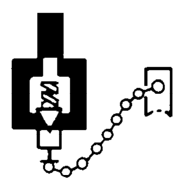
WEMAC (CREW)



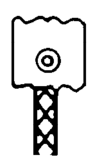
WEMAC (PASSENGER)



FILLER VALVE AND
PROTECTIVE CAP



OVERBOARD DISCHARGE
INDICATOR (VENT PORT)



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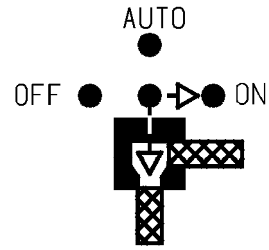
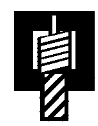
OXYGEN SYSTEM SYMBOLS (Continued)

A34295

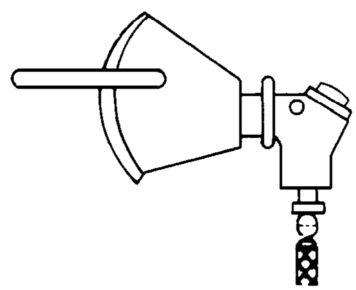
VALVE



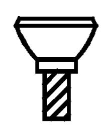
DOOR ACTUATOR
(PRESSURE ACTUATED)



MASK (PILOT)



MASK (PASSENGER)



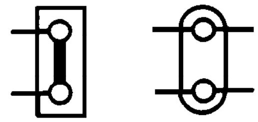
ORIFICE

ELECTRICAL SYMBOLS

A34275

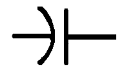
BATTERY

BUS



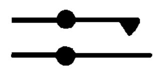
CAP AND STOW

CAPACITOR

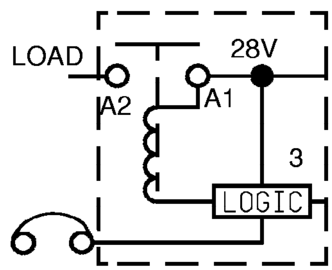


CIRCUIT BREAKER

The switch contacts connect to an annunciator system to warn when a circuit breaker is open.

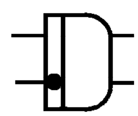


Remote circuit breakers combine the functions of circuit breaker and relay. A 1 amp or 0.5 amp circuit breaker is used at pilot's circuit breaker panel to indicate an overload.



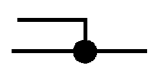
CONNECTOR

The black circle indicates contact will accept 16 gage wire. A black triangle indicates contact will accept 12 gage wire. Unmarked contacts accept 20 gage wire.

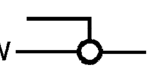


CONNECTIONS

SOLDERED



CRIMP OR SCREW



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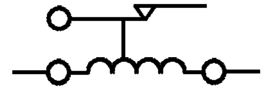
ELECTRICAL SYMBOLS (Continued)

A34276

CURRENT SENSOR — Current flowing in coil opens switch to indicate circuit is functioning correctly.

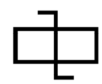


CURRENT TRANSFORMER — Current flowing in wire produces a voltage in coil.

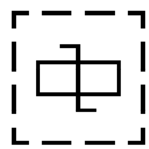
DIODE — Regular - Low resistance forward, high resistance reverse.

Zener - Low resistance forward, high resistance reverse until a specific voltage is applied, then conducts freely. A transzorb is similar to a zener, but with higher peak current limit.

Varistor - High resistance either way until a specific voltage is applied, then conducts freely. Example: V47ZA1 conducts freely above 47 volts.



Varistor - Encapsulated for moisture protection.

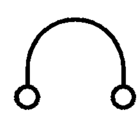


FILTER — Passes direct current but opposes pulsating current, used to reduce noise in sensitive avionics equipment.

FUSE/LIMITER

GROUND

HEADSET



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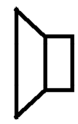
ELECTRICAL SYMBOLS (Continued)

A34278

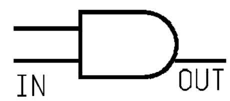
HEATER

HORN/SPEAKER

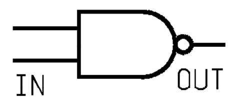


INTEGRATED CIRCUIT Integrated circuits do not necessarily work on the principle of ON-OFF as a switch, instead some work on high and low voltage. Example: high might be 5.0 volts and low might be 0.5 volts.

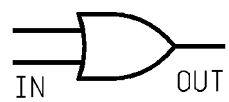
AND GATE - Output is low until both inputs are high, then the output is high.



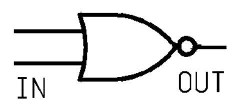
NAND GATE - Output is high until both inputs are high, then the output is low.



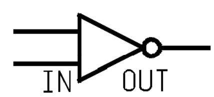
OR GATE - Output is low until either or both inputs are high, then output is high.



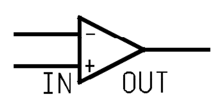
NOR GATE - Output is high until either or both inputs are high, then output is low.



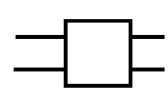
INVERTER - Output is low when input is high, output is high when input is low.



OPERATIONAL AMPLIFIER (OP AMP) - amplifies the difference in voltage between the two inputs. The minus input is the inverting input and the plus is the noninverting input. If an input is applied to the minus input, with the plus input grounded, the polarity of the output will be opposite to the input. If an input is applied to the plus input, with the minus input grounded, the polarity of the output will be the same as that of the input.



TIMER - Changes the output from high to low in a regular pattern.



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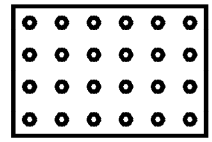
ELECTRICAL SYMBOLS (Continued)

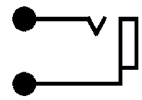
A34279

JUNCTION BLOCK

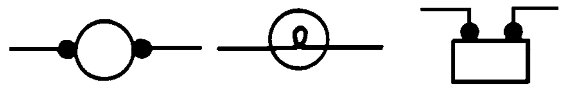
All contacts are joined internally.



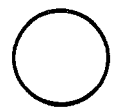
PHONE JACK



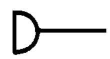
LAMP



METER/INDICATOR

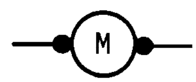


MICROPHONE

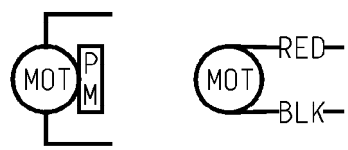


MOTOR

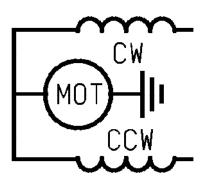
Basic symbol for motor.



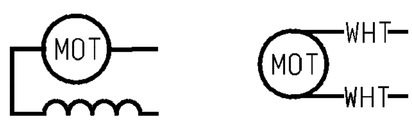
Reversible Motor - Direction of rotation is controlled by reversing power and ground on input wires.



Reversible Motor - Direction of rotation is controlled by applying power to either field winding input wire.



Nonreversible Motor - Direction of rotation is controlled by design; input wires may be connected either way.



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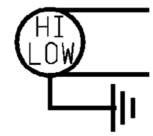
ELECTRICAL SYMBOLS (Continued)

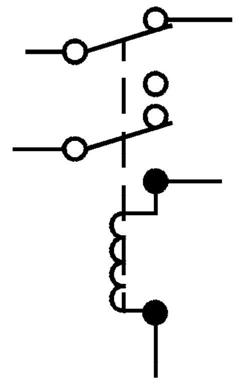
A34280

MOTOR (Continued)

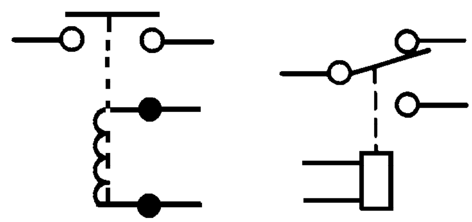
Nonreversible - Motor - Two-speed controlled by applying power to either input wire.



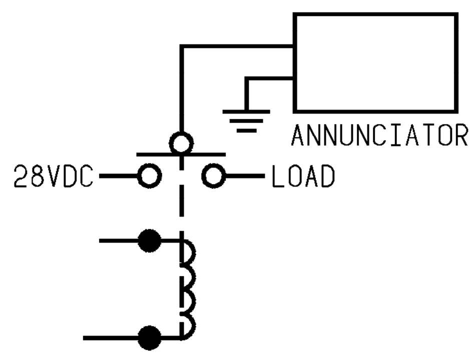
RELAY



The symbol for the solenoid may be a box or a coil, the operation is identical

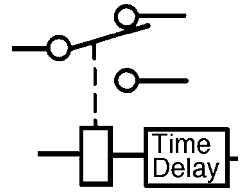


An annunciator relay has a connection on the movable contact to indicate by a light or annunciator panel when the relay is energized.



The contacts of a time delay relay do not move to the energized position instantly when power is applied.

For some time delay relays, the delay time is part of design of the relay.



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ELECTRICAL SYMBOLS (Continued)

A34281

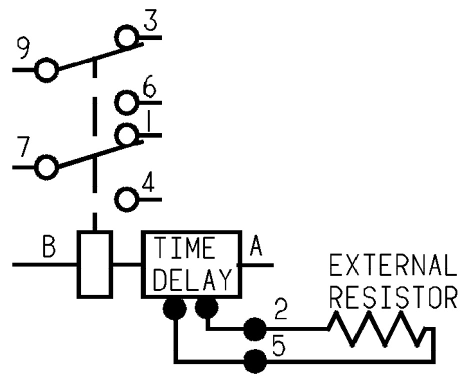
RELAY (Continued)

For some time delay relays, the delay time is controlled by the size of an external resistor.

Jumper wire gives 0.1 second delay.

160,000 OHM resistor gives 10-second delay.

Other resistors give delay time between 0.1 second and 10 seconds.

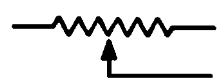


RESISTOR

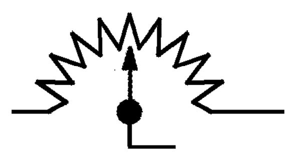
REGULAR - Resistance does not change.

TEMPERATURE CONTROLLED - Resistance changes with the temperature.

VARIABLE OR ADJUSTABLE - Resistance changes with mechanical input.

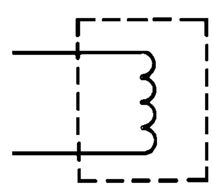


RHEOSTAT - Type of variable resistor.



SOLENOID/SOLENOID VALVE

NO (normally open) or NC (normally closed by a solenoid operated valve indicates the position of the valve with no power applied to the solenoid.



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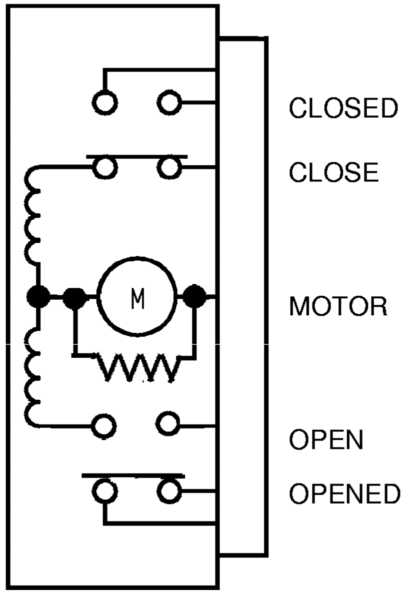
ELECTRICAL SYMBOLS (Continued)

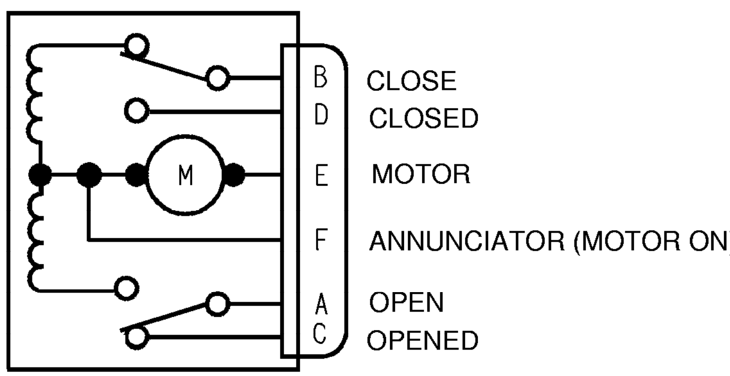
A34282

SOLENOID/SOLENOID VALVE (Continued)

Motor operated - limit switches stop power when limit of travel is reached.

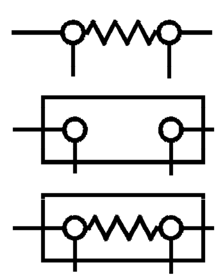


SHOWN OPEN



SHOWN OPEN

SHUNT



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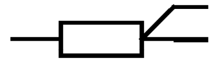
ELECTRICAL SYMBOLS (Continued)

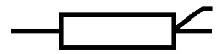
A34284

SPLICE

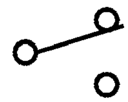
CRIMP - Nylon Insulated 

Environmental Crimp 

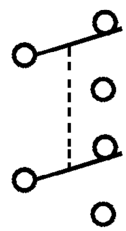
Environmental Permanent 

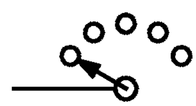
Temporary 

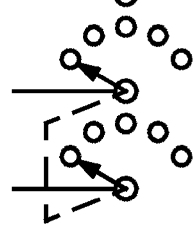
SWITCH

SINGLE POLE/DOUBLE THROW (SPDT) may have OFF position in the center. 

SINGLE POLE/SINGLE THROW (SPST) 

DOUBLE POLE/DOUBLE THROW (DPDT) may have OFF position in the center. Dashed line indicates all parts move simultaneously. 

ROTARY OR MULTI POSITION 

TWO POLE ROTARY - On rotary or multi pole switches controlled by a knob, the poles (or decks) are identified on wiring diagrams as A,B,C with A being the part on the knob or shaft end. 

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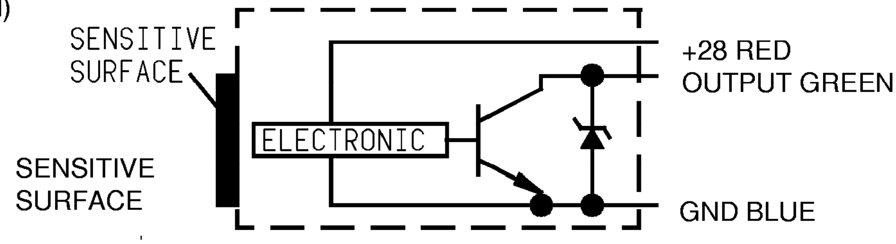
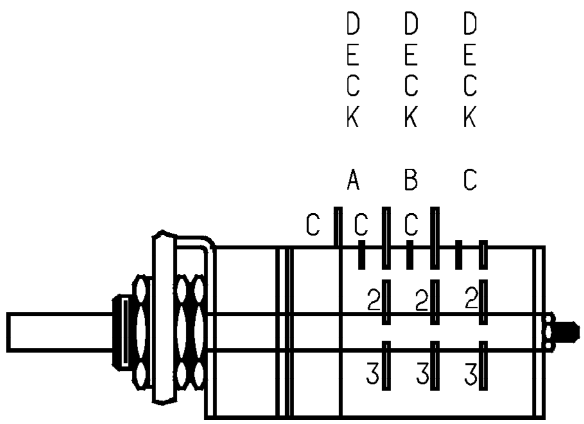
ELECTRICAL SYMBOLS (Continued)

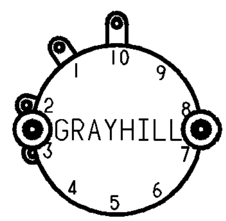
A34285

SWITCH (Continued)



PROXIMITY - Metal in close proximity (typical 0.1 inch) to the sensitive surface will cause the electronics to turn the transistor on or off. Some are normally closed and open with metal to the sensitive surface. Some are normally open and close with metal to the sensitive surfaces.





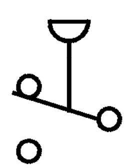
SIDE VIEW
WITH TYPICAL TERMINAL NUMBERING

REAR VIEW

C= Common terminals for each deck
1 thru 10 = Switch terminal position

EXAMPLE:
AC= Common terminal on deck A
B1= Switch position 1 on deck B

PRESSURE OPERATED



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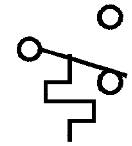
ELECTRICAL SYMBOLS (Continued)

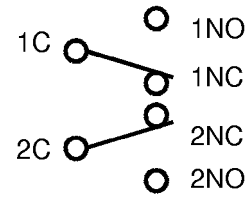
A34286

SWITCH (Continued)

TEMPERATURE OPERATED

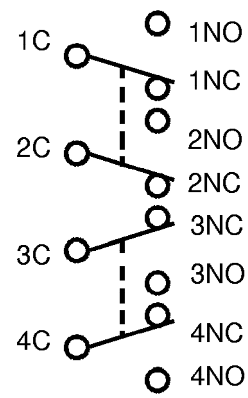


TWO STAGE - Two-pole, four-pole or six-pole switch designed so that all movable switch contacts do not move simultaneously.



2 POLE

Handle position is referenced to the flat side of the mounting threads.

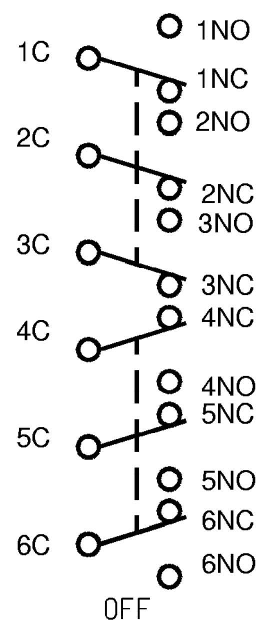


4 POLE

	TO FLAT	CENTER*	OPPOSITE
CONTACT 1 OF 2 POLE CONTACTS 1 AND 2 OF 4 POLE CONTACTS 1, 2 AND 3 6 POLE	NO C NC	NO C NC	NO C NC
CONTACT 2 OF 2 POLE CONTACTS 3 AND 4 OF 4 POLE CONTACTS 4, 5 AND 6 6 POLE	NC C NO	NC C NO	NC C NO

C IS THE COMMON TERMINAL
NC IS THE NORMALLY CLOSED TERMINAL
NO IS THE NORMALLY OPEN TERMINAL

* **NOTE:** Some switches of this type do not have a center position.



6 POLE

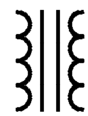
(Continued Next Page)

ELECTRICAL SYMBOLS (Continued)

A34287

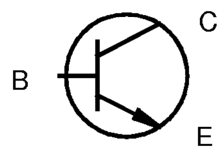
TERMINAL STRIP

TRANSFORMER

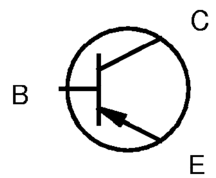


TRANSISTOR

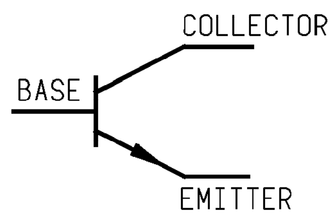
NPN

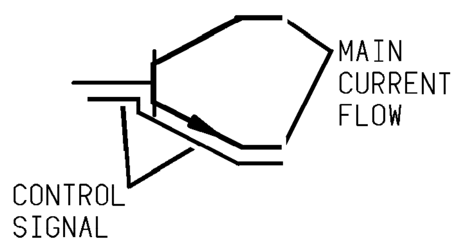


PNP

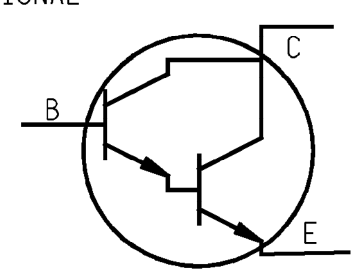


Transistor contacts are identified as base, collector and emitter. Flow of current through a transistor is controlled by the signal applied to the base. The control current (3 to 5 percent of total current) flows between base and emitter. The main flow of current (95 to 97 percent) is between collector and emitter. Transistors may be drawn without the circle.





DARLINGTON



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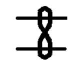
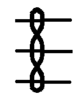
ELECTRICAL SYMBOLS (Continued)

A34289

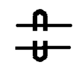
WIRE

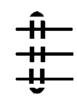
TWISTED





SHIELDED





HIGH TEMPERATURE WIRE

Q12A20

VENDOR SUPPLIED WIRE LEADS AND/OR EQUIPMENT.

SECTION I

DESCRIPTION AND SPECIFICATIONS

CONTENTS

Page

GENERAL DESCRIPTION

The Cessna Citation X is certified in accordance with FAR Part 25, airworthiness standards and utilizes the fail-safe construction concept. It combines state-of-the-art engineering for reliability and systems simplicity with ease of access to reduce maintenance requirements. Even though it is a high performance aircraft, takeoff and landing speeds are sufficiently slow to permit operation at smaller airports. High bypass turbofan engines and a super-critical wing contribute to overall operating efficiency and performance. The high pressure ratio and high bypass ratio of the engines, combined with the low drag characteristics of the airframe, provide a superior specific fuel consumption, increasing performance and decreasing operating costs.

FLIGHT CONTROLS

Primary dual flight control is accomplished through hydraulically powered non-reversible surfaces made of extremely strong composite material. An artificial feel system is incorporated. The elevator control columns are both equipped with a control column shakers for early stall warning. Dual rudders (upper and lower) are installed, each of which is equipped with its own separate yaw damper. The lower rudder is hydraulically powered from the airplane system or from a rudder standby system. The upper rudder is electrically powered from inputs from the rudder pedals. Trimming is provided in all three axes. Hydraulically operated spoilers and speed brakes are installed on the upper surface of both wings. Both trailing edge flaps and leading edge slats are provided, to improve low speed handling characteristics and to enable operation into and out of smaller fields. The trailing edge flaps are powered electrically, and the leading edge slats are powered hydraulically. Nose wheel steering is hydraulically actuated by the rudder pedals and a steering wheel.

ENGINES

Two Allison AE3007C Turbofan engines, installed on rear fuselage pylons, are flat rated at a sea level static thrust of 6442 pounds (each) up to a temperature of ISA +27°F (with no bleed air extraction taking place). Complete ice protection and fire detection and extinguishing systems are incorporated. Fuel is carried in two integral wing tanks and a fuselage tank, which is located in the fairing forward of the center wing section. Each engine is normally supplied from its respective side, but transfer can be accomplished. Fueling is accomplished through a single point pressure refueling fitting in the fuselage, forward of the right wing. An overwing port in each wing tank is also available for fueling. Target-type thrust reversers are individually operated by conventional "piggy back" controls which are mounted on the throttles.

FUSELAGE

The unpressurized nose section provides space for avionics equipment and the nose wheel well. The pressurized area is 28.5 feet from the forward pressure bulkhead to the aft cabin pressure bulkhead and accommodates up to eight passengers (typical) in the standard configuration, and a crew of two. As many as twelve passengers may be accommodated in the maximum high density seating option. The unpressurized tailcone section contains equipment and systems components. A 72.4 cubic foot pressurized and heated baggage compartment is located just aft of the pressurized cabin.

(Continued Next Page

FUSELAGE (Continued)

The cockpit seats can be moved vertically, horizontally and tilted. Each passenger seat in the cabin section can be reclined.

An air outlet, light and oxygen mask are provided in the cabin section for each occupant. An aft compartment in the cabin has a toilet which can be closed off for privacy.

ELECTRICAL SYSTEM

The main direct current (DC) buses are supplied from two brushless generators. Secondary DC power is available from either the batteries, an external source or an onboard Auxiliary Power Unit. Two alternators provide power to electrically anti-ice the windshield. Two 44 ampere-hour batteries provide a source of emergency DC power, and for essential electrical power which may be required while engine start is being accomplished.

HYDRAULIC SYSTEM

The hydraulic system is a dual closed center system. Pumps driven by each engine supply pressure for operation of the landing gear, nose wheel steering, antiskid brakes, spoilers, speed brakes, roll control spoilers, elevators, ailerons, lower rudder, and the thrust reversers. The two separate hydraulic systems are identified as the A system and the B system. Redundancy is provided by the fact that the B system can operate the A system through a hydraulic motor/pump unit in which no fluid exchange takes place. An electrically operated auxiliary pump in the A system also provides backup power for equipment powered by that system. Pneumatic backup is also available for landing gear extension and braking.

ENVIRONMENTAL CONTROL

Cabin pressurization utilizes bleed air from the engines which is conditioned by an environmental control unit. Temperature is controllable over a wide range and the system provides sufficient pressure to maintain an 8000-foot cabin at a cruise altitude of 51,000 feet. The oxygen system supplies the cockpit through quick donning masks and the cabin with dropout type masks which automatically deploy in the event of excessive cabin altitude.

AVIONICS

The standard, factory-installed avionics package includes turbulence detection color weather radar, dual digital autopilots, a dual integrated flight director system driven by a dual attitude and heading reference system (AHRS), a five-tube electronic flight instrument system (EFIS).and a radio altimeter. A Honeywell Primus II remote radio system is installed as standard equipment. It is comprised of two very high frequency omnidirectional radio range (VOR)/localizer/glideslope/marker beacon receivers, dual distance measuring equipment (DME) systems, dual transponders with altitude reporting and mode S capabilities, and includes one digitally tuned automatic direction finder (ADF). Long distance communication capability is provided by a Bendix/King high frequency (HF) transceiver.

(Continued Next Page)

AVIONICS (Continued)

Dual flight management systems (FMS) with GPS (global positioning system) function, a Flitefone VI with voice privacy, and a cockpit voice recorder (CVR) are also installed as standard equipment. Optional systems such as a dual LASEREF III inertial reference system, a second high frequency transceiver (or provisions for a second transceiver), a three-frequency emergency locator beacon, Collins Proline IV radios, a second digital ADF receiver, a flight data recorder (FDR), a selective calling system decoder (SELCAL), and a Global Airborne Flight Information System (AFIS) with SATCOM sensor are available. A Bendix/King TCAS II (Traffic Collision Advisory System) is also available.

CABIN DOOR

A counterbalanced entry door for the passengers and crew is located on the left forward side of the fuselage. The door is hinged at the bottom and opens outward. The inner surface of the door is provided with fixed steps. Locking pins around the door are linked to the door handles and electrically connected to the CAS system which will display a CABIN DOOR OPEN annunciation to warn of a door not locked condition. One of the door locking pins also actuates the door seal valve which controls inflation of the primary door seal. Loss of seal pressure will illuminate the CABIN DOOR SEAL annunciator of the crew alerting (CAS) system. A secondary seal will compress outward to seal the door in the event of a failure of the primary seal.

A precatch system allows the door to be held in the closed position while the handle is being latched. The precatch mechanissmoperates automatically when the door is opened in the event of a malfunction or the precatch mechanism.

EMERGENCY EXIT DOOR

A removable emergency exit door is located on the right side of the cabin above the wing. This exit is an alternate to the cabin door in the event of a crash landing and is the primary exit in a ditching situation.

When the emergency exit door is unlatched, it is completely removed and may be discarded overboard away from the escape route.

INSTRUMENT PANEL (TYPICAL)

FOLDOUT

Figure 1-1. Instrument Panel

INSTRUMENT PANEL (TYPICAL)

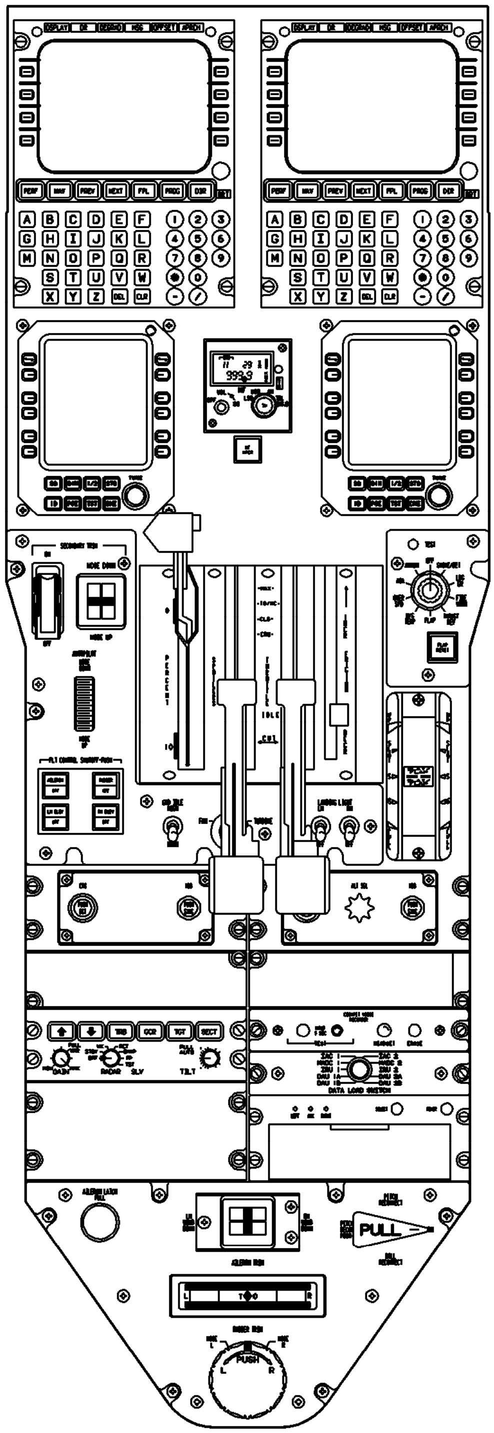


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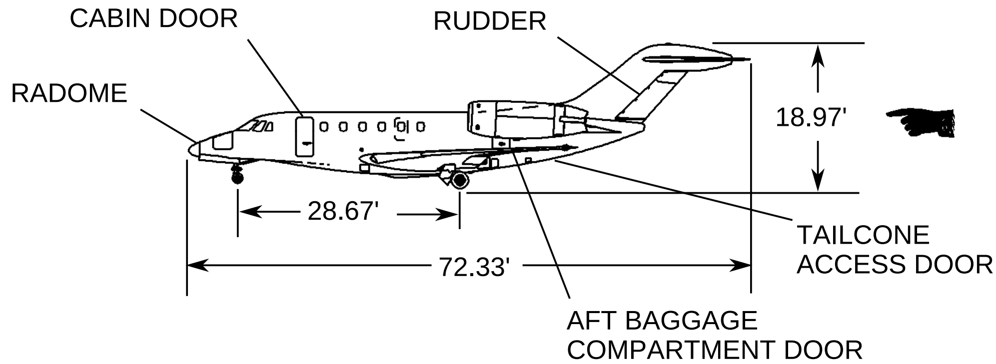
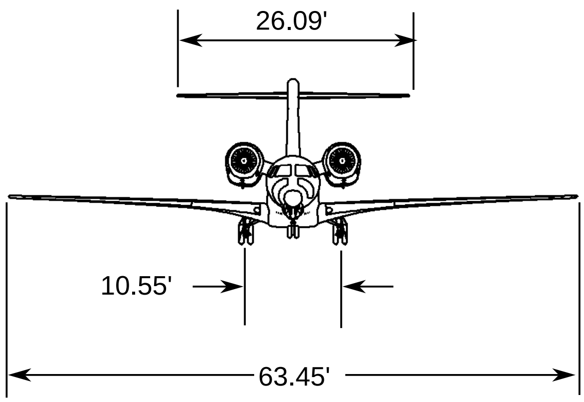
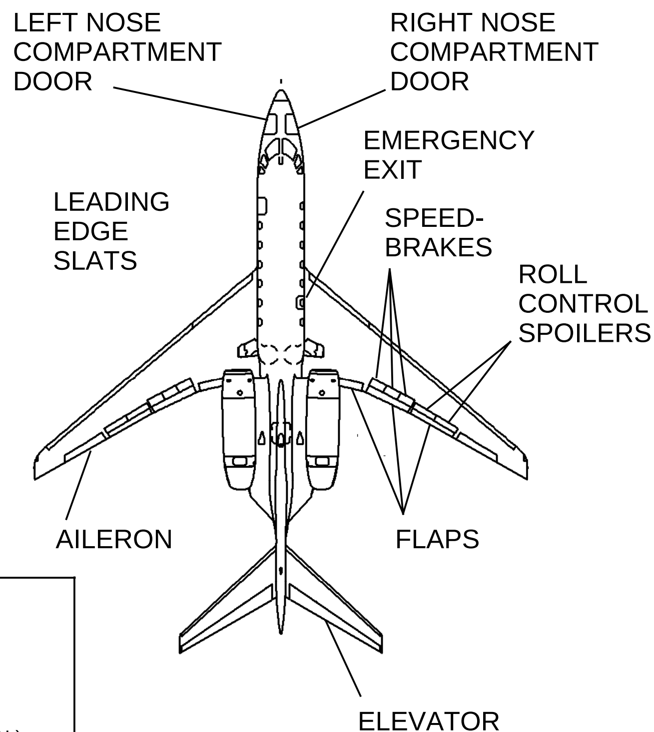
Figure 1-1 (Sheet 2 of 2)

THREE VIEW DRAWING







AIRFOILS		
WING		
DEVELOPMENT ROOT	B L 0.00	CESSNA 7500*
REFERENCE TIP	W S 383.20	CESSNA 7504*
ASPECT RATIO		
(BASED ON TRAPEZOIDAL AREA)		7.75
		*(SUPERCRITICAL)
TAIL (VERTICAL)		
ROOT	W L 140.600	NACA 0012
TIP	W L 267.03	NACA 0012
MEAN AERODYNAMIC CHORD	W L 198.55	129.06 INCHES
TAIL (HORIZONTAL)		
ROOT	H S 0.00	WD140
TIP	H S 153.588	DGMA90
MEAN AERODYNAMIC CHORD	H S 64.431	60.62 INCHES
INCIDENCE		
WING DEVELOPMENT ROOT	W S 37.0	+4.00 °
WING DEVELOPMENT TIP	W S 359.453	-2.00 °
HORIZONTAL TAIL		0°
DIHEDRAL		
WING		2 °
HORIZONTAL STABILIZER		0°
ENGINE PYLONS		16 °

6710C1003

Figure 1-2

SPECIFICATIONS

DIMENSIONS

Length	72.33 Feet
Height	18.97 Feet
Wing Span	63.45 Feet
Horizontal Stabilizer Span	26.09 Feet
Wheelbase (Main to Nose Gear)	28.67 Feet
Tread (Distance Between Main Gear)	10.55 Feet
Cabin:	
Length (Pressure Vessel)	28.50 Feet
Height	5.80 Feet
Width	5.70 Feet

CAPACITIES

Oil (Each Engine)	Approximately 13 Quarts (System), 8.0 Quarts (Tank)
Oil (Onboard Auxiliary Power Unit)	2.0 Quarts
Oil (Environmental Control Unit Air Cycle Machine)	3.4 Ounces
Oil (Air Turbine Starters)	425 Cubic Centimeters
Fuel (Maximum Usable)	Approximately 13,000 Pounds (2096.7 Gallons)
Oxygen (49 Cubic-foot - Full Bottle)	1234 Liters (Usable)
Optional (76 Cubic-foot - Full Bottle)	1923 Liters (Usable)

Based on 1850 PSI charge, regulated to 70 PSI for system usage

Hydraulic Fluid (Reservoir)	Approximately 1.75 Gallons

ENGINES

Type	AE 3007C
Turbofan Manufacturer	Allison
Dry Weight	Approximately 1588 Pounds
Thrust (Takeoff, Standard Day at Sea Level)	6442 Pounds
Bypass Ratio	5 to 1

AVIONICS (STANDARD PACKAGE)

Equipment	Quantity	Type Equipment
Communications (VHF)	2	Honeywell Primus II (SRZ-850)
Navigation (VHF)	2	Honeywell Primus II (SRZ-850)
Standby HSI	1	Aeronetics HSI-315A
DME (Distance Measuring Equipment)	2	Honeywell Primus II (SRZ-850)
Transponder (Mode S)	2	Honeywell Primus II (SRZ-850)
Weather Radar (Turbulence Detection)	1	Honeywell Primus 870
ADF (Automatic Direction Finder)	1	Honeywell Primus II (SRZ-850)
Autopilot/Flight Director	1	Honeywell Primus 2000 System
Audio Control Panel	2	Honeywell AV-850A
Radiotelephone	1	Global Wulfsberg Flitefone VI
Radio Altimeter	1	Honeywell AA-300
Flight Management System	2	Honeywell FMZ-800
HF Radio	1	Bendix/King KHF-950
Electronic Flight Instrument System	1	Honeywell Primus 2000 System

(Continued Next Page)

SPECIFICATIONS (Continued)

AVIONICS (STANDARD PACKAGE) (Continued)

Equipment	Quantity	Type Equipment
Clearance Delivery Unit (VHF)	1	Honeywell Primus II (SRZ-850)
Marker Beacon/ILS/Glide Slope Rcvrs	1	Honeywell Primus II (SRZ-850)
Engine Indicating & Crew Alerting System (EICAS)	1	Honeywell EICAS
Cockpit Voice Recorder	1	Fairchild A200S
Digital Air Data System	2	Honeywell AZ-840
IRS (if installed)	2	Honeywell Laseref III
AHRS (if installed)	2	Honeywell AHZ-800
Standby Attitude Gyro	1	J.E.T. AI-904
Standby Altimeter/Airspeed Indicator	1	Smiths Industries
Magnetic Compass	1	Airpath

MAXIMUM PITCH/ROLL ATTITUDE FOR TAKEOFF AND LANDING

WING TIP/TAILCONE GROUND CONTACT ROLL-PITCH ENVELOPE

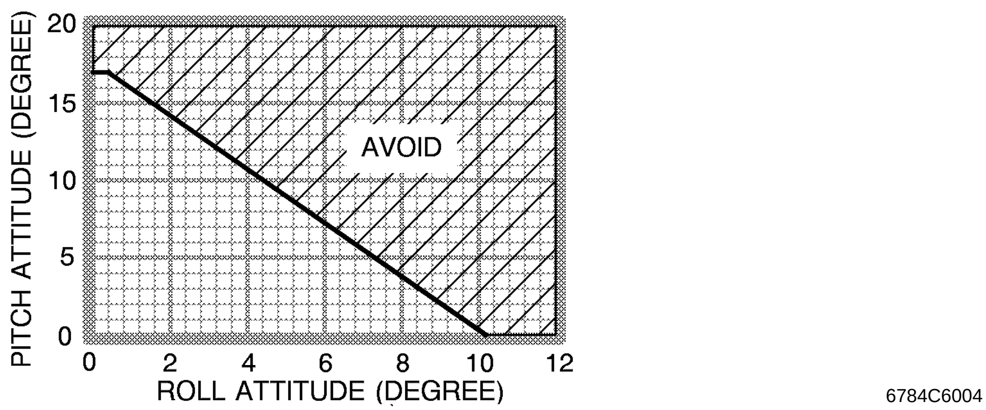


Figure 1-3

CAUTION

EXCESSIVE ROLL AND/OR PITCH, WITH THE MAIN GEAR ON THE GROUND, DURING TAKEOFF OR LANDING CAN RESULT IN TAILCONE AND/OR WING TIP GROUND CONTACT.

OPERATING LIMITATIONS

NOTICE

CERTIFICATION AND OPERATIONAL LIMITATIONS ARE CONDITIONS OF THE TYPE AND AIRWORTHINESS CERTIFICATES AND MUST BE COMPLIED WITH AT ALL TIMES AS REQUIRED BY LAW.

CERTIFICATION STATUS

This airplane is certificated in the Transport Category of the U.S. Federal Air Regulations Part 25.

TAKEOFF AND LANDING OPERATIONAL LIMITS

Takeoff or approach and landing shall not exceed the weight, altitude, temperature and runway gradients or any combination thereof as contained in the Takeoff and Landing Performance Charts in Section IV of the FAA Approved Airplane Flight Manual.

Maximum Altitude Limit . . . . 14,000 Feet
Maximum Tailwind Component . . . . 10 Knots
Maximum Ambient Temperature . . . . Refer to Figure 1-5
Maximum Crosswind Component (Tower reported winds measured 10 meters above runway):

Manual Flight Controls
(Dual hydraulic failure, rudder standby system on or off,
aileron flight control PCU off, rudder flight control PCU off) . . . . 10 Knots
Slats Asymmetry . . . . 10 Knots

Minimum altitude for in flight use of speed brakes . . . . 500 Feet AGL
Maximum asymmetric fuel . . . . 400 Pounds
Emergency asymmetric fuel . . . . 800 Pounds
Minimum wing fuel per tank for takeoff . . . . 500 Pounds
Takeoff in high idle is prohibited (except touch and go)

WEIGHT LIMITATIONS

Maximum Design Ramp Weight . . . . 36,000 Pounds
Maximum Design Takeoff Weight . . . . 35,700 Pounds
Maximum Design Landing Weight . . . . 31,800 Pounds
Standard Maximum Design Zero Fuel Weight . . . . 24,400 Pounds

Takeoff weight is limited by the most restrictive of the following requirements:

Maximum Certified Takeoff Weight . . . . 35,700 Pounds
Maximum Takeoff Weight Permitted by
Climb Requirements . . . . Refer to Takeoff and Landing Performance Charts in Section IV of the FAA Approved Flight Manual
Takeoff Field Length . . . . Refer to Takeoff and Landing Performance Charts in Section IV of the FAA Approved Flight Manual

(Continued next Page)

WEIGHT LIMITATIONS (Continued)

Landing weight is limited by the most restrictive of the following requirements:

Maximum Certified Landing Weight . . . . 31,800 Pounds
Maximum Landing Weight Permitted by Climb Requirements or
Brake Energy Limit . . . . Refer to Takeoff and Landing Performance Charts in Section IV of the FAA Approved Flight Manual
Landing Distance . . . . Refer to Takeoff and Landing Performance Charts in Section IV of the FAA Approved Flight Manual

WEIGHT AND BALANCE DATA

Center-of-Gravity Moment Envelope . . . . Refer to Figure 1-4

The airplane must be operated in accordance with the approved loading schedule. Refer to Weight and Balance Data Sheets and Model 750 Citation X FAA Approved Weight and Balance Manual.

CAUTION

WITH MORE THAN 3100 POUNDS PER SIDE OF WING FUEL, FUEL BURN WILL MOVE THE CENTER-OF-GRAVITY FORWARD AND THEN AFT. IF LOADING NEAR THE FORWARD LIMIT, CHECK THE CENTER-OF-GRAVITY WITH MID FUEL BURN.

NOTE

When single-point refueling the wings only, normal testing and sequencing of the system will result in 100 to 200 pounds of fuel being placed in the center tank.

BALLAST FUEL

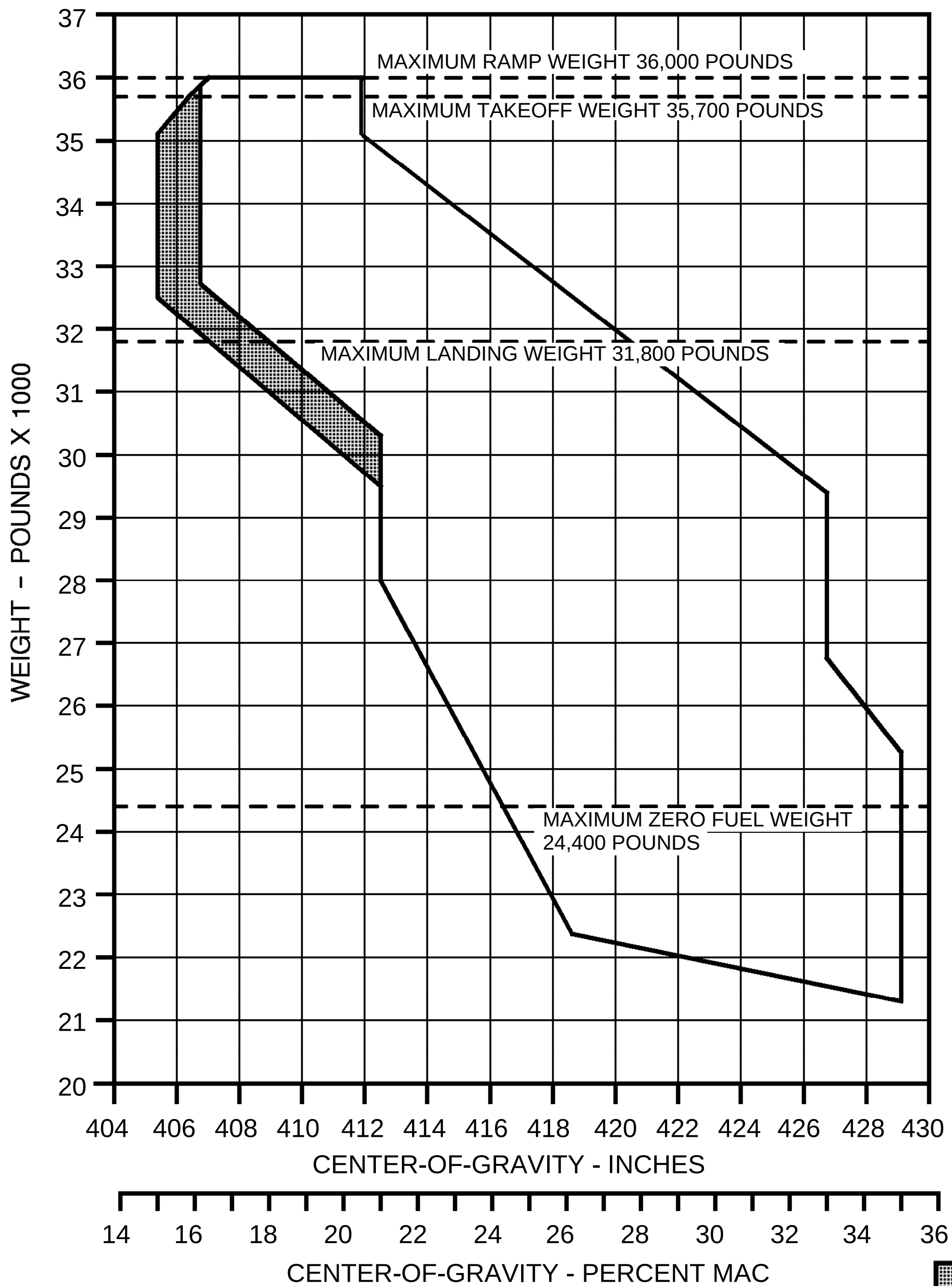
Fuel that remains within the wing fuel tanks which cannot be used without causing the aft center-of-gravity limit to be exceeded. ***Ballast fuel is nonusable fuel***. Ballast fuel requirements must be determined prior to flight. Refer to Weight and Balance Data Sheets (Airplane Weighing Form and Ballast Fuel Graph) and Model 750 Citation X FAA Approved Weight and Balance Manual for determining ballast fuel requirements.

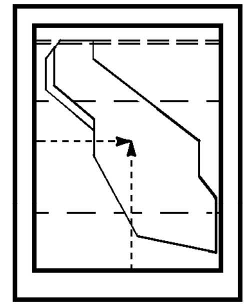
ENGINE - LIMITATIONS

Engine Type . . . . Allison AE-3007C Turbofan
Full Authority Digital Engine Controls (FADECs) . . . . . All four must be operative for takeoff
Air Data Computers (ADCs) . . . . Both must be operational for takeoff
Engine Operating Limits . . . . Refer to Figure 1-6
Minimum Start Duct pressure (EICAS) prior to ground start . . . . 25 PSI

Continuous engine ground static operation up to and including takeoff thrust is limited to ambient temperatures not to exceed the limits of Figure 1-5, Ambient Temperature Limits.

CENTER-OF-GRAVITY LIMITS





= **NOTE:**

IF LOADED IN THIS AREA WITH MORE THAN 3100 POUNDS PER SIDE WING FUEL, CHECK THAT FUEL BURN WILL NOT EXCEED THE FORWARD CG LIMIT.

FORM NUMBER 1953, 1 May 1996
REVISED 9 August 1996

Figure 1-4

AMBIENT TEMPERATURE LIMITS

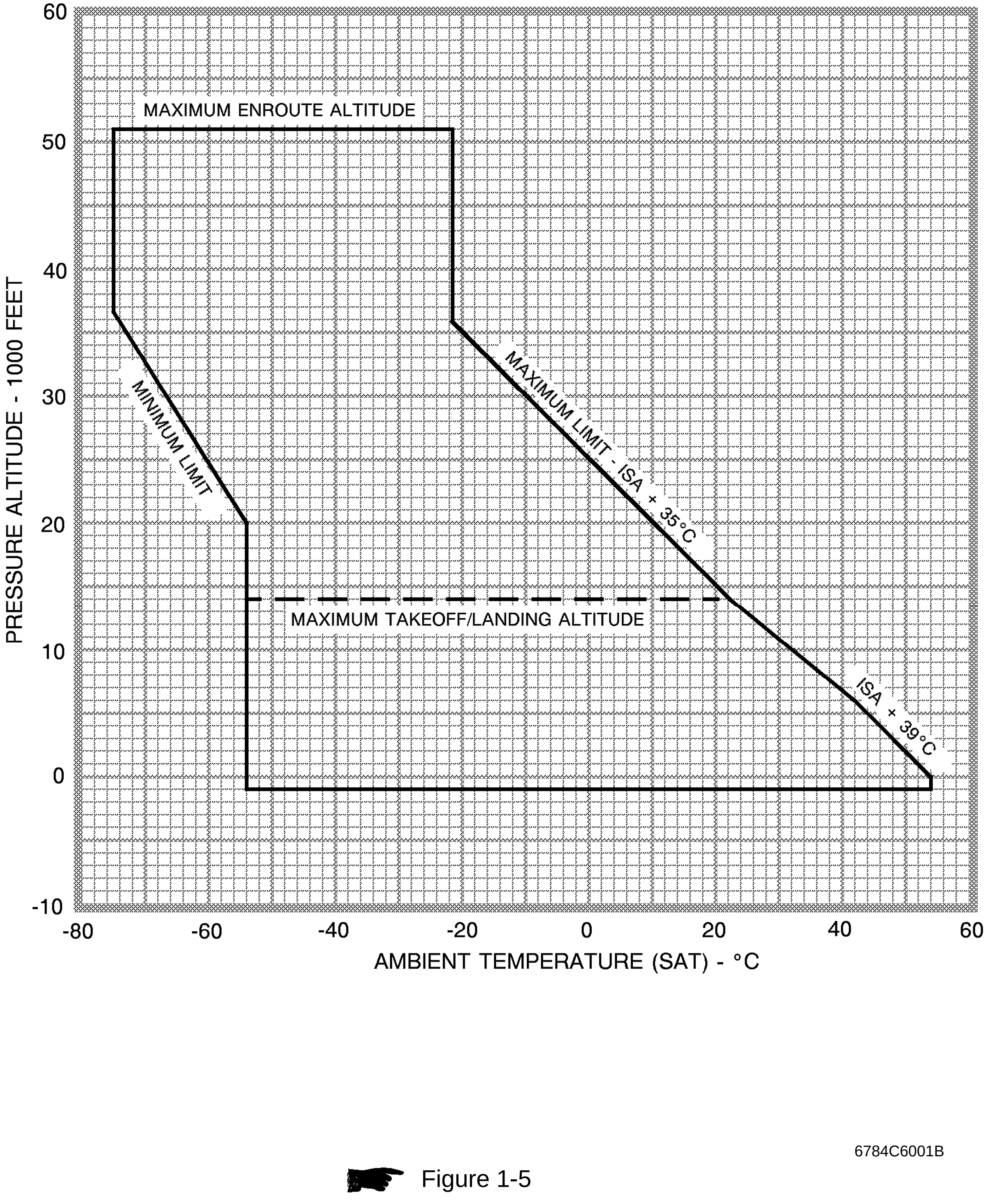


Figure 1-5

ENGINE OPERATING LIMITS

OPERATING CONDITIONS	OPERATING LIMITS					
THROTTLE DETENT	TIME LIMIT	ITT TEMPERATURE °C	N_2 % TURBINE RPM (NOTES 5 AND 6)	N_1 % FAN RPM (NOTE 4)	OIL PRESSURE PSIG (NOTE 7)	OIL TEMPERATURE °C
TO/MC (TAKEOFF) (NOTE 1)	5 MINUTES	888	56.7 TO 101	100	34 TO 90 (95)*	127 MAXIMUM
TO/MC (TAKEOFF) (NOTE 1)	CONTINUOUS (OEI)	850	56.7 TO 101	100	34 TO 90 (95)*	127 MAXIMUM
CLB (CLIMB) (NOTE 2)	CONTINUOUS	850	56.7 TO 101	100	34 TO 90 (95)*	127 MAXIMUM
CRU (CRUISE) (NOTE 3)	CONTINUOUS	850	56.7 TO 101	100	34 TO 90 (95)*	127 MAXIMUM
STARTING	---	800 (NOTE 8)	---	---	90 MAXIMUM (95)* (NOTE 4)	(NOTE 4)

NOTES

1. One engine inoperative (OEI) continuous operation is approved in the TO/MC (Takeoff) detent. Maximum allowable ITT for takeoff is 888°C in the TO/MC detent (not to exceed 5 minutes in the amber range) then 850°C for continuous operation in the TO/MC detent (OEI) or CLB detent (multi-engine).
2. Multi-engine continuous operation is approved in the CLB (Climb) detent.
3. CRU (Cruise) detent should be set within 10 minutes after level off from top-of-climb.
4. During cold day starts, oil pressure may exceed 90 (95)* PSIG. The pressure will decrease as oil temperature increases. Engine speed should not be advanced above idle until oil pressure no longer exceeds 90 (95)* PSIG. Once the oil pressure is below 90 (95)* PSIG, engine speed can be advanced but should not exceed 40% N_1 until the engine fuel temperature is within normal limits, $\geq$4°C. Refer to Figure 2-7, Approved Oils for minimum oil temperature for start.
5. FADEC automatic overspeed shutdowns are set at 105% N_1 and 105.6% N_2. Minimum fan speed for takeoff is 73.6% N_1.
6. When the engine is running, the FADEC will automatically shut the engine down at 54% N_2 or below.
7. Minimum oil pressure BELOW 88% N_2 is 34 PSIG. A cautionary oil pressure range, from $\geq$34 to <50 PSI, exists when in flight or anytime the TLAs are above 30° on the ground.
8. Windmilling airstart ITT limit is 888°C.

* Airplanes Incorporating Honeywell P2000 Integrated Avionics Flight Control System Phase V Software.

Figure 1-6

APU LIMITATIONS

WARNING

DO NOT APPLY EXTERNAL AIRPLANE DEICING FLUID WHEN THE APU IS OPERATING.

CAUTION

THE APU IS NOT APPROVED FOR UNATTENDED GROUND OPERATION.

APU ENGINE LIMITS

Ambient Temperature Limits		Same as airplane, Refer to Figure 1-5
Maximum Airspeed/Mach for Starting		350 KIAS/0.92 MACH
Maximum Altitude for Starting		31,000 Feet
Maximum Operating Altitude		31,000 Feet
In Flight Maximum Generator Load (26 to 29 Volts)		200 Amps
Maximum Generator Load (26 to 29 Volts)		Ground 300 Amps
		Flight 200 Amps
Turbine Speed:	Normal Governed	100±1% RPM
	Caution Range	> 101% to 108% RPM
	Maximum	> 108% RPM
Exhaust Gas Temperature:	Maximum During Start	973°C
	Maximum (Governed Operation)	718°C
	Maximum Continuous (Governed Operation)	665°C

APU OIL LIMITS

Approved oils and ambient temperature requirements are the same as for the airplane. Refer to Figures 1-5 and 1-8.

APU FUEL LIMITS

Approved fuels are the same as for the airplane. Refer to Figure 1-7.

STARTER DUTY CYCLE

Maximum starter duty cycles are six consecutive successful starts at ten minute intervals. A one hour off time must be observed for additional successful starts.

Unsuccessful start attempts:

Battery: Two cycles, 30 seconds each/30 minutes off/Two cycles, 30 seconds each/One hour off (check batteries).

Generator/GPU: Two cycles, 15 seconds each/20 minutes off/Two cycles, 15 seconds each (maximum four cycles per hour).

The APU compartment must be inspected following automatic shutdown.

NOTE

Following automatic shutdown, the APU FAIL annunciator will be illuminated and the APU will not start.

ENGINE OPERATING LIMITS

OPERATING CONDITIONS	OPERATING LIMITS					
THROTTLE DETENT	**TIME LIMIT**	**ITT TEMPERA-TURE °C**	**N_2 % TURBINE RPM (NOTES 5 AND 6)**	**N_1 % FAN RPM (NOTE 4)**	**OIL PRESSURE PSIG (NOTE 7)**	**OIL TEMPERATURE °C**
TO/MC (TAKEOFF) (NOTE 1)	5 MINUTES	888	56.7 TO 101	100	34 TO 90 (95)*	127 MAXIMUM
TO/MC (TAKEOFF) (NOTE 1)	CONTINUOUS (OEI)	850	56.7 TO 101	100	34 TO 90 (95)*	127 MAXIMUM
CLB (CLIMB) (NOTE 2)	CONTINUOUS	850	56.7 TO 101	100	34 TO 90 (95)*	127 MAXIMUM
CRU (CRUISE) (NOTE 3)	CONTINUOUS	850	56.7 TO 101	100	34 TO 90 (95)*	127 MAXIMUM
STARTING	---	800 (NOTE 8)	---	---	90 MAXIMUM (95)* (NOTE 4)	(NOTE 4)

NOTES

1. One engine inoperative (OEI) continuous operation is approved in the TO/MC (Takeoff) detent. Maximum allowable ITT for takeoff is 888°C in the TO/MC detent (not to exceed 5 minutes in the amber range) then 850°C for continuous operation in the TO/MC detent (OEI) or CLB detent (multi-engine).
2. Multi-engine continuous operation is approved in the CLB (Climb) detent. When climbing with bleed air anti-ice on, it is acceptable to use the TO/MC detent provided ITT is ≤ 850°C and thrust is reduced to the CLB (Climb) detent upon reaching cruise altitude.
3. CRU (Cruise) detent should be set within 10 minutes after level off from top-of-climb.
4. During cold day starts, oil pressure may exceed 90 (95)* PSIG. The pressure will decrease as oil temperature increases. Engine speed should not be advanced above idle until oil pressure no longer exceeds 90 (95)* PSIG. Once the oil pressure is below 90 (95)* PSIG, engine speed can be advanced but should not exceed 40% N_1 until the engine fuel temperature is within normal limits, ≥4°C. Refer to Figure 2-7, Approved Oils for minimum oil temperature for start.
5. FADEC automatic overspeed shutdowns are set at 105% N_1 and 105.6% N_2. Minimum fan speed for takeoff is 73.6% N_1.
6. When the engine is running, the FADEC will automatically shut the engine down at 54% N_2 or below.
7. Minimum oil pressure BELOW 88% N_2 is 34 PSIG. A cautionary oil pressure range, from ≥34 to <50 PSI, exists when in flight or anytime the TLAs are above 30° on the ground.
8. Windmilling airstart ITT limit is 888°C.

* Airplanes Incorporating Honeywell P2000 Integrated Avionics Flight Control System Phase V Software.

Figure 1-6

APU LIMITATIONS

WARNING

DO NOT APPLY EXTERNAL AIRPLANE DEICING FLUID WHEN THE APU IS OPERATING.

CAUTION

THE APU IS NOT APPROVED FOR UNATTENDED GROUND OPERATION.

APU ENGINE LIMITS

Ambient Temperature Limits		Same as airplane, Refer to Figure 1-5
Maximum Airspeed/Mach for Starting		350 KIAS/0.92 MACH
Maximum Altitude for Starting		31,000 Feet
Maximum Operating Altitude		31,000 Feet
In Flight Maximum Generator Load (26 to 29 Volts)		200 Amps
Maximum Generator Load (26 to 29 Volts)		Ground 300 Amps
		Flight 200 Amps
Turbine Speed:	Normal Governed	100±1% RPM
	Caution Range	> 101% to 108% RPM
	Maximum	> 108% RPM
Exhaust Gas Temperature:	Maximum During Start	973°C
	Maximum (Governed Operation)	718°C
	Maximum Continuous (Governed Operation)	665°C

APU OIL LIMITS

Approved oils and ambient temperature requirements are the same as for the airplane. Refer to Figures 1-5 and 1-8.

APU FUEL LIMITS

Approved fuels are the same as for the airplane. Refer to Figure 1-7.

STARTER DUTY CYCLE

Maximum starter duty cycles are six consecutive successful starts at ten minute intervals. A one hour off time must be observed for additional successful starts.

Unsuccessful start attempts:

Battery: Two cycles, 30 seconds each/30 minutes off/Two cycles, 30 seconds each/One hour off (check batteries).

Generator/GPU: Two cycles, 15 seconds each/20 minutes off/Two cycles, 15 seconds each (maximum four cycles per hour).

The APU compartment must be inspected following automatic shutdown.

NOTE

Following automatic shutdown, the APU FAIL annunciator will be illuminated and the APU will not start.

APU LIMITATIONS (Continued)

APU AIRSTART ENVELOPE

A4725

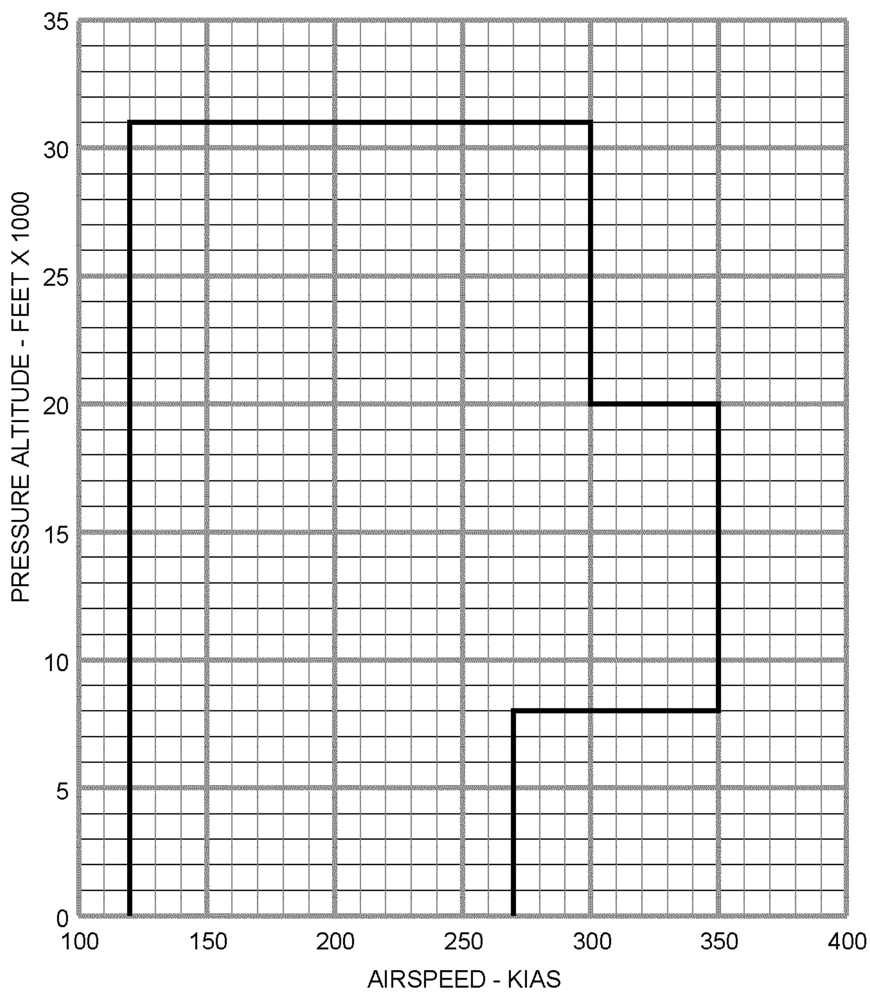


Figure 1-6A

APU LIMITATIONS (Continued)

APU BLEED

APU maximum bleed may not be used during airplane engine starting.

NOTE

APU bleed will be automatically controlled (reduced) if the 665°C EGT limit is reached. This may occur in very hot or very cold temperature conditions if the APU maximum cool bleed is selected or if maximum cool is selected during engine start.

FUEL LIMITATIONS

The following fuels are approved for use in accordance with Figure 1-7:

Jet A, Jet A-1, Jet B, NO. 3 (GB6537-94), JP-4 (NATO F40), JP-5 (NATO F43 or F44), and JP-8 (NATO F34 or F35).

	JET A/A-1 NO. 3 (GB6537-94) JP-5 (NATO F43 or F44) JP-8 (NATO F34 or F35)	JET B JP4 (NATO F40)
MINIMUM FUEL TEMPERATURE FOR START, TAKEOFF (FUEL TANK TEMPERATURE)	-37°C	-37°C
MAXIMUM FUEL TEMPERATURE FOR START, TAKEOFF AND ENROUTE (FUEL TANK TEMPERATURE)	+52°C	+48°C
MINIMUM FUEL TEMPERATURE (ENGINE), ENGINE OPERATING	+4°C	+4°C
MAXIMUM FUEL TEMPERATURE (ENGINE), ENGINE OPERATING	+98.9°C	+98.9°C
MAXIMUM ALTITUDE	51,000 FEET	51,000 FEET

NOTE

- Minimum fuel temperature is based on a maximum fuel viscosity of 12 centistokes.
- Takeoff with Engine Fuel Temperature below +4°C or above 98.9°C is not permitted.

Figure 1-7

Single point refueling operations must be accomplished per the procedures on the placard installed on the single point refueling access door.

(Continued Next Page)

FUEL LIMITATIONS (Continued)

UNUSABLE FUEL

Fuel remaining in the fuel tanks when the EICAS fuel quantity indication reads zero is not usable in flight, and is not to be considered ballast fuel. Unusable fuel is 4.81 gallons for each wing/hopper tank and 2.2 gallons for the center tank.

FUEL TRANSFER/CROSSFEED LIMITATIONS

CAUTION

- CENTER WING TANK TO WING TRANSFER MUST BE INITIATED PRIOR TO 3100 LBS PER SIDE WING FUEL.
- MAXIMUM LATERAL FUEL IMBALANCE (INTENTIONAL) IS 400 POUNDS. AN IMBALANCE OF 800 POUNDS HAS BEEN DEMONSTRATED FOR EMERGENCY RETURN.
- SIMULTANEOUS USE OF CROSSFEED AND CENTER WING TANK TRANSFER IS PROHIBITED WHEN THE WING QUANTITY IS 2900 LBS OR LESS PER SIDE. FUEL LATERAL IMBALANCE WILL RESULT.

APPROVED HYDRAULIC FLUIDS

Hyjet IVA	Skydrol 500B
Hyjet IVA Plus	Skydrol LD-4

GROUND PNEUMATIC CART LIMITATION

If a ground pneumatic cart is being used for engine start, it must be capable of maintaining a minimum air pressure of 30 PSI, as displayed in the EICAS, prior to initiating the start.

BAGGAGE COMPARTMENT

The baggage compartment smoke detection system must be operational if baggage is carried in the baggage compartment. Live animals may not be transported in the baggage compartment. Flight time with the baggage compartment not pressurized must be logged. Refer to the Model 750 Aircraft Maintenance Manual for cycle and hour limits. Maximum weight of baggage in the baggage compartment is 700 lbs. Maximum weight in the ski holding compartment is 75 lbs.

CAUTION

CHECK CENTER-OF-GRAVITY BEFORE LOADING THE BAGGAGE COMPARTMENT.

ENGINE OIL LIMITATIONS

Only oils listed in Figure 1-8 may be used in the AE3007C engine.

APPROVED OILS

Oils Conforming to MIL-L-7808K	Oils Conforming to MIL-L-23699D
Mobile RM 284A	Mobil Jet II
	Aeroshell/Royco Turbine Oil 500
	Exxon Turbo Oil 2380
	Mobile Jet Oil 254

CAUTION

- USE OF NON-APPROVED OIL COULD RESULT IN DAMAGE TO THE ENGINE, PREMATURE ENGINE FAILURE, AND WILL BE CONSIDERED MISUSE UNDER THE PROVISIONS OF THE ENGINE WARRANTY.
- IF MIXED WITH OTHER OILS, MOBIL JET OIL 254 CAN CAUSE WASHING OR SHEDDING OF CARBON DEPOSITS LEFT BY THOSE OILS. THIS CLEANING PROCESS CAN LEAD TO OIL SYSTEM PROBLEMS, SUCH AS BLOCKED PASSAGEWAYS AND SCREENS. CHANGING FROM EXXON 2380, MOBIL JET II OR AEROSHELL/ROYCO 500, TO MOBIL JET 254 SHOULD ONLY BE DONE WHEN THE ENGINE IS NEW OR OVERHAULED.
- IF BRANDS OF OIL ARE CHANGED, IT SHOULD BE ACCOMPLISHED GRADUALLY USING THE "TOP OFF" METHOD.
- ENSURE OIL TEMP IS ABOVE -40°C (-40°F) BEFORE ATTEMPTING A START WHEN USING MIL-L-23699D TYPE OIL, OR ABOVE -54°C (-65°F) WHEN USING MIL-L-7808K TYPE OIL.
- DO NOT MIX MIL-23669D AND MIL-L-7808K TYPE OILS.

NOTE

The AE3007 engine will perform best on MIL-L-23699D type oil. Use of MIL-L-7808K type oil should be limited to only those times when operating in extreme cold without preheat capability (-40°C to -54°C or -40°F to -65°F) or when MIL-L-7808K is the only oil available.

Figure 1-8

GENERATOR LIMITATIONS

Main Generators (EACH)	. . . .	400 Amperes 41,000 Feet
	. . . .	300 Amperes >41,000 Feet

BATTERY LIMITATIONS

CAUTION

IF THE AIRPLANE WILL BE COLD SOAKED (PARKED) BELOW -20°C (-4°F), THE BATTERIES SHOULD BE REMOVED AND STORED IN A WARM ENVIRONMENT. BATTERIES COLDER THAN -20°C MAY BE INERT AND WILL NOT DISCHARGE OR CHARGE.

The battery temperature warning system must be operational for all ground and flight operations.

If a BATT O'TEMP EICAS message occurs during ground operation, do not take off until after the proper battery maintenance procedures have been accomplished.

Battery Cycle Limitation	. . . .	Six APU starts per hour Refer to APU Limitations.

NOTE

1. If battery limitation is exceeded, a deep cycle including a capacity check may be required to detect possible cell damage. Refer to Chapter 24 of the Maintenance Manual for procedure.

2. If a ground external power unit is used for APU start, no battery cycle is counted.

COCKPIT AND CABIN PAC SELECTOR SWITCHES

Operation in HIGH mode is not approved for takeoff, landing or flight above 45,000 feet.

Operation in HIGH mode is not approved during normal operation when any of the following systems are on: engine anti-ice, slat anti-ice or stabilizer anti-ice. During emergency operations, HIGH mode is approved when the bleed air anti-ice systems are on, but anti-ice performance will be degraded.

Operation in HIGH is not approved above 25,000 feet when the isolation valve is open and either the left or right engine bleed air switch is OFF.

Single PAC operation above 41,000 feet is prohibited.

OXYGEN SYSTEM

Service oxygen system with Aviator's Breathing Oxygen per MIL-O-27210. The use of medical oxygen is not approved.

HONEYWELL PRIMUS 2000 INTEGRATED AVIONICS SYSTEM AND AUTOPILOT

1. The Honeywell Primus 2000 Pilot's Manual must be immediately available to the flight crew: Primus 2000 Integrated Avionics System and Flight Control Systems, for the Citation X - Publication Number A28-1146-104-01 dated October 1997 or later appropriate revision.
2. The airplane should not be taxied until the AHRS or IRS ground alignment is complete (approximately three minutes).
3. One pilot must remain in his seat with seat belt and shoulder harness fastened during all autopilot operations.
4. PFD data must be displayed in the No. 1 and No. 5 display units for dispatch.
5. Autopilot minimum use height:
   a. Cruise . . . . 1000 Feet AGL
   b. Precision Approach (Category I ILS) . . . . 170 Feet AGL
   c. Nonprecision Approach . . . . 400 Feet AGL
6. Autopilot coupled operation with single operational or displayed AHRS or IRS is prohibited.
7. Approved for Category I and II operations. Refer to Category II limitations.
8. Autopilot coupled ILS approaches with flaps up are prohibited.
9. VOR navigation without DME: For proper radial tracking following station passage using a VOR navaid without DME, the VOR navaid must be the active waypoint in the FMS flight plan.

HONEYWELL PRIMUS II SRZ-850 INTEGRATED RADIO SYSTEM

1. The Honeywell Pilot's Operating Handbook for the PRIMUS II Integrated Radio System, Publication Number: A28-1146-50-04, dated April 1993 or later revision, must be immediately available to the flight crew. Honeywell Publication A28-1146-121-00, dated February 1999 or later revision is an acceptable replacement for A28-1146-50-04 and is the required document for those airplanes equipped with 8.33 KHz spacing radios.

CATEGORY II LIMITATIONS

1. Specific operational approval and crew qualification is required for Category II operation.
2. The CAT 2 mode annunciation must be displayed in both PFDs from the final approach fix to the decision height.
3. Maximum final approach speed is V_{REF} +20 knots at the outer marker, slowing to V_{REF} (or V_{REF} adjusted for wind gust) prior to reaching the decision height.
4. Category II approaches with flaps in any position other than FULL (35°) are prohibited.
5. Autopilot minimum use height (Category II ILS) . . . . 80 Feet AGL
6. Wind Limitations:
   Maximum tailwind component . . . . 10 knots
   Maximum crosswind component . . . . 15 knots

NOTE

If the FMS indicates significantly different wind on final than reported on the surface, low altitude wind shear may result in exceeding the localizer or glideslope Category II deviation limits.

PAC HIGH PRESSURE BLEED AIR SWITCH

Operation of the cabin and cockpit PACs in high pressure bleed air, HP BLEED SELECT switch to HP (PAC HP VLV OPEN message on), is not approved for normal takeoff and landing operations.

Operation of the cabin and cockpit PACs in high pressure bleed air (PAC HP VLV OPEN message on) is prohibited when any of the following systems are on: engine anti-ice, slat anti-ice or horizontal stabilizer anti-ice.

The PAC BLEED SELECT switch must be positioned to NORM or HP above 41,000 feet.

OXYGEN MASKS

NOTE

The following aircraft certification requirements are in addition to the requirements of applicable operating rules. The most restrictive (certification or operating) must be observed.

The pressure demand crew oxygen masks must be checked, adjusted and properly stowed prior to flight.

Crew oxygen masks are not approved for sustained operation at a cabin altitude greater than 40,000 feet.

Passenger oxygen masks are not approved for sustained operation at a cabin altitude greater than 25,000 feet.

Headsets and/or hats must be removed prior to donning oxygen masks.

NOTE

Some headsets, eyeglasses, hairstyles, mustaches, beards, or hats worn by the crew members may interfere with the quick-donning capabilities of the oxygen masks. Crew members must ensure that they can properly don the oxygen mask.

STANDBY ATTITUDE, AIRSPEED, AND ALTIMETER INSTRUMENTS

The standby attitude indicator, airspeed/altimeter, and HSI instruments must be operational. The standby power preflight check must be accomplished each flight.

The standby airspeed indicator speed limitations as noted on the placard adjacent to the indicator are applicable only if both the pilot's and copilot's primary airspeed indicators are inoperative. Airspeeds on this placard, above 24,000 feet are approximately 0.82 Mach.

NOTE

Standby airspeed and altitude are not corrected for static and pitot source error and will normally vary from calibrated data presented in the PFD. Refer to Figure 4-3 of the FAA Approved Airplane Flight Manual. Placard airspeeds above 24,000 feet may be linearly interpolated.

SPEED LIMITATIONS

Design Speed Envelope (calibrated altitude) . . . . Refer to Figure 1-9
Maximum Operating MACH - M_{MO} (above 30,650 feet) . . . . 0.92 Mach (Indicated)
- M_{MO} (Mach trim off) . . . . 0.82 Mach (Indicated)
Maximum Operating KNOTS V_{MO}, 350 KIAS at 8000 feet to 30,650 feet . . . . . 350 KIAS
V_{MO} (below 8000 feet) . . . . 270 KIAS

NOTE

- The M_{MO} and V_{MO} limits are lower for certain equipment failures. Refer to the applicable Emergency or Abnormal Procedure.
- The maximum operating limit speeds may not be deliberately exceeded in any regime of flight (climb, cruise or descent) unless a higher speed is authorized for flight test or pilot training.

With standby airspeed indicator as primary speed reference, the following V_{MO} schedule must not be exceeded:

Sea level to 8,000 feet . . . . 270 KIAS
8000 feet to 24,000 feet . . . . 345 KIAS
24,000 feet to 35,000 feet . . . . 275 KIAS
35,001 feet to 41,000 feet . . . . 240 KIAS
41,001 feet to 51,000 feet . . . . 190 KIAS

NOTE

- Above 24,000 feet, airspeed may be linearly interpolated between altitudes.
- Speeds above 24,000 feet are based on 0.82 Mach limit.

Maximum Maneuvering Speeds V_A . . . . Refer to Figure 1-10

NOTE

Full application of rudder and aileron controls, as well as maneuvers that involve angles-of-attack near stall, should be confined to speeds below maximum maneuvering speed.

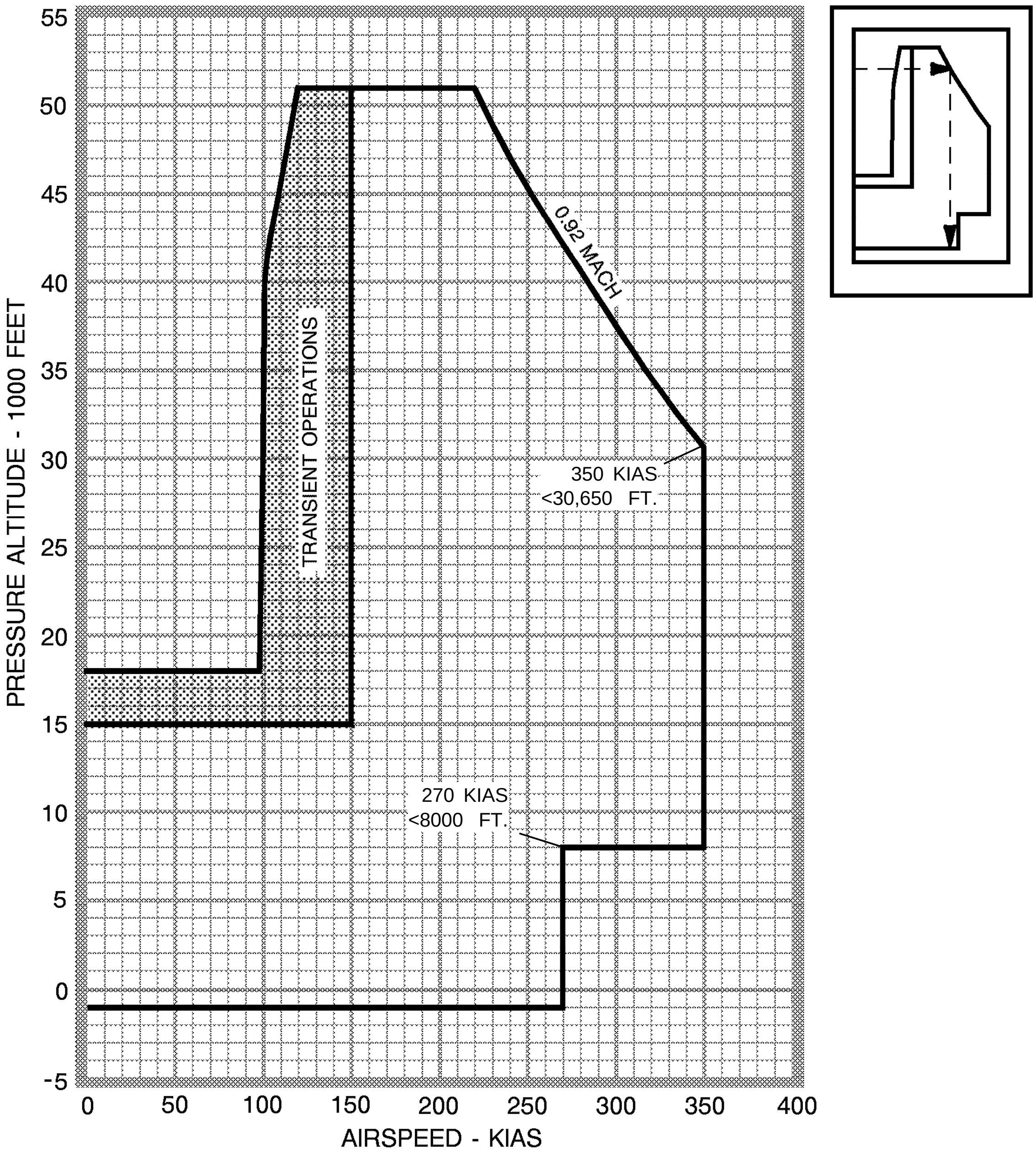
Maximum Altitude for Extension of Flaps and Landing Gear . . . . 18,000 Feet
Maximum Slat Extended Speed . . . . 250 KIAS
Maximum Flap Extended Speed-V_{FE}
Partial Flaps 5° position . . . . 250 KIAS
Partial Flaps 15° position . . . . 210 KIAS
Full Flaps - FULL position . . . . 180 KIAS
Maximum Landing Gear Operating/Extended Speed - V_{LO} /V_{LE} . . . . 210 KIAS

NOTE

This is the maximum speed at which the landing gear may be lowered or raised as well as the maximum speed with the landing gear extended.

(Continued Next Text Page)

DESIGN SPEED ENVELOPE
INDICATED AIRSPEED



NOTE: TRANSIENT OPERATION AREAS ARE FOR INTENTIONAL OR INADVERTENT STALL RECOVERY ONLY. INTENTIONAL STALLS ABOVE 18,000 FT. ARE PROHIBITED.

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Figure 1-9

MAXIMUM MANEUVERING SPEEDS
INDICATED AIRSPEED

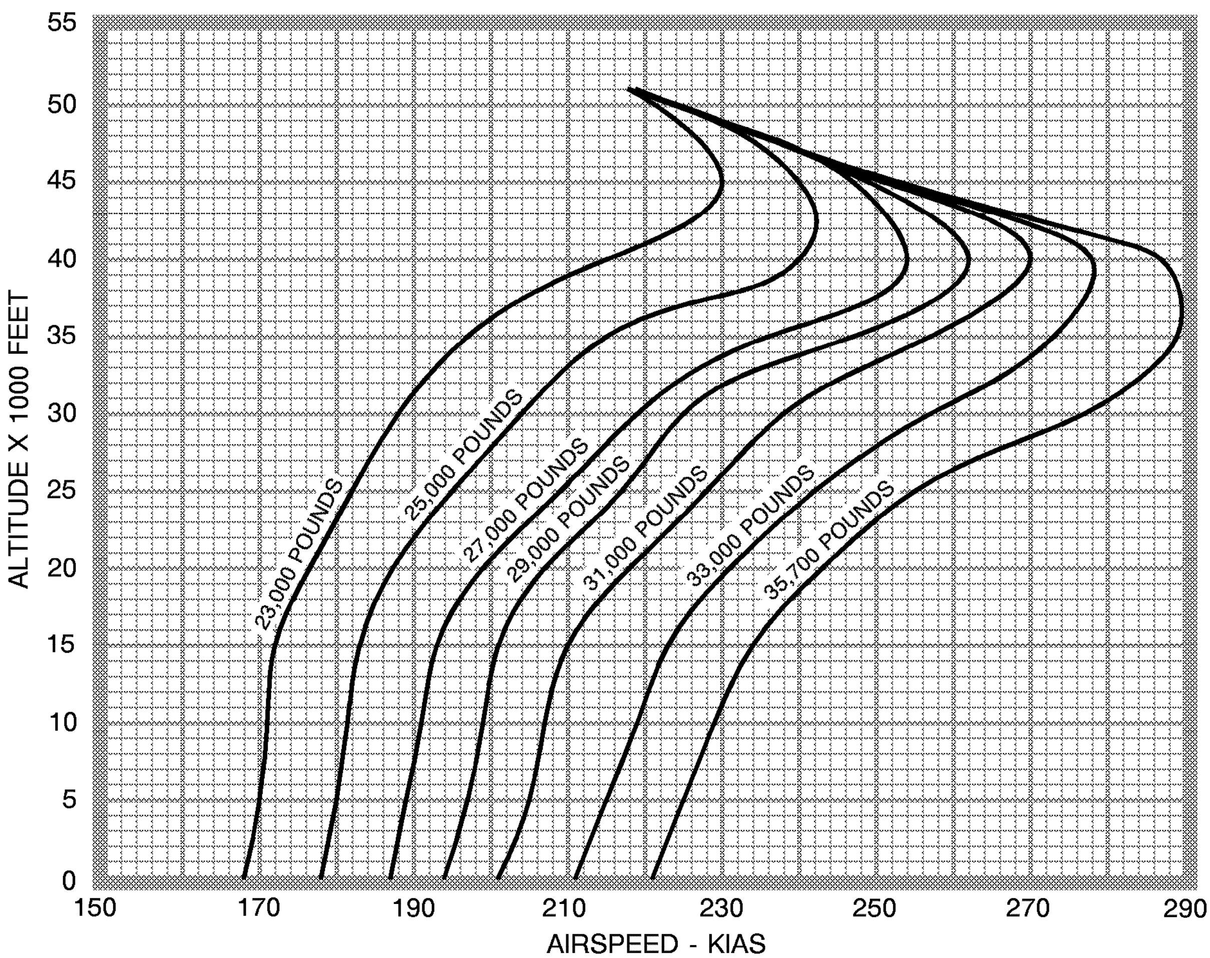

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Figure 1-10

SPEED LIMITATIONS (Continued)

Maximum Turbulent Air Penetration Speed . . . . 300 KIAS / 0.9 Mach
Maximum Speed Brake Extension Speed . . . . No Limit
Minimum Speed Brake Extension Speed . . . . V_{REF} +15 KIAS
Minimum Single Engine Enroute Climb Speed . . . . 190 KIAS
Maximum Tire Ground Speed . . . . 210 Knots

NOTE

For minimum control speeds (V_{MCA}, V_{MCL}, and V_{MCG}) refer to the respective definitions in Section IV, FAA Approved Airplane Flight Manual.

NOSE TIRE LIMITATION

Only the Goodyear 164F03-1 and 164F03-2 nose tires are approved. Approved tires must be inflated to 130 ± 5 PSIG, unloaded, in accordance with the service placard.

NOTE

- Tire pressures identified as UNLOADED are pressures with the airplane on jacks or before the wheels are installed on the airplane.
- Loaded tire pressure will be 2 to 5 PSIG higher, depending on airplane weight and center-of-gravity.

ENROUTE OPERATIONAL LIMITS

Maximum Calibrated Operating Altitude . . . . 51,000 Feet
Ambient Temperature Limits - Refer to Figure 1-5 of this manual and Section IV - Performance Charts in the FAA Approved Airplane Flight Manual.

ENGINE AIR TURBINE STARTER LIMITATION

Three consecutive normal starts followed by 25 minutes cooling. One 30 second motoring cycle is equivalent to one normal start.

OPERATIONS AUTHORIZED

This airplane is approved for day and night VFR and IFR flight, and flight into known icing conditions.

This airplane is eligible for over water operations with applicable equipment specified in the appropriate operating rules.

This airplane is not approved for ditching under FAR 25.801.

OPERATIONS AUTHORIZED (Continued)

This airplane is approved for Category II operations. This does not constitute operational approval.

No acrobatic maneuvers, including spins, are approved. No intentional stalls permitted above 18,000 feet.

MINIMUM CREW

Minimum Flight Crew for all Operations . . . . Pilot and Copilot

LOAD FACTOR

In flight
Flaps - UP Position (slats retracted) . . . . -1.0 to +2.7 G at 35,700 Pounds
Flaps - UP Position (slats extended) . . . . 0.0 to +2.0 G at 35,700 Pounds
Flaps - 5 Degrees to FULL Position (slats extended) 0.0 to +2.0 G at 35,700 Pounds
Maximum Duration - Zero to Negative G . . . . 10 Seconds

NOTE

These accelerations limit the angle-of-bank in turns and limit the severity of pullup maneuvers.

Landing . . . . +3.5 G at 31,800 Pounds

NOTE

This acceleration represents landing at a sink rate, at touchdown, of 600 feet per minute.

CABIN PRESSURE LIMITATIONS

Normal Cabin Pressure Limitations . . . . 9.7 PSI Maximum Differential

SEATING

The maximum number of seats is 14 (pilot, copilot and 12 passengers).

Passenger seats must be in the following positions during all takeoffs and landings:

All Seats Fully upright and outboard with occupied seat headrests fully extended.
Seat backs - Clear of emergency exits.

BELTED TOILET SEAT

During Taxi, Takeoff and Landing when the belted toilet seat is occupied the aft divider sliding doors must be LATCHED OPEN.

CRACKED WINDSHIELD

If either cockpit windshield cracks in flight, continued flight to destination is permitted in accordance with Section V, Abnormal Procedures, Cockpit Forward or Side Windshield Cracked or Shattered. After landing, the following guidance applies:

(Continued Next Page)

CRACKED WINDSHIELD (Continued)

1. If only the outer (non-structural) ply of the windshield is cracked, flight to a maintenance base is permitted, observing Cockpit Forward or Side Windshield Cracked or Shattered Procedures.

2. If either structural ply of the windshield is cracked, restricted flight is permitted only on a ferry permit (Special Airworthiness Certificate).

NOTE

Windshield construction consists of a 0.10 inch outer (non-structural) face ply, a 0.19 inch structural ply, and a 0.235 inch structural inner ply, separated by 0.15 inch PVB/Urethane layers for a total thickness of 0.825 inches.

ICING LIMITATIONS

Pitot-static/RAT heat and engine and stabilizer bleed air anti-ice must be turned on when operating in icing conditions as defined in Section IV. All other anti-ice systems must be turned on unless it can be verified that ice is not forming or detected. Maximum SAT for operation of bleed air anti-ice above idle is +20°C.

Selection of PAC HP bleed is prohibited with engine, slat, or tail anti-ice on.

Minimum speed/configuration for sustained flight in icing is 200 KIAS/slats up, except for approach and landing. Normal approach procedures in icing conditions may be flown at normal airspeeds and normal configurations.

The airplane must be free of ice as defined in Section IV of this manual and Section VII of the FAA Approved Airplane Flight Manual prior to takeoff.

WARNING

DO NOT APPLY EXTERNAL AIRPLANE DEICING FLUID WHEN THE APU IS OPERATING.

CAUTION

TO PREVENT POSSIBLE ENGINE DAMAGE FROM THE INGESTION OF ICE, DO NOT CHIP OR SCRAPE ICE OR SNOW FROM THE ENGINE AIR INLET. DEICE THESE AREAS PRIOR TO START. REFER TO SECTION IV OF THIS MANUAL OR TO SECTION VII OF THE FAA APPROVED AIRPLANE FLIGHT MANUALS.

NOTE

- Section VII of the FAA Approved Airplane Flight Manual and Section IV of this manual contain information on airplane deicing.

- Selection of PAC HP bleed with anti-ice on will degrade anti-ice system performance and cause cold messages to illuminate

(Continued Next Page)

ICING LIMITATIONS (Continued)

OPERATIONS IN SEVERE ICING CONDITIONS

WARNING

SEVERE ICING MAY RESULT FROM ENVIRONMENTAL CONDITIONS OUTSIDE OF THOSE FOR WHICH THE AIRPLANE IS CERTIFIED. FLIGHT IN FREEZING RAIN, FREEZING DRIZZLE, OR MIXED ICING CONDITIONS (SUPERCOOLED LIQUID WATER AND ICE CRYSTALS) MAY RESULT IN ICE BUILD-UP ON PROTECTED SURFACES EXCEEDING THE CAPABILITY OF THE ICE PROTECTION SYSTEM, OR MAY RESULT IN ICE FORMING AFT OF THE PROTECTED SURFACES. THIS ICE MAY NOT BE SHED WHEN USING THE ICE PROTECTION SYSTEMS, AND MAY SERIOUSLY DEGRADE THE PERFORMANCE AND CONTROLLABILITY OF THE AIRPLANE.

During flight, severe icing conditions that exceed those for which the airplane is certified shall be determined by the following visual cues:

1. Unusually extensive ice accumulation on the airframe and windshield in areas not normally observed to collect ice.
2. Accumulation of ice on the upper surface of the wing aft of the protected area.

If one or more of these visual cues exist, immediately request priority handling from Air Traffic Control to facilitate a route or altitude change to exit the icing conditions.

ENGINE SYNCHRONIZATION

The use of engine synchronization is prohibited during takeoff and landing, single engine operation, or FADEC ADC or N_1 reversionary operation.

ANGLE-OF-ATTACK/STALL WARNING SYSTEM

Both stall warning systems, the auto-slat system, and the minimum speed system must be verified to be operational by a satisfactory preflight test as contained in Section IV.

The angle-of-attack indicating system may be used as a reference but does not replace the airspeed indicator as a primary instrument.

FLIGHT CONTROL SYSTEMS

The following flight control hydraulic systems must be verified operational by a satisfactory preflight test as contained in section IV:

a. A and B hydraulic systems (proper hydraulic pressure, no CAS message).
b. The A system auxiliary pump (proper pressure with A and B systems off, setting brake).
c. The B-to-A hydraulic power transfer system (proper pressure cycling after right engine start).
d. B system rudder standby hydraulic system (absence of CAS messages after right engine start)
e. PCU monitor system (absence of CAS messages or monitor annunciators).

Both A and B Flight Guidance Computers and all flight control systems including slats, flaps, ailerons, aileron trim, spoilers, speed brakes, rudders, rudder trim, elevator, primary and secondary stabilizer trim, and all respective indicators, must be verified to be operational by a satisfactory preflight test as contained in Section IV.

Both upper and both lower yaw damper channels must be operational.

The stabilizer trim must be set in accordance with Figure 3-2 (green arc), of the FAA Approved Flight Manual, for takeoff.

The Mach trim system must be operational for speeds above Mach 0.82.

Except as required by Abnormal or Emergency Procedures, the A and B hydraulic systems may not be intentionally unloaded, (Pump A and/or Pump B switches to UNLOAD) in flight above 15,000 feet MSL altitude.

THRUST REVERSERS

Thrust reversers are restricted to ground operations on paved surfaces only.

Use of Thrust Reversers is prohibited during touch-and-go-landings.

Maximum reverse thrust is limited by preset maximum reverse throttle lever angle (28°) and is approximately 50% N_1 at sea level, standard conditions.

Reverse thrust must be reduced to idle reverse (detent) at 60 KIAS during landing rollout.

During single engine reversing, either with nosewheel steering inoperative or on a slippery runway, thrust must be reduced to idle reverse (detent) by 70 KIAS during landing rollout.

The thrust reverser must be verified to be operational by a satisfactory test as contained in Section IV.

CAUTION

THRUST REVERSERS SHOULD NOT BE DEPLOYED UNTIL THE NOSE WHEEL IS ON THE GROUND. AIRPLANE PITCH-UP MAY OCCUR.

ICING LIMITATIONS (Continued)

OPERATIONS IN SEVERE ICING CONDITIONS

WARNING

SEVERE ICING MAY RESULT FROM ENVIRONMENTAL CONDITIONS OUTSIDE OF THOSE FOR WHICH THE AIRPLANE IS CERTIFIED. FLIGHT IN FREEZING RAIN, FREEZING DRIZZLE, OR MIXED ICING CONDITIONS (SUPERCOOLED LIQUID WATER AND ICE CRYSTALS) MAY RESULT IN ICE BUILD-UP ON PROTECTED SURFACES EXCEEDING THE CAPABILITY OF THE ICE PROTECTION SYSTEM, OR MAY RESULT IN ICE FORMING AFT OF THE PROTECTED SURFACES. THIS ICE MAY NOT BE SHED WHEN USING THE ICE PROTECTION SYSTEMS, AND MAY SERIOUSLY DEGRADE THE PERFORMANCE AND CONTROLLABILITY OF THE AIRPLANE.

During flight, severe icing conditions that exceed those for which the airplane is certified shall be determined by the following visual cues:

1. Unusually extensive ice accumulation on the airframe and windshield in areas not normally observed to collect ice.
2. Accumulation of ice on the upper surface of the wing aft of the protected area.

If one or more of these visual cues exist, immediately request priority handling from Air Traffic Control to facilitate a route or altitude change to exit the icing conditions.

ENGINE SYNCHRONIZATION

The use of engine synchronization is prohibited during takeoff and landing, single engine operation, or FADEC ADC or N_1 reversionary operation.

ANGLE-OF-ATTACK/STALL WARNING SYSTEM

Both stall warning systems, the auto-slat system, and the minimum speed system must be verified to be operational by a satisfactory preflight test as contained in Section IV.

The angle-of-attack indicating system may be used as a reference but does not replace the airspeed indicator as a primary instrument.

FLIGHT CONTROL SYSTEMS

The following flight control hydraulic systems must be verified operational by a satisfactory preflight test as contained in section IV:

a. A and B hydraulic systems (proper hydraulic pressure, no CAS message).
b. The A system auxiliary pump (proper pressure with A and B systems off, setting brake).
c. The B-to-A hydraulic power transfer system (proper pressure cycling after right engine start).
d. B system rudder standby hydraulic system (absence of CAS messages after right engine start)
e. PCU monitor system (absence of CAS messages or monitor annunciators).

Both A and B Flight Guidance Computers and all flight control systems including slats, flaps, ailerons, aileron trim, spoilers, speed brakes, rudders, rudder trim, elevator, primary and secondary stabilizer trim, and all respective indicators, must be verified to be operational by a satisfactory preflight test as contained in Section IV.

Both upper and both lower yaw damper channels must be operational.

The stabilizer trim must be set in accordance with Figure 3-2 (green arc), of the FAA Approved Flight Manual, for takeoff.

The Mach trim system must be operational for speeds above Mach 0.82.

Except as required by Abnormal or Emergency Procedures, the A and B hydraulic systems may not be intentionally unloaded, (Pump A and/or Pump B switches to UNLOAD) in flight above 15,000 feet MSL altitude.

THRUST REVERSERS

Thrust reversers are restricted to ground operations on paved surfaces only.

Use of Thrust Reversers is prohibited during touch-and-go-landings.

Maximum reverse thrust is limited by preset maximum reverse throttle lever angle (40.2°) and is approximately 70% N_1 at sea level, standard conditions.

Reverse thrust must be reduced to idle reverse (detent) at 65 KIAS during landing rollout.

During single engine reversing, either with nosewheel steering inoperative or on a slippery runway, thrust must be reduced to idle reverse (detent) by 70 KIAS during landing rollout.

The thrust reverser must be verified to be operational by a satisfactory test as contained in Section IV.

CAUTION

THRUST REVERSERS SHOULD NOT BE DEPLOYED UNTIL THE NOSE WHEEL IS ON THE GROUND. AIRPLANE PITCH-UP MAY OCCUR.

RADIO ALTIMETER

The radio altimeter must be on, and operable for dispatch, except in accordance with an approved MEL.

AUTOMATIC DIRECTION FINDER (ADF)

The ADF bearing pointer may be unreliable during HF radio transmissions.

STATIC DISCHARGE WICKS

There are a total of 18 static discharge wicks installed on the airplane. No more than a total of two static discharge wicks may be missing from the airframe for dispatch for flight. There cannot be two adjacent static discharge wicks missing at any one time.

COLLINS RTU 4210 RADIO TUNING UNIT (IF INSTALLED)

The Collins RTU 4210 Radio Tuning Unit, Pilot's Guide, dated 11 August 1995 or later applicable revision, must be immediately available to the flight crew for airplanes equipped with the Collins RTU 4210 system.

EICAS AND INSTRUMENT MARKINGS

A and B System Hydraulic Pressure		
Digital Indication	Green Range:	2800 to 3200 PSI
	Amber Range :	< 2800, > 3200 PSI
Either engine running and both		
*Hydraulic Pressures Low	Red Range :	< 2600 PSI
*Both engines shut down	Green Range :	< 2600 PSI

Red digits when both hydraulic systems have low pressure AND either engine is running, OR green digits if neither engine running.

A and B System Hydraulic Quantity		
Digital Indication	Green Range :	> 16 to 100%
	Amber Range :	≤ 16%
Accumulator Pressures (A and B Hydraulic Systems emergency brake, Gear blowdown, rudder standby system, and nose wheel steering)		Per Placard according to temperature
APU MFD EICAS		
% RPM Indication	Green Range :	0 to 101%
	Amber Range :	> 101 to 108%
	Red Range :	> 108%
EGT	Green Range :	0 to 665°C
	Amber Range :	>665 to 718°C
	Red Range :	>718°C

(Continued Next Page)

EICAS AND INSTRUMENT MARKINGS (Continued)

APU DC AMPS (Gage)	Green Range (ground or flight) :	0 to 200
	Yellow Range (ground only) :	200 to 300
	Red Line :	300
	Red Range :	> 400
APU Start Pressure Indication	Green Range :	20 to 55 PSI
	Amber Range :	< 20, > 55 PSI
Brake and Gear Pneumatic Pressure Indicators		
(Two gages In Nose Compartment)		**1550 to 2100 PSI

** Refer to temperature vs. pressure placard mounted on nose compartment door (-40°F to 130°F)

Cabin Differential Pressure Indicator	Green Arc :	0.0 to 9.7 PSI
	Red Line :	9.7 PSI
Fuel Quantity Digital Indication (Wing Tanks)	Amber :	< 500 Pounds
Fuel Temperature Indication		
Engine	Green :	4 to 99°C
	Amber :	< 4, > 99°C
Tank	Green :	–35 to 52°C
	Amber :	< –35, > 52°C
Left and Right Electrical Systems		
Digital Voltage Indication	Green Range:	23 to 29 VDC
	Amber Range:	< 23, > 29 VDC

Red when both systems < 23 and either engine running.
Green when respective engine off.

Digital Ammeter Indication (EICAS)		
SL to FL410	Green Range:	0 to 400 AMPS
	Amber Range:	> 400 to 401 AMPS
	Red Range:	> 401 AMPS
Above FL410	Green Range:	0 to 300 AMPS
	Amber Range:	> 300 to 301 AMPS
	Red Range:	> 301 AMPS
Battery Temperature Indication	Green Range:	> -20 to 62.8°C
	Amber Range:	≤ –20°C
	Red Range:	> +62.8°C
Battery Voltage Indication	Green Range:	23 to 29 VDC
	Amber Range:	< 23, > 29 VDC

(Continued Next Page)

EICAS AND INSTRUMENT MARKINGS (Continued)

Left and Right Inter Turbine Temperature Indication (EICAS)		
During Start	Red Arrows:	800°C (Max Starting)
Engine Running	Amber Range	> 850°C to ≤ 888°C
	Red Line:	> 888°C
Left and Right N_1 RPM Indication	Red Line:	100% RPM
Left and Right N_2 RPM Indication		
Engine Running	Green Range (Digits):	< 101% RPM
	Red Range (Digits):	≥ 101% RPM
Left and Right Oil Pressure Indication	Green Range:	50 to 95 PSI
	Amber Range:*	*34 to 49 PSI
	Red Range:	< 34 or > 95 PSI
Left and Right Oil Quantity Indication	Green Range:	< 8.0 quarts low
	Amber Range:	≥ 8.0 quarts low
Left and Right Oil Temperature Indication	Green Range:	21 to 127°C
	Red Range:	>+127°C

* Amber region displayed if TLA > 30°, or anytime in flight.

Oxygen Pressure Indication	Green Arc:	1600 to 1800 PSI
	Yellow Arc :	0 to 400 PSI
	Red Line :	2000 PSI
Stabilizer Trim Indication		
On Ground	Flaps ≤ 5° Green Arc :	–2° to –5°
	Flaps 15° Green Arc :	+2° to –8°
In Flight	White Arc :	+1.2° to –12°

NOTE

+1.2 and –12 degrees are nominal primary stabilizer trim limits. The EICAS stabilizer trim digits and needle will turn amber beyond these nominal values. Primary stabilizer trim tolerances or the use of secondary trim, may allow stabilizer trim travel slightly beyond these nominal values.

EICAS PRESENTATIONS

Selected color EICAS presentations are depicted on the following pages in order to expand upon the above listed limits, to acquaint crew members with typical EICAS indications, and to represent some of the possible system selections.

SAMPLE EICAS INSTRUMENT MARKINGS

ABOVE FL 180

A3694

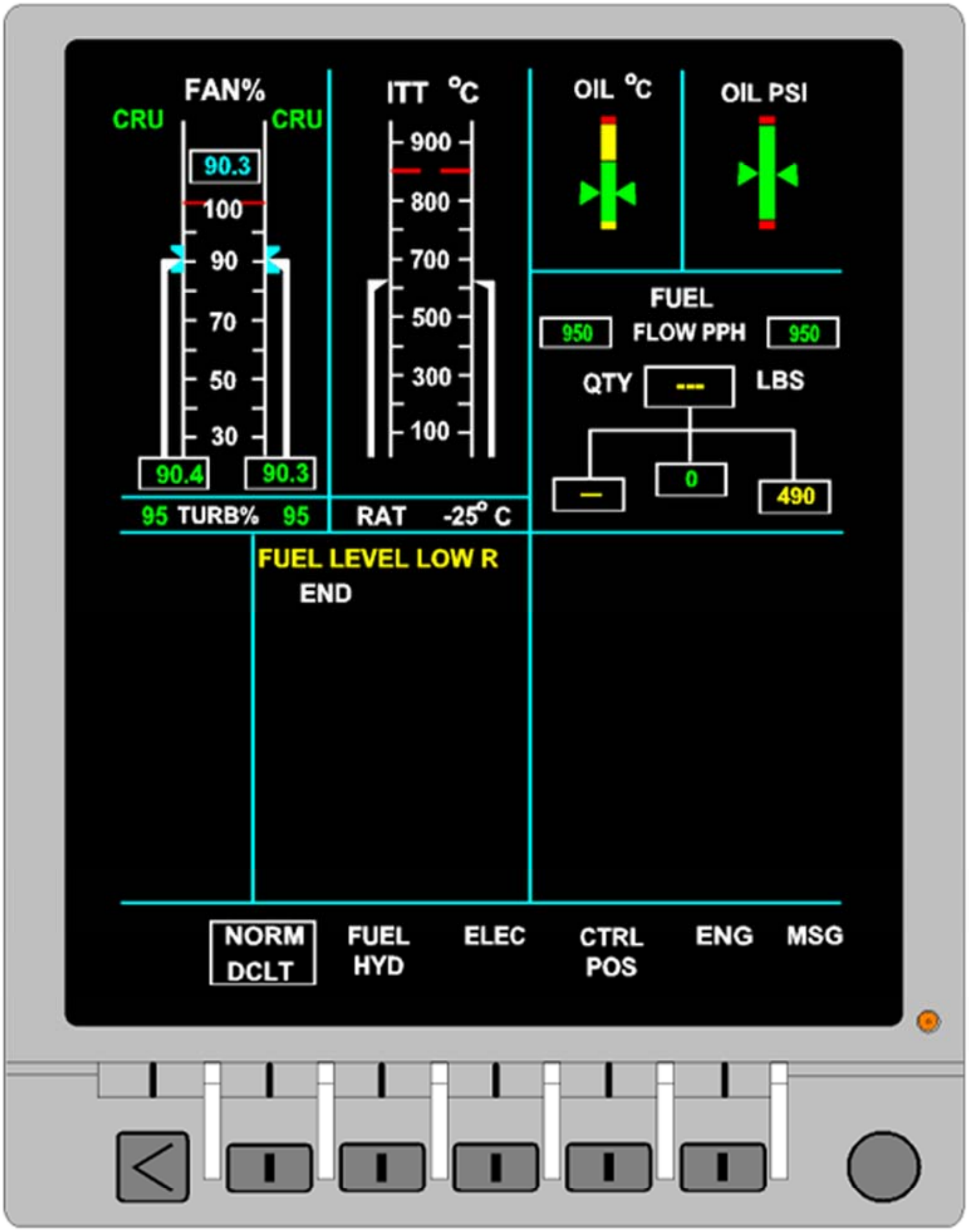

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Figure 1-11 (sheet 1 of 3)

EICAS AND INSTRUMENT MARKINGS (Continued)

Left and Right Inter Turbine Temperature Indication (EICAS)		
During Start	Red Arrows:	800°C (Max Starting)
Engine Running	Amber Range	> 850°C to ≤ 888°C
	Red Line:	> 888°C
Left and Right N_1 RPM Indication	Red Line:	100% RPM
Left and Right N_2 RPM Indication		
Engine Running	Green Range (Digits):	< 101% RPM
	Red Range (Digits):	≥ 101% RPM
Left and Right Oil Pressure Indication	Green Range:	50 to 90 PSI
	Amber Range:*	*34 to 49 PSI
	Red Range:	< 34 or > 90 PSI
Left and Right Oil Quantity Indication	Green Range:	< 8.0 quarts low
	Amber Range:	≥ 8.0 quarts low
Left and Right Oil Temperature Indication	Green Range:	21 to 127°C
	Red Range:	>+127°C

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	Flaps 15° Green Arc :	+2° to –8°
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EICAS PRESENTATIONS

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SAMPLE EICAS INSTRUMENT MARKINGS

ABOVE FL 180

A3694

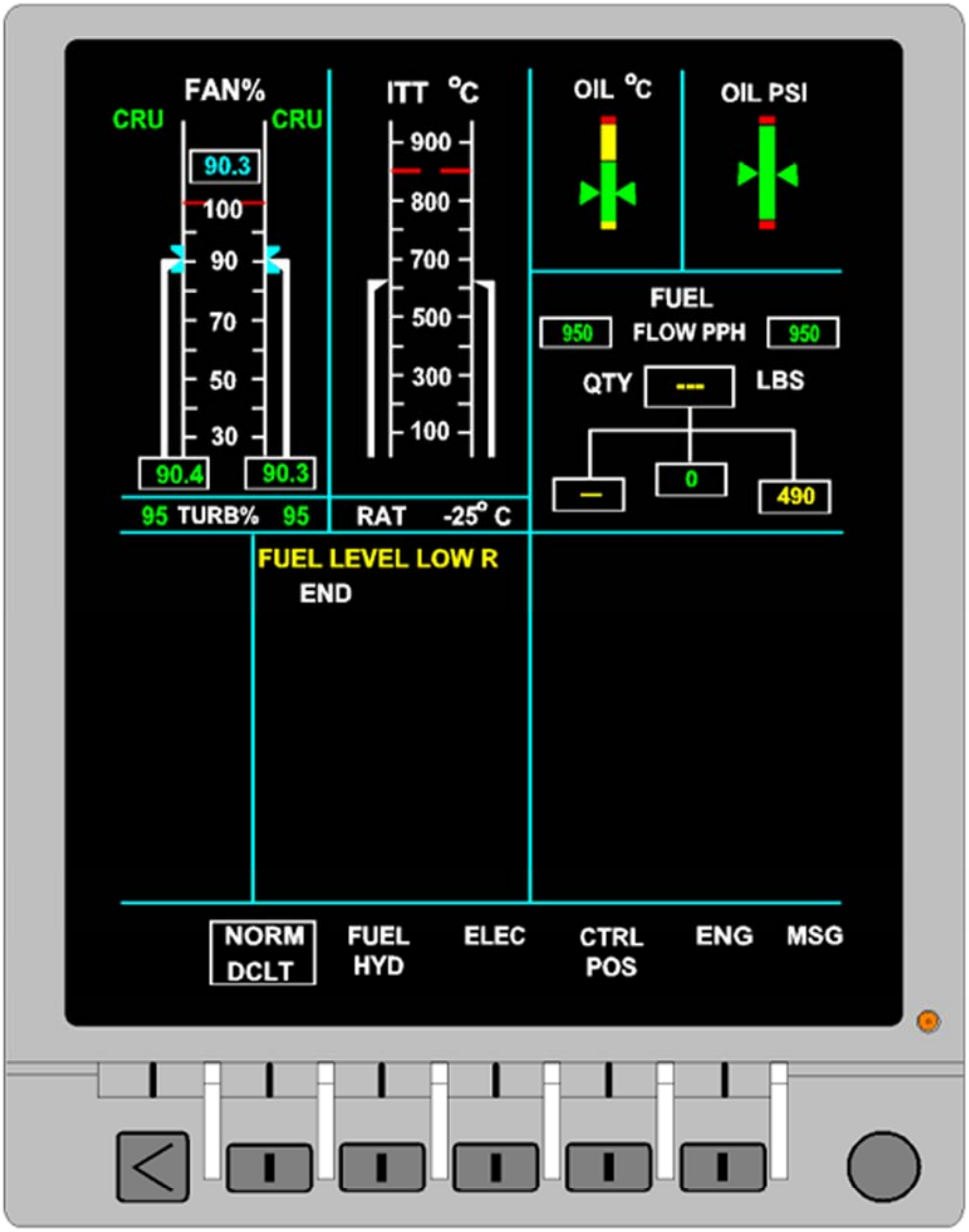

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Figure 1-11 (sheet 1 of 3)

SAMPLE EICAS INSTRUMENT MARKINGS

CRUISE

A3796

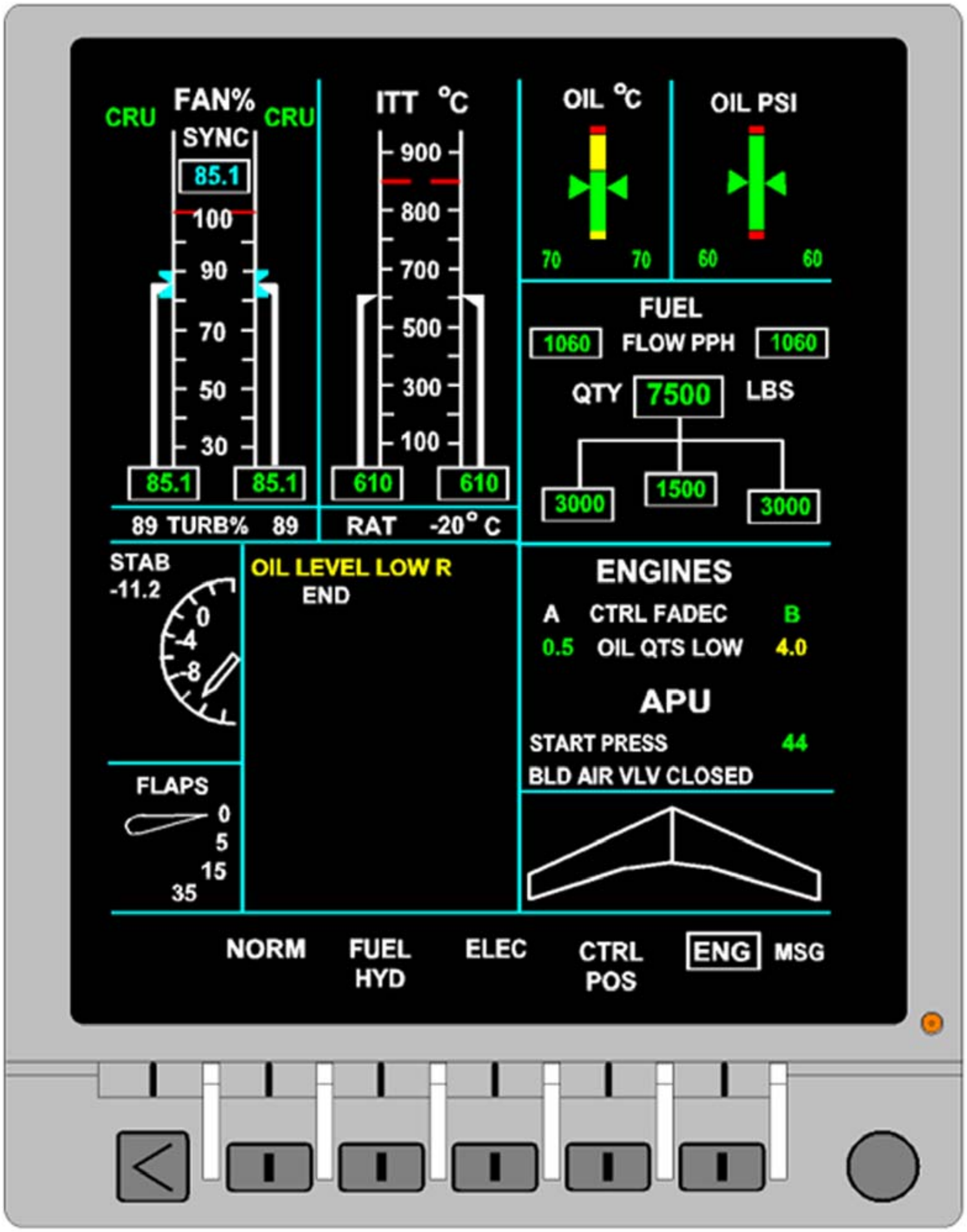

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Figure 1-11 (Sheet 2)

SAMPLE EICAS INSTRUMENT MARKINGS

LANDING APPROACH

A3835

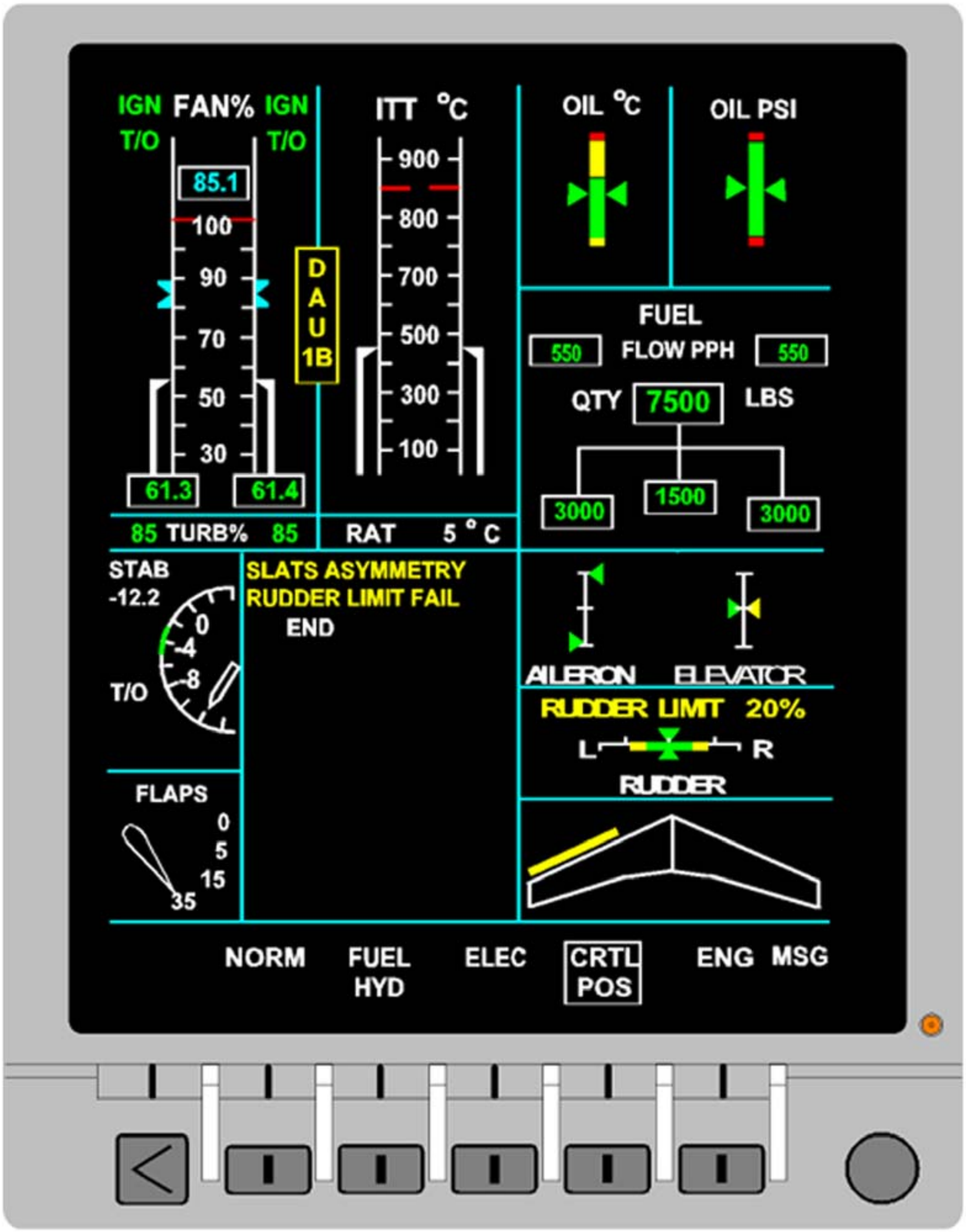

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Figure 1-11 (Sheet 3)

SECTION II

AIRPLANE AND SYSTEMS

CONTENTS

ENGINE

GENERAL

DESCRIPTION

Jet engines produce thrust by accelerating air. It is the product of the mass of the air times the increase in velocity that determines thrust output. To generate a given amount of thrust, a small volume of air can be accelerated to a very high velocity, or a relatively large amount can be accelerated to a lower velocity.

In a turbofan engine, with which the Citation X is equipped, only a portion of incoming air is combusted. The combusted hot air drives the compressor, and a fan that is used to accelerate a large volume of uncombusted air at a lower velocity. This uncombusted air is bypassed around the engine and exhausted at the rear, being mixed with the combustion exhaust. The relation of the total mass of bypassed air, to the amount of air going through the combustion section, is known as the Bypass Ratio.

The Allison AE 3007C engine, installed in the Citation X Model 750, is a high-bypass ratio two spool, axial flow, turbofan engine rated at 6442 pounds static thrust at sea level. The engine is flat rated up to 86°F (30°C) ambient temperature (ISA +27°F, ISA +15°C). The bypass ratio is approximately 5.0 to 1.0. A concentric shaft system supports the 24-blade single-stage fan and the turbine rotors. The inner shaft connects the fan (N_1) at the front of the engine to the three-stage low pressure turbine assembly at the rear of the engine. The outer shaft connects the fourteen-stage axial flow compressor (N_2) and the two-stage high pressure turbine. Both low pressure and high pressure spools are mounted on co-axial shafts, but are not mechanically connected. The high pressure spool drives the accessory gearbox through a set of bevel gears and a radial drive tower shaft that is splined to the input bevel gear of the accessory gearbox. The fourteen-stage axial compressor has six variable vane stages, which includes the inlet guide vanes.

All intake air passes through the inlet-fan case, and is compressed by the single-stage fan. Immediately aft of the fan the airflow is divided by the concentric duct into a bypass stream that goes through the bypass duct and a core stream that goes to the fourteen-stage axial flow high pressure compressor. Most of the total airflow is bypassed around the engine through the outer duct and is exhausted at the rear. Inner duct air that has passed through the fan, where compression began, is directed through the inlet guide vanes and into the compressor where it is further compressed. Nonrotating stator rings, installed between each compressor wheel, act as small diffuser ducts allowing air velocity to diminish and pressure to increase. The air is then discharged into the integrated diffuser/combustion casing where it is mixed with atomized fuel supplied by sixteen fuel nozzles, the fuel-air mixture is ignited by two igniter plugs. After ignition cutout, during the starting process, combustion is self-sustaining. The resultant combustion gases are directed through a set of vanes (stators) to the two-stage high pressure turbine.

Part of the energy available in the hot high pressure air is absorbed by the high pressure turbine that drives the axial flow compressor. As the expanding gases move rearward, they pass through another set of vanes (stators) and enter the three-stage low pressure turbine. Some of the remaining energy is extracted there and transmitted forward by the inner shaft to the fan. The hot engine exhaust is passed through a forced exhaust mixer at the rear of the engine where it, and the uncombusted bypass air, is mixed at the forced exhaust mixer, and is exhausted into the air.

The turbofan is in effect two interrelated power plants. One section is designed to produce energy in the form of high velocity, hot air. The other utilizes some of this air to provide the power to drive the fan. The high-bypass AE 3007C engine provides the required combination of efficient fan operation for good takeoff performance and lower altitude operation, coupled with the requisite high exhaust velocity and volume for efficient high speed, high altitude operation.

ENGINE AIRFLOW

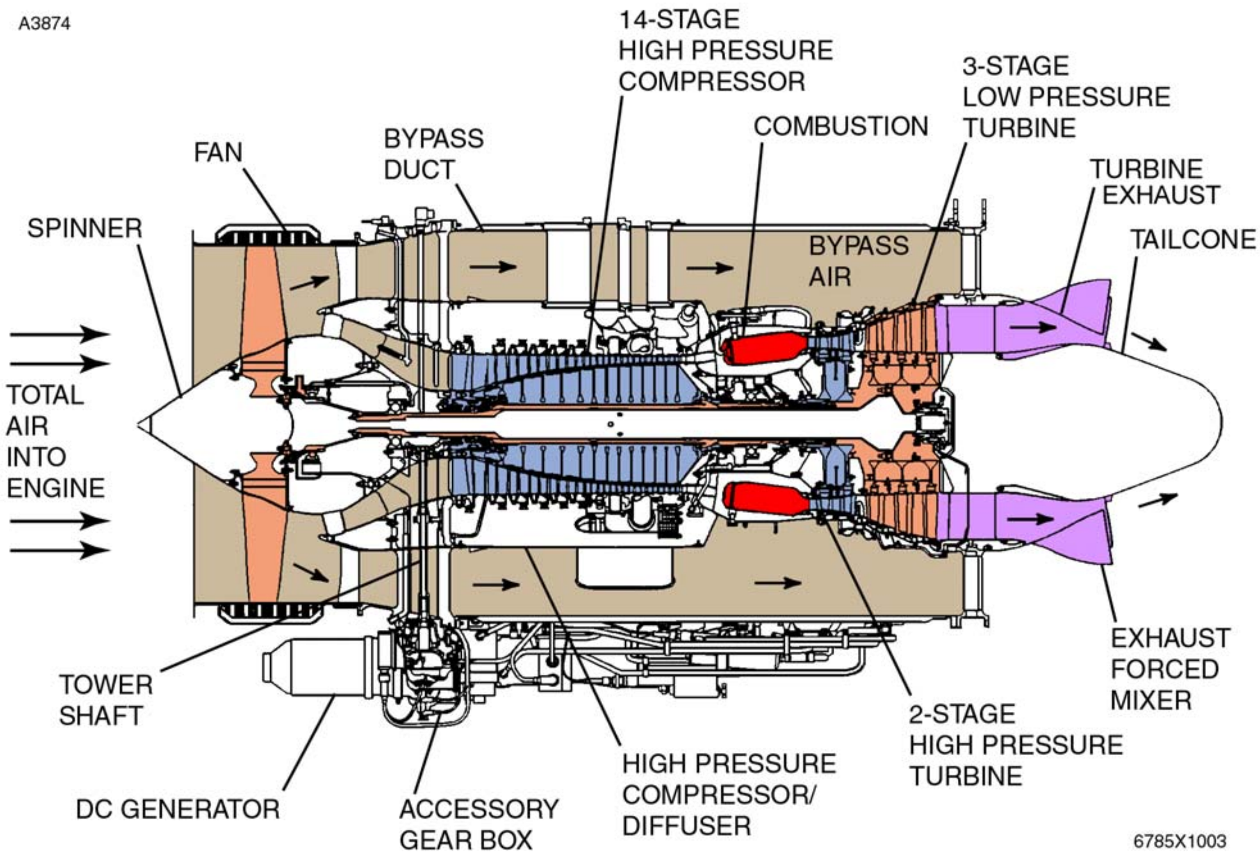


Figure 2-1

Control of the engines is accomplished by an advanced electronic system called Full Authority Digital Engine Control (FADEC). The FADEC is the controlling computer of the engine control system. Fuel supply to the engine is controlled to provide the thrust requested by the pilot (via the throttle lever angle - TLA). The system is dual redundant, having dual (A and B) FADECs, with only one FADEC in control of an engine at one time. It includes limiters, fault detection and accommodation, and reversionary control modes. The FADEC which is not in command is fully operational at all times and is capable of automatically assuming control of the engine, should the FADEC in command experience a fault. The FADEC systems, as well as the various engine systems and subsystems, are discussed below.

FULL AUTHORITY DIGITAL ENGINE CONTROL (FADEC)

Each engine has dual FADECs (A and B). Both FADECs are operating all of the time, however, only one is in command of an engine at any one time. The FADEC which is not in command will automatically assume command of the engine in case of a FADEC failure. Both FADECs (A and B) for both engines must be functioning in normal mode for dispatch. Selection of the FADECs is by the LH and RH FADEC RESET/NORM/SELECT switches. These switches are spring loaded to NORM. Momentarily pressing the switch to SELECT will select the opposite FADEC, except that the FADEC will not allow selection of a failed FADEC. Momentarily pressing the switch to RESET resets the fault memory only; it does not clear the fault.

The FADECs are automatically alternated at each engine start, to ensure equal use and reliability, therefore do not arbitrarily select alternate FADECs.

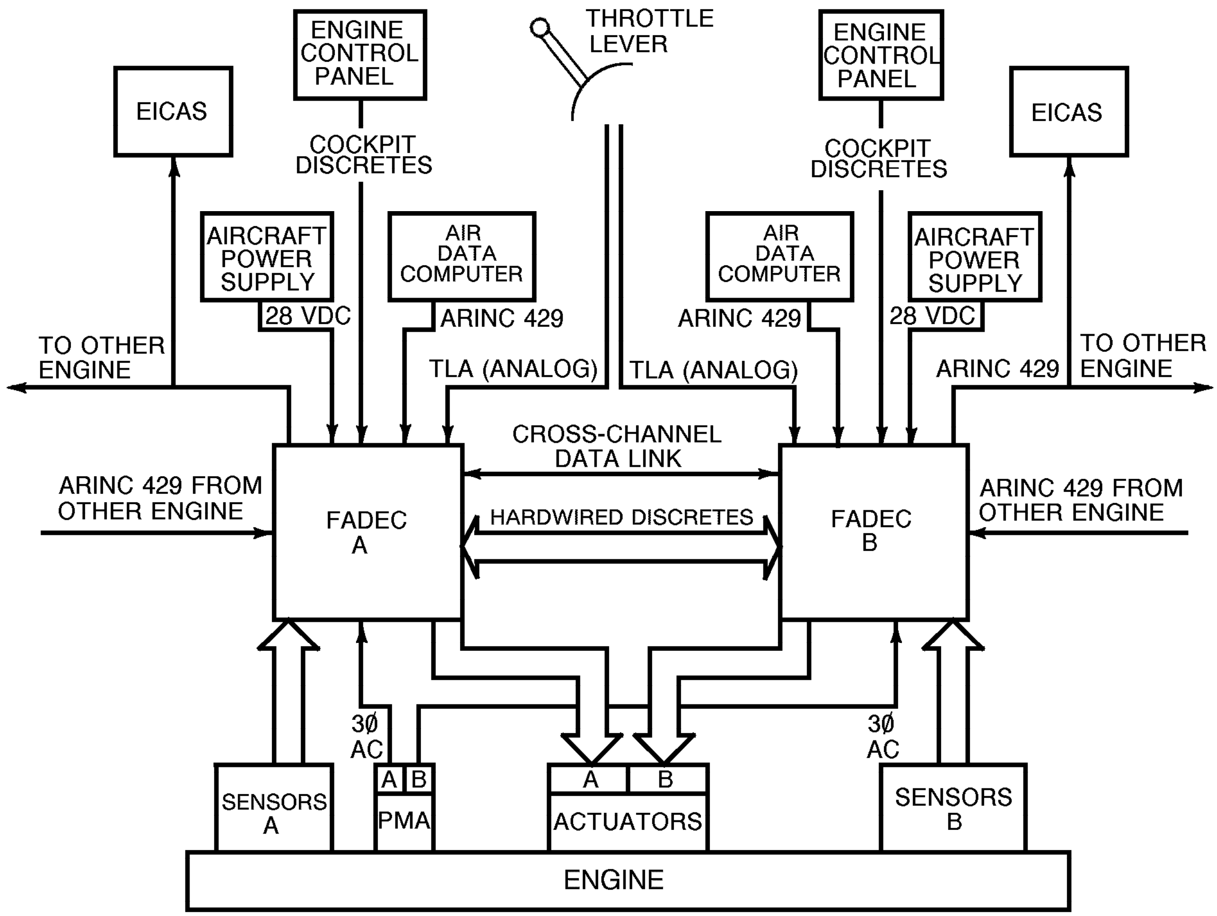
FADEC power is provided by 28 volt direct current (DC) power from the airplane battery or by engine driven permanent magnet alternators (PMA). The PMAs provide power for the engine ignition system after the engine reaches approximately 10% N_2 RPM on start and, if the engine is running, will continue to supply FADEC power to allow continued engine operation. The PMAs are the primary power source; the battery provides backup power and power for starting only.

Information is provided to the FADECs by the dual resolvers on each throttle lever in the throttle quadrant, from the dual air data computers, and from the various cockpit and aircraft switches. In order to schedule engine thrust, the FADECs compare the data from the dual air data computers. If there is a discrepancy, the FADECs will select the air data which most closely agrees with the engine internal temperature and pressure. The FADECs compute thrust commanded by the throttle lever resolvers and transmit engine data to the EICAS cockpit displays.

The FADEC in command schedules actual engine thrust and displays it as tape and digital N_1 in the EICAS engine display. The FADEC not-in-command displays commanded thrust as a digital target (the lower value of that computed by both the left and right not-in-command FADECs) and the N_1 target bugs. All other EICAS displayed engine data is from the FADEC in command. In case of failure of the FADEC in command the remaining FADEC will assume command, however, the target information will then be coming from the FADEC in command as well as the actual N_1 data. To alert the crew of this fact the target symbol will change from cyan to amber.

When the throttle lever is placed in cutoff, the cutoff information is transmitted by a microswitch to the FADEC, which commands the engine to be shut down. Above cutoff, and increasing from idle, the throttle resolvers signal the FADECs to vary the thrust linearly until reaching a series of three detents. The first detent is labeled CRU and will, in normal FADEC mode, command the normal maximum cruise thrust. The second detent is labeled CLB and will command the normal maximum climb thrust. The third detent is labeled TO/MCT and will command the normal takeoff thrust which is also maximum continuous thrust. Pushing the throttle levers beyond the TO/MTO detent will still command the normal takeoff/maximum continuous thrust. The commanded mode, CRU, CLB, or TO, will be annunciated by the FADEC mode indicator adjacent to the command N_1 box in the EICAS N_1 display.

ENGINE CONTROL SYSTEM LOGIC DIAGRAM



TLA = THROTTLE LEVER ANGLE
ARINC 429 = AERONAUTICAL RADIO INCORPORATED 429 DIGITAL DATA BUS
PMA = PERMANENT MAGNET ALTERNATOR

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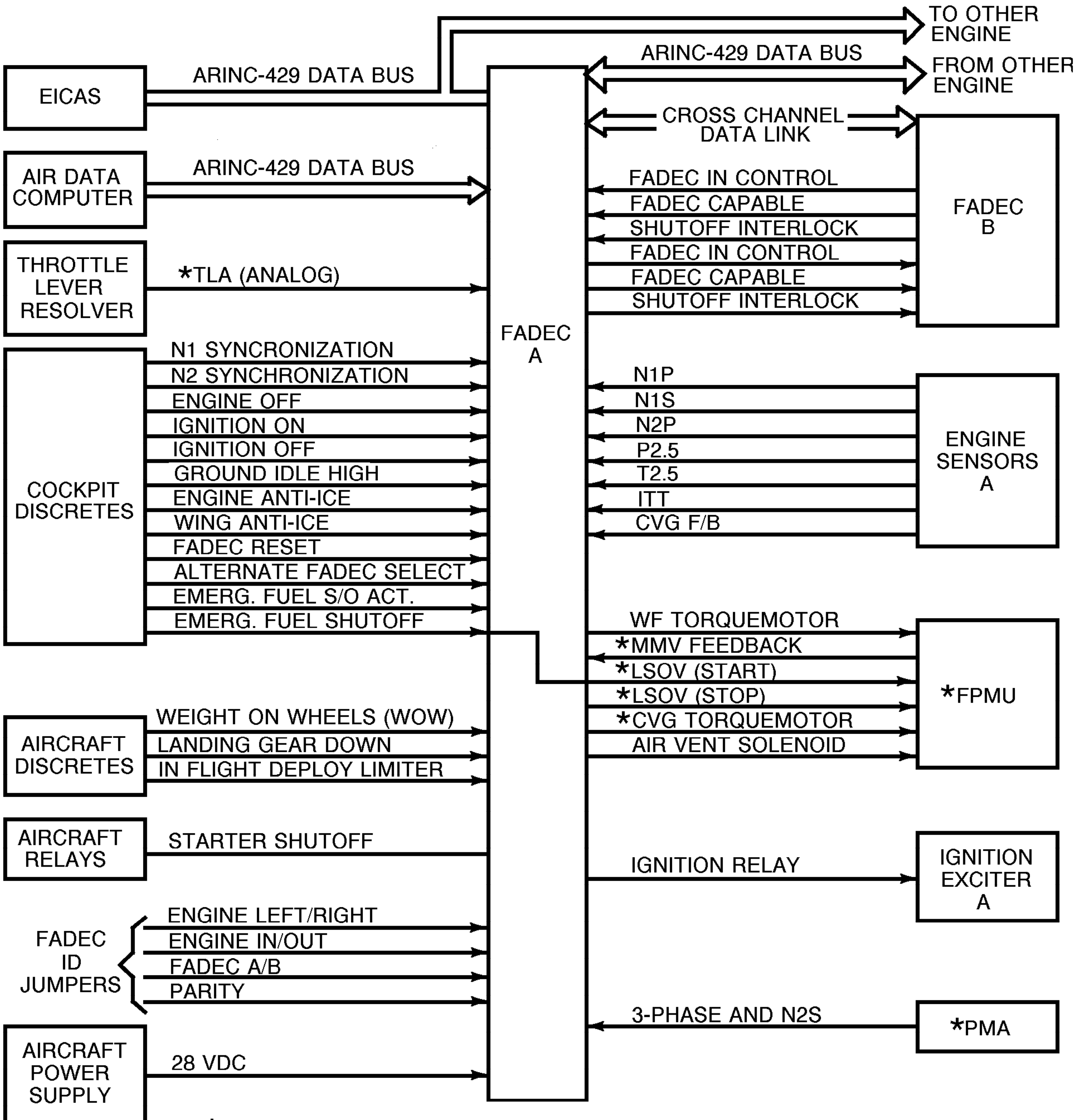
Figure 2-2

FADEC INPUT/OUTPUT



*LSOV - LATCHING SHUTOFF VALVE
CVG - COMPRESSOR VARIABLE GEOMETRY
PMA - PERMANENT MAGNET ALTERNATOR
TLA - THROTTLE LEVER ANGLE
FPMU - FUEL PUMP AND METERING UNIT
MMV - MAIN METERING VALVE

F/B - FEEDBACK
P - PRESSURE
S - SPEED

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Figure 2-3

In flight, when a throttle is in detent, the command N_1 display from the FADEC not-in-command will show the command thrust for that detent. In flight, with landing gear up, and the throttle levers not in a detent, the command N_1 display will be the next higher detent. On the ground, or in flight with landing gear down, the command N_1 display will be takeoff and the FADEC mode indication, TO, will be in white unless the throttle levers are in the TO/MCT detent, in which case the TO will be green. All other times the FADEC mode indication will be green.

The FADECs have two reversionary modes, ADC and N_1. If data from both air data computers is invalid, the FADECs will use engine internal (compressor inlet) pressure and temperature to schedule thrust N_1. This mode will be annunciated by the FADEC REV ADC amber CAS message. In the ADC reversionary mode, thrust computation is accurate within the takeoff altitude/temperature envelope and the engine will produce at least takeoff thrust. At higher altitudes maximum thrust will be reduced. The FADEC normally schedules thrust as a function of N_1. If all N_1 signals to the FADEC are lost, the FADEC will schedule N_2 to achieve a target N_1 based on a normal engine N_1 versus N_2 curve. This mode will be annunciated by a FADEC REV N_1 amber CAS message. The N_1 reversionary mode commands relatively accurate thrust, but does not guarantee takeoff thrust at all extremes of the takeoff envelope. It does not result in as large a thrust loss at altitude. N_1 indication is not available in N_1 reversionary mode.

NOTE

Avoid rapid throttle movements if operating in the N_1 reversionary mode.

A third reversionary mode is used when a significant change occurs in the N_1/N_2 relationship, such as could happen because of fan damage due to a large bird. This mode is annunciated by an amber FAN DAMAGE message. As in N_1 reversionary mode, the FADEC sets thrust derived from the normal engine N_1/N_2 relationship, resulting in an N_1 increase which gains some of the thrust lost due to fan damage. In this case EICAS display of N_1 is available.

CAUTION

IF ENGINE DAMAGE HAS OCCURRED, THE FLIGHT SHOULD NOT BE CONTINUED. LAND AS SOON AS PRACTICAL.

The FADECs also provide engine monitoring and will not allow engine ITT (888°C) limits to be exceeded. They will provide automatic engine shutdown if N_1 or N_2 limits are significantly exceeded due to a failure, but will normally not allow N_1 to exceed the N_1 command.

ENGINE SYNCHRONIZATION

Engine synchronization is enabled by the ENGINE SYNC FAN/OFF/TURBINE rotary switch, if the following conditions exist:

- Engine operating modes and bleed air settings of the two engines agree.
- Selected air data computer (ADC) channels agree.
- Left and right throttle lever angles (TLA) are within three degrees of each other.

FAN mode will synchronize both engines to the average of the two commanded fan speeds. TURBINE mode will synchronize the higher RPM engine to the lower engine N_2 RPM. When FAN or TURBINE SYNC is on, a SYNC message is displayed above the target N_1 in the EICAS display. Engine synchronization will automatically be shut off if an engine fails or the throttle lever split exceeds four degrees.

NOTE

Turbine synchronization is only to be selected during climb, cruise, or descent, however, the FADEC will not disable SYNC on the ground or during takeoff or approach.

FUEL PUMP AND METERING UNIT (FPMU)

The fuel pump and metering unit is a fully integrated fuel handling package which incorporates the engine fuel pumping, filtering, and metering functions into a single line replaceable unit (LRU). The fuel pumping and metering unit requires no external adjustments when replaced or when different fuels are used. The unit operates in conjunction with the dual FADECs to provide control of fuel flow to the engines and control of compressor variable geometry (CVG) vanes.

FUEL PUMP AND FILTER

The fuel pump unit consists of a single-stage centrifugal pump followed by a high pressure, positive displacement gear pump. Both pumping elements are driven by a common shaft from a pad on the engine accessory gearbox.

Fuel is pumped by the centrifugal element through an external fuel cooled oil cooler (FCOC) to the main fuel filter, which is a part of the FPMU assembly. The FCOC provides for preheating ice accumulation that would otherwise block the filter. The filter protects the gear pump, metering unit, and fuel nozzles from the effects of contaminants in the fuel. Both impending and actual bypass indicators are incorporated. A full flow bypass valve allows continued operation in the event of a complete filter blockage.

The high pressure gear pump supplies fuel to the main metering valve and CVG control valve. A full-flow relief valve across the gear pump provides protection against an overpressure condition within the engine fuel system. An air vent system at the discharge of the gear pump provides automatic venting of entrapped air or fuel vapor.

The fuel metering and compressor variable geometry (CVG) system encompasses the fuel metering, fuel shutoff, and CVG control functions. The fuel metering system controls the position of the main metering valve plunger while maintaining a constant pressure drop across the main metering valve.

The servo operated main metering valve is biased towards the closed position. During engine operation, in the absence of a signal from the FADEC in control, the valve will slew closed, shutting off fuel flow to the engine. This feature provides an independent, redundant fuel shutoff means within the FPMU.

The FPMU incorporates a two-position magnetically latching fuel shutoff valve which is controlled by two dual coil torquemotors, - START and STOP. The START torquemotor causes the shutoff valve to latch into the open position when energized by the FADEC; the STOP torquemotor will cause the shutoff valve to latch in the closed position. One winding of each of the START and STOP torquemotors is connected to each FADEC, providing redundant shutoff capabilities.

Control of the compressor variable geometry system (CVG) is provided by a dual-coil torquemotor and a servo powered spool valve. Each coil of the torquemotor is controlled by one of the two FADECs. The torquemeter, which is attached to a flexible jet pipe, directs high pressure fuel to one of a pair of receiver orifices. Pressures developed in these orifices are fed respectively to both ends of the CVG four-way orifices. Pressures developed in these orifices are fed respectively to both ends of the CVG four-way spool valve and act as servo pressures to actuate this valve. The spool valve in turn ports high pressure (gear pump discharge) fuel to one side of the piston while venting the other side of the piston to low pressure (gear pump inlet) fuel. The differential pressure provides the power for the actuator to move the compressor variable vanes for optimum airflow.

FUEL MANIFOLDS AND NOZZLES

The fuel manifold system consists of a fuel supply manifold and a separate fuel drain manifold. Fuel flows to fuel nozzles via the fuel manifold. The fuel nozzle connection to the supply line is enclosed with a sealing collar to trap any leaks. The collars are connected to the fuel drain manifold.

The fuel nozzles supply atomized fuel to the combustors at the proper spray angle and pattern for the varying airflow conditions. There are 16 fuel nozzles mounted on studs on the diffuser. Each nozzle shroud slip fits into a combustor swirler ferrule at the front end of the combustor.

ADDITIONAL FUEL SYSTEM COMPONENTS

Additional fuel system components are the associated fuel lines, drains, and the pressure drop spill valve (PDSV) and the pressure raising valve (PRV). The PDSV maintains a constant pressure drop across the main metering valve by recirculating excess fuel back to the gear pump inlet. The PRV generates adequate system pressures for proper functioning of the metering valve and pressure drop servos, and generates sufficient force to operate the compressor variable geometry hydraulic actuator (CVG).

ENGINE ELECTRICAL SYSTEM

Each engine has a permanent magnet alternator (PMA) which is driven by the engine accessory gearbox. The PMA provides primary electrical power for the engine control and ignition system. On engine start, aircraft 28 volt DC power is used to power the FADECs until the PMAs get up to adequate speed to generate sufficient electrical power. The ignition relay is powered by the PMA but is designed to fail safe, (i.e., it is normally closed, or energized open) so that on engine start or in the event of loss of aircraft power the ignition is automatically turned on. The PMA is the only source of power for the ignition exciters.

The permanent magnet alternators (PMA) have four separate electrical windings. There are two three-phase windings and two single-phase windings. Each three-phase winding provides power to one of the engine FADECs. The single-phase windings provide electrical power to the redundant ignition systems. One of the three phases to each FADEC is used to derive a secondary speed signal for the high pressure (HP) rotor shaft. The PMA provides sufficient power to drive the ignition system at all speeds above 10 percent HP rotor shaft speed, and powers the FADECs at a minimum of 50 percent HP rotor shaft speed.

IGNITION SYSTEM

The ignition system is dual-redundant and self-contained. Each half of the ignition system consists of an igniter, a high tension igniter lead, and an exciter. Each exciter is controlled by a separate FADEC and is powered by a separate electrical winding of the permanent magnet alternator (PMA). Airplane electrical power is not used as a backup for the ignition exciter. The ignition systems are alternated, during normal operation; each system provides ignition for every other start.

FADEC controls the ignition system for automatic engine starting and auto-relight. Continuous ignition operation can be manually selected from the cockpit, through a switch connected to the FADEC. The ignition system can also be disabled manually via a cockpit switch. In the case of manual selection, the automatic control of igniters for starting and relight are disabled.

The ignition exciters are of a high-energy, high-tension, continuous duty, capacitance discharge type; they store power and discharge 4 to 7 times per second. They are controlled by the FADECs and receive power from one of the single-windings of the permanent magnet alternator. Each exciter contains a relay that is energized or de-energized by the FADEC.

The igniters, located on oposite sides of the engine, are recessed electrode type and protrude into the combustor.

In case of loss of airplane 28 volt DC power or in the event of failure of the FADEC, the ignition is designed to fail safe (ignition on).

ANTI-ICING SYSTEM

Hot air from low pressure bleed air in flight, and from high pressure bleed air on the ground, is used to keep the engine intakes ice free.

INDICATING SYSTEM

Indicating system components, providing cockpit indications, include the interstage turbine temperature (ITT) thermocouples (sensors), fan and low pressure turbine speed (N_1) sensors, the high pressure compressor and turbine (N_2) sensors, and the compressor inlet pressure (P2.5) sensor. Two vibration sensors comprise part of the integrated engine instrument system. A cockpit CAS indication is also provided for the electronic magnetic chip detectors.

INTERSTAGE TURBINE TEMPERATURE (ITT) SENSORS

Sixteen thermocouples are mounted around the center part of the low pressure turbine case near the rear of the compressor diffuser. The system includes two harnesses (eight thermocouples on each harness) and an ITT trim plug for each harness. The thermocouples measure the temperature of the gas entering the turbine section from the compressor diffuser and transmit that information through the ITT harness to the EICAS (engine instrument and crew alerting system) and the standby engine instruments in the cockpit. The ITT trim plug receives the signal and adjusts it before passing it on to the engine FADEC (full authority digital engine control).

LOW PRESSURE (N_1) AND HIGH PRESSURE (N_2) SENSORS

Two dual element N_1 sensors are mounted on the front frame of each engine. Each N_1 sensor has a magnetic coil that monitors the speed of the fan and sends the value to the EICAS and standby engine instrumentation on the cockpit. Since the fan and the low pressure compressor (N_1) are mechanically connected, fan speed is equal to N_1 speed.

Two N_2 sensors are mounted on the bottom left side of the accessory-drive gear box of each engine. The sensors have magnetic coils that monitor the speed of the alternator gearshaft in the gearbox. The gearshaft is driven by the high pressure compressor rotor, so when the gearshaft speed is known the system can calculate the speed of the compressor rotor. The N_2 sensors also have a backup power source from the permanent magnet alternators (PMAs) on each engine.

STANDBY ENGINE INSTRUMENT INDICATOR

The standby engine instrument indicator is located high and slightly to the right on the center instrument panel. It provides a necessary minimum of information to enable the crew to efficiently operate the engines. The standby indicator will be available if the EICAS (engine indicating and crew alerting system) should fail. Information displayed is N_1 (fan speed) in percent RPM, N_2 (high pressure turbine speed) in percent RPM, and ITT (interturbine temperature) in degrees Celsius.

On initial power up, the standby engine instrument indicator will display all eights and will flash the digits for approximately three seconds, indicating that the built in test is completed and that the system is operational.

The signal for the standby instrument indicator is transmitted in the form of serial data on the ARINC-429 bus which is used by the EICAS system. The standby engine instrument indicator is a redundant system in that if one FADEC should become unreliable or invalid, the second FADEC on the applicable engine will provide the data on the common serial bus and to the indicator.

MAGNETIC INDICATOR PLUG AND MAGNETIC DRAIN PLUG

A magnetic indicator plug capable of attracting magnetically permeable materials is provided on the static air/oil separator which is mounted inside the tank at the bottom of the engine oil tank. The oil tank also has a magnetic drain plug.

MAGNETIC CHIP COLLECTORS

Each of the engine sump inlets to the scavenge pump includes a removable magnetic chip collector and screen. The magnets prevent damage by collecting particles before they enter the scavenge pump elements, thereby preventing damage and aiding in fault detection.

ENGINE INSTRUMENT AND CREW ALERTING SYSTEM (EICAS)

The engine instrument and crew alerting system (EICAS) is the medium by which engine operating information is imparted to the crew. Engine information is only one of the several possible selections which may be made on the center display unit (DU). If additional engine information is desired the button below the ENG identification on the display is pressed; engine information will then be presented in the crew alerting system (CAS) section of the display.

At all times, on the center display unit (DU), normal engine status information of engine fan and turbine speed, inter-turbine temperature, oil pressure and temperature, and fuel status is displayed. Abnormal or emergency engine information will appear in the crew alerting system (CAS) window of the EICAS DU any time the EICAS system senses an abnormal or emergency condition. If the message is a warning message (red) the same message will also be presented on the multifunction display tubes (MFD) until it is acknowledged. The MASTER CAUTION or the MASTER WARNING, as applicable, will also be illuminated. The MASTER CAUTION will be in a steady mode and the MASTER WARNING in a flashing mode. A tone (chime or double chime) will also be heard, depending upon the type of installation.

The Engine Instrument and Crew Alerting System, since it is an electronic system which is more closely associated with avionics systems, is covered in detail in Section Three, Instrumentation and Avionics.

ENGINE OIL SYSTEM

The lubrication system is a self-contained, pressure regulated and recirculating dry sump system. The system provides filtered pressurized oil to the engine oil coolers, engine sumps, and the accessory gearbox to cool and lubricate the bearings, seals, and gear meshes.

The engine oil supply is contained in the engine-mounted oil tank. The tank, which has a thirteen quart capacity, is equipped with an oil level sight gage and an oil level/low oil warning sensor which is connected to the EICAS system. The low level warning system is triggered when there are three quarts or less in the tank.

The oil is pumped from the tank through a filter and is then cooled by the air-cooled oil cooler (ACOC) and the fuel-cooled oil cooler (FCOC). Oil to the accessory gearbox is distributed through cast passages to the various meshes and bearings in the accessory gearbox. Pressurized oil to the front frame is divided inside the front frame and routed to the fan sump, forward sump, and an external core tube which delivers oil to the diffuser assembly and the rear turbine bearing support for the center and aft sumps.

The lube and scavenge pumps are an integral unit mounted at the rear, lower right pad of the accessory gearbox. The gerotor type pump includes a series of gerotor elements, one pressure and five scavenge, all arranged in series on a common drive shaft. A pressure regulating valve in the oil pump housing maintains a 56 PSI pressure differential between the center sump supply pressure and the center sump scavenge pressures.

The filter unit, which is mounted on the outer bypass duct, includes a replaceable three-micron filter element, visual and electrical impending bypass indicators, and visual actual bypass indicator. A bypass valve opens at a pressure differential across the filter of 28 to 32 PSID, which allows oil to bypass the filter when the filter becomes contaminated or during cold starts. The visual and electrical impending bypass indicators activate when the pressure differential across the filter is from 19 to 25 PSID.

ENGINE OIL SYSTEM SCHEMATIC

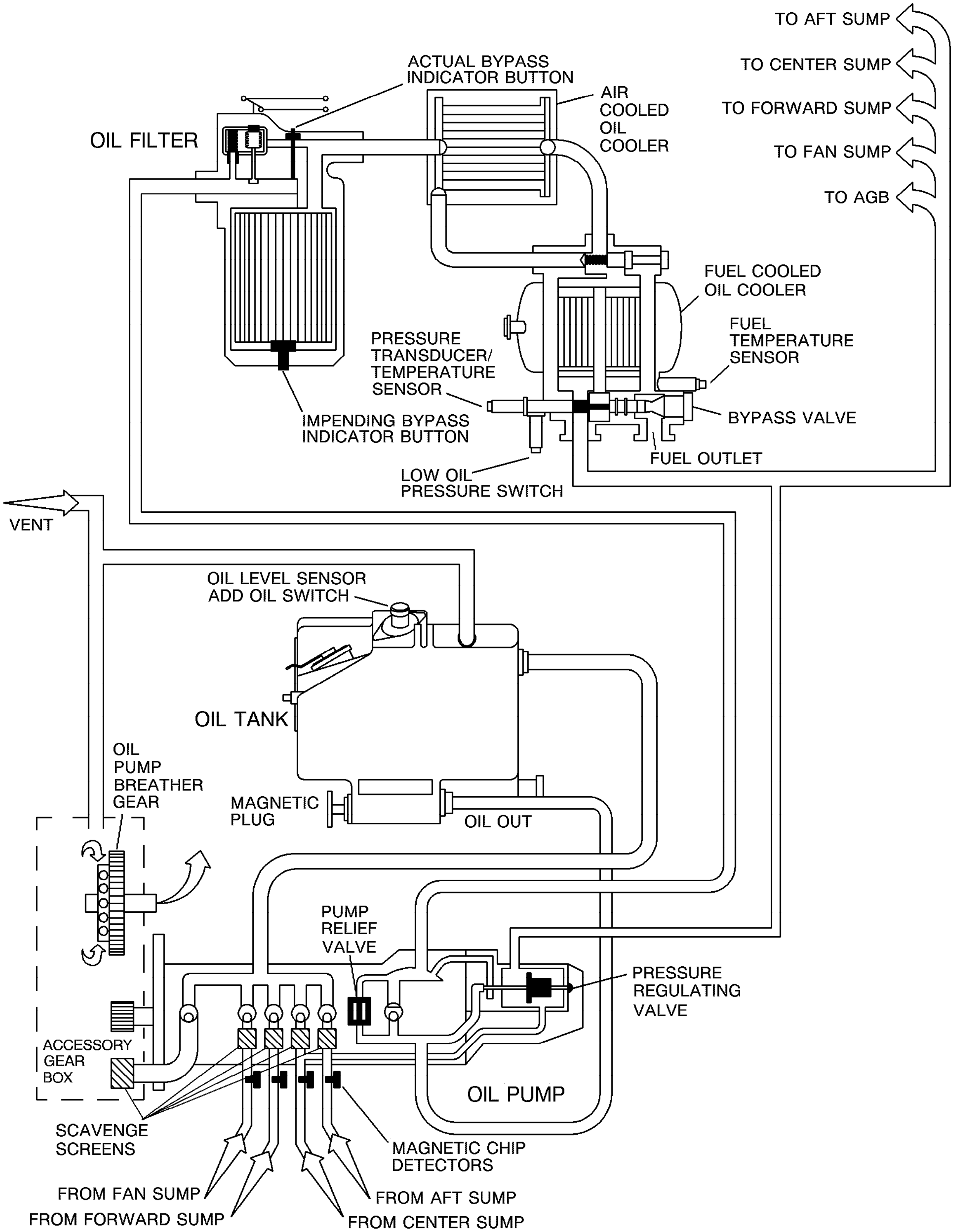


Figure 2-4

AIR-COOLED OIL COOLER (ACOC)

The air-cooled oil cooler is located in the bypass flow on the inside wall of the outer bypass duct at the bottom of the engine. The surface-type heat exchanger has a single plate-fin oil section. A thermal/pressure bypass valve located in the fuel-cooled oil cooler allows cold oil to bypass the ACOC. The bypass valve will also open to ensure flow to the engine if the oil cooler plugs.

FUEL-COOLED OIL COOLER (FCOC)

The fuel-cooled oil cooler is mounted to the outer bypass duct on the bottom of the engine. It simultaneously cools the engine lubricating oil and warms the fuel upstream of the fuel pump and metering unit (FPMU) filter. A thermal/pressure bypass valve senses the temperature of fuel leaving the FCOC and bypasses oil internal to the cooler to prevent heating of the fuel above a predetermined point. The bypass valve will also open to prevent clogging of the cooler or for cold starts.

COMPONENTS AND ACCESSORIES

Various engine components and accessories are mounted on the fan stator and air inlet housing, the bypass duct and rear mount ring, and the accessory drive gearbox.

GROUND IDLE

A GND IDLE switch on the left side of the pedestal near the throttles has NORM and HIGH positions. In NORM, engine idle power is reduced when the throttles are in idle during ground operation. During landing, with throttles in idle, the reduction of power is delayed for approximately eight seconds after touchdown, to provide for a touch-and-go or go-around. This reduced power feature is designed to relieve braking requirements during landing run and taxiing. Appearance of a GROUND IDLE L - R EICAS annunciation indicates that the applicable full authority digital engine control (FADEC) has commanded ground idle in flight. This malfunction can be corrected by placing the GND IDLE HIGH/NORM switch to HIGH. Except for a malfunction correction, HIGH position is only selected during touch-and-go landings.

DIRECTIONAL REFERENCES

Directional references to front and rear, right and left, top and bottom and clockwise and counterclockwise are made facing the exhaust cone with the engine in a horizontal position and the accessory drive gearbox downward. Direction of rotation of both the fan and low pressure compressor and the high pressure spool is counterclockwise.

ENGINE COMPONENTS AND ACCESSORIES

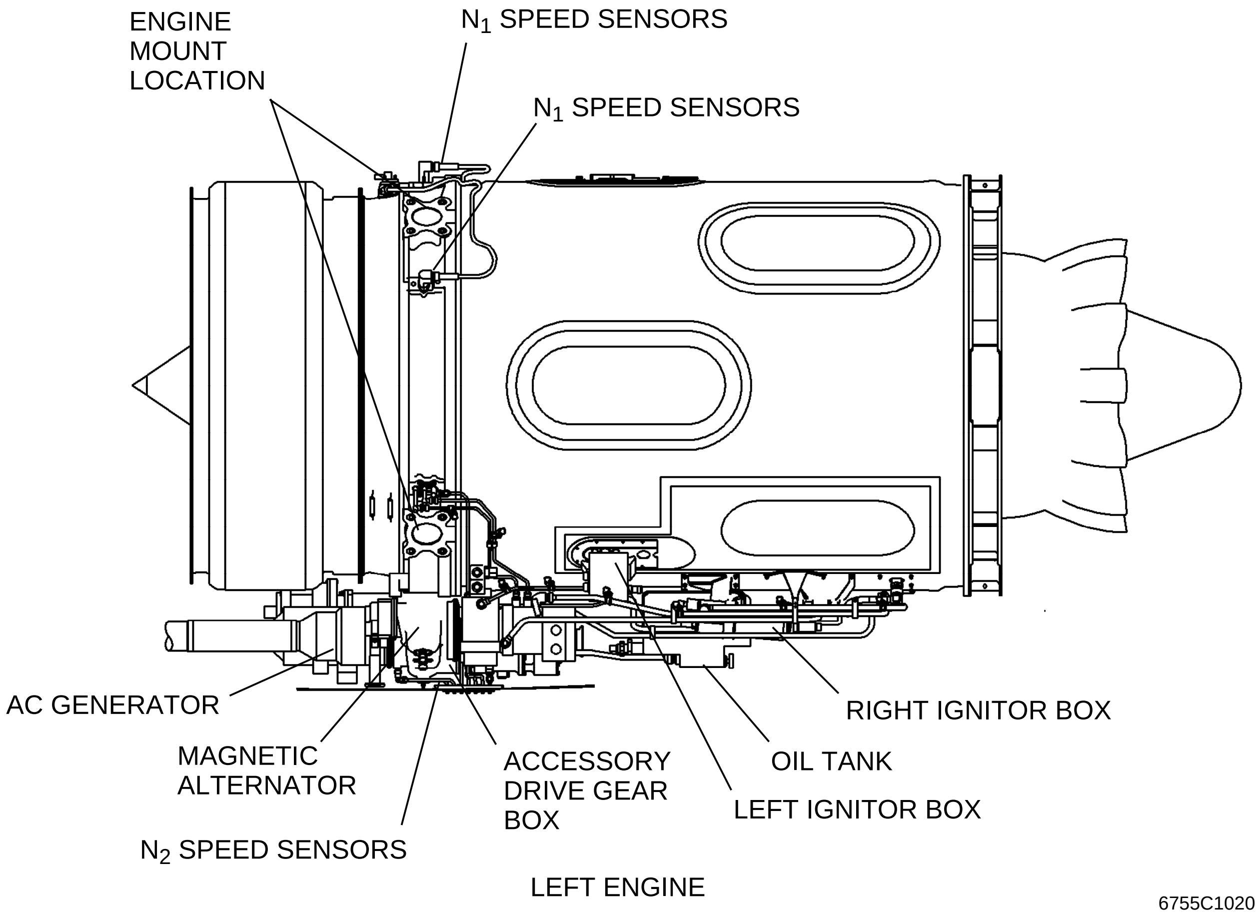


Figure 2-5 (Sheet 1)

ENGINE COMPONENTS AND ACCESSORIES

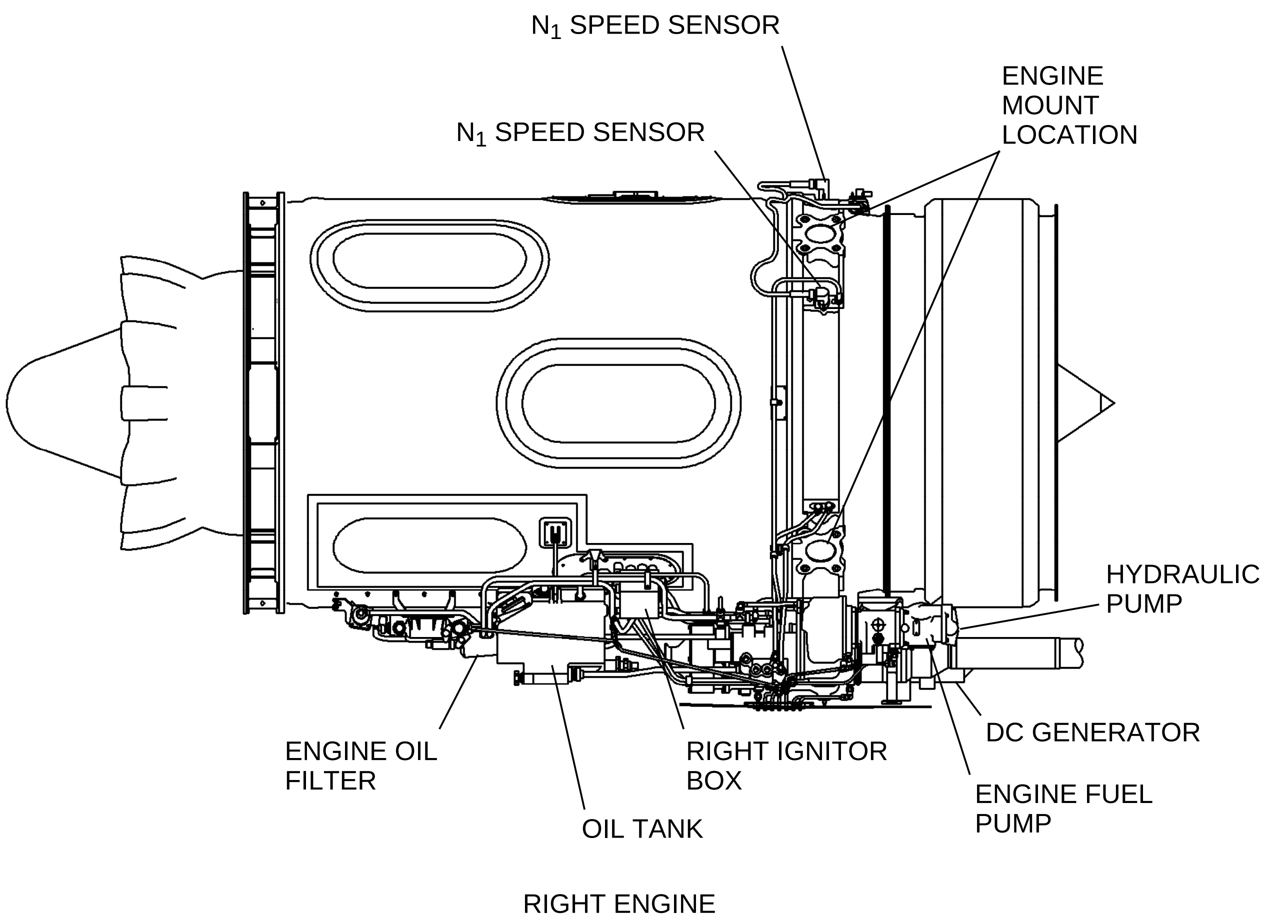


Figure 2-5 (Sheet 2)

THRUST REVERSER SYSTEM

DESCRIPTION AND OPERATION

The thrust reversers are of the external target type employing two vertically oriented doors or buckets, which, when deployed, direct exhaust gases forward to provide a deceleration force for ground braking. When stowed, the reversers fair into external airplane contours to form the aft portion of the nacelle. The thrust reverser doors are attached to the thrust reverser body, which bolts to the aft end of the engine case. The faired reverser doors seal sufficiently to control and direct the escape of the high pressure exhaust gasses.

NORMAL OPERATION

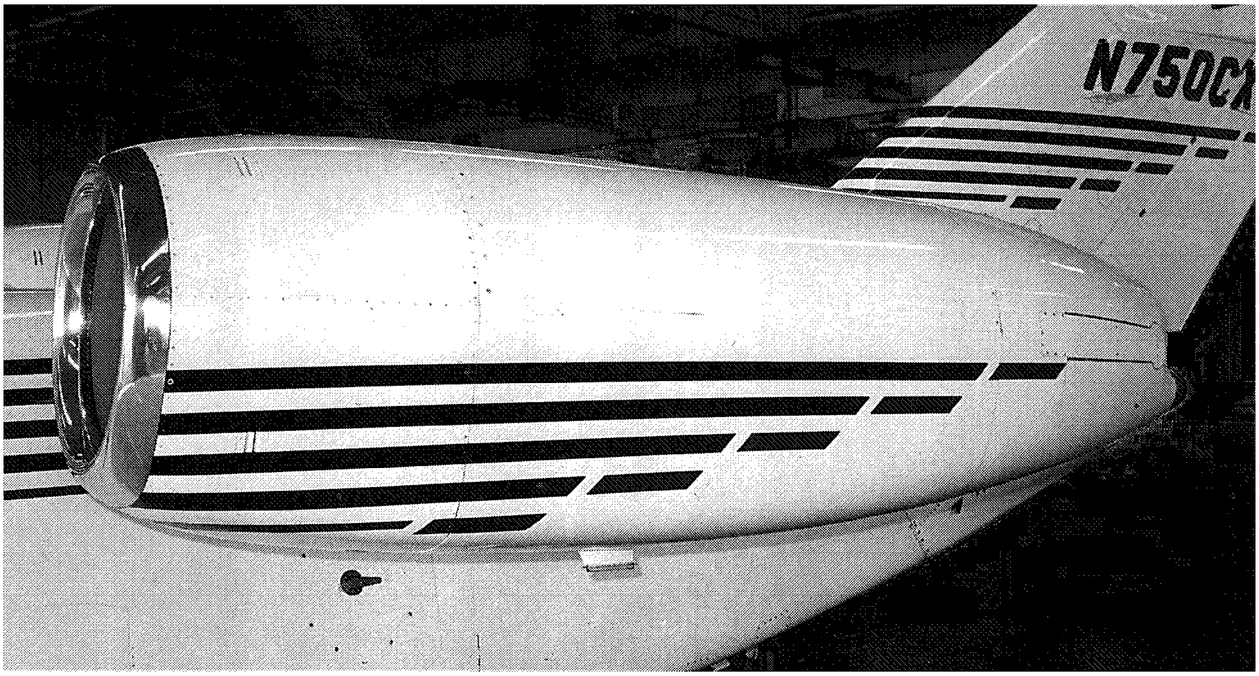
The reverser system is designed for two-position operation: stowed during takeoff and flight and deployed during landing ground roll. The reversers are activated by pilot operation of the thrust reverser levers and are deployed by hydraulic pressure supplied by engine-driven pumps and directed to the drive actuators through the electrically operated thrust reverser control valves. The reversers each use two hydraulic actuators connected by pushrods to the thrust reverser door. The hydraulic actuators are located on the left and right sides of the thrust reverser. The aft end of the thrust reverser door is attached to a fixed hinge. As the hydraulic rams move aft, push rods open the doors to full deployed position. As the hydraulic rams move forward, the pushrods pull the doors into the stowed position.

Control of the individual thrust reverser is through a reverse thrust lever mounted on each of the engine throttles (thrust levers). The reversers can only be deployed, by the reverse thrust levers, when the primary throttle (thrust levers) are in the idle thrust position and the airplane is on the ground, as sensed by either of the main gear squat switches. The reverse thrust levers also control engine thrust during reverse thrust operation.

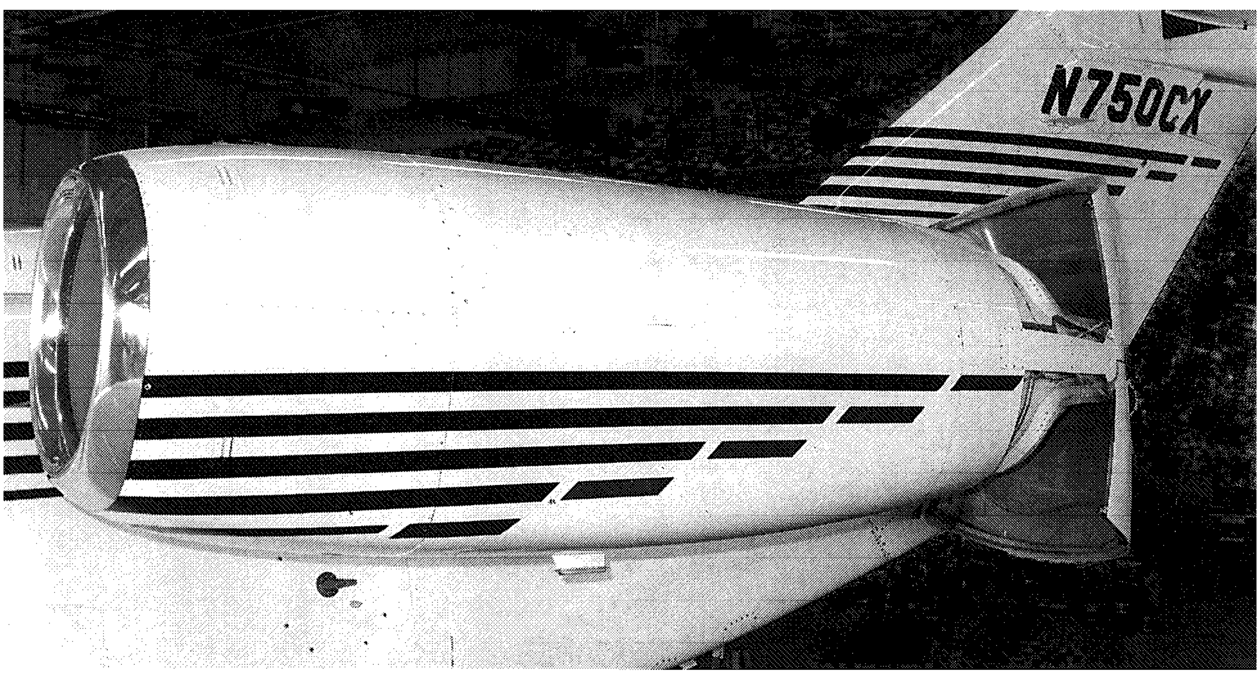
In the event of an inadvertent thrust reverser deployment, there is an automatic electronic power reduction circuit, activated by the thrust reverser control unit. It will send a signal to the full authority digital engine control (FADEC), which will bring the engine to idle, but the throttle lever position will remain the same. An amber message (or red for a dual occurrence) will appear in the EICAS display (TR AUTOSTOW L or R) and a chime (double chime for both thrust reversers) will sound to indicate that an in flight thrust reverser deployment has occurred. Thrust above idle will not then be possible until the throttle lever is moved to idle. If the automatic feature that restricts the effective TLA to idle during in flight thrust reverser deployment should be disabled or the inflight deploy switch is faulted, an amber EICAS message (ENG TR SW FAULT L or R) will appear and a chime will sound to warn the crew to use extra caution.

When restowing the thrust reversers, the main throttles should not be advanced from idle until the reversers are stowed as indicated by extinguishing of the UNLOCK lights. The thrust reversers should, therefore, not be used on touch-and-go landings and a full stop landing should be made once the thrust reversers are selected.

THRUST REVERSER IN STOWED AND DEPLOYED POSITIONS



STOWED



DEPLOYED

6785P6003
6785P6004

Figure 2-6

THRUST REVERSER SYSTEM HYDRAULIC FLOW DIAGRAM

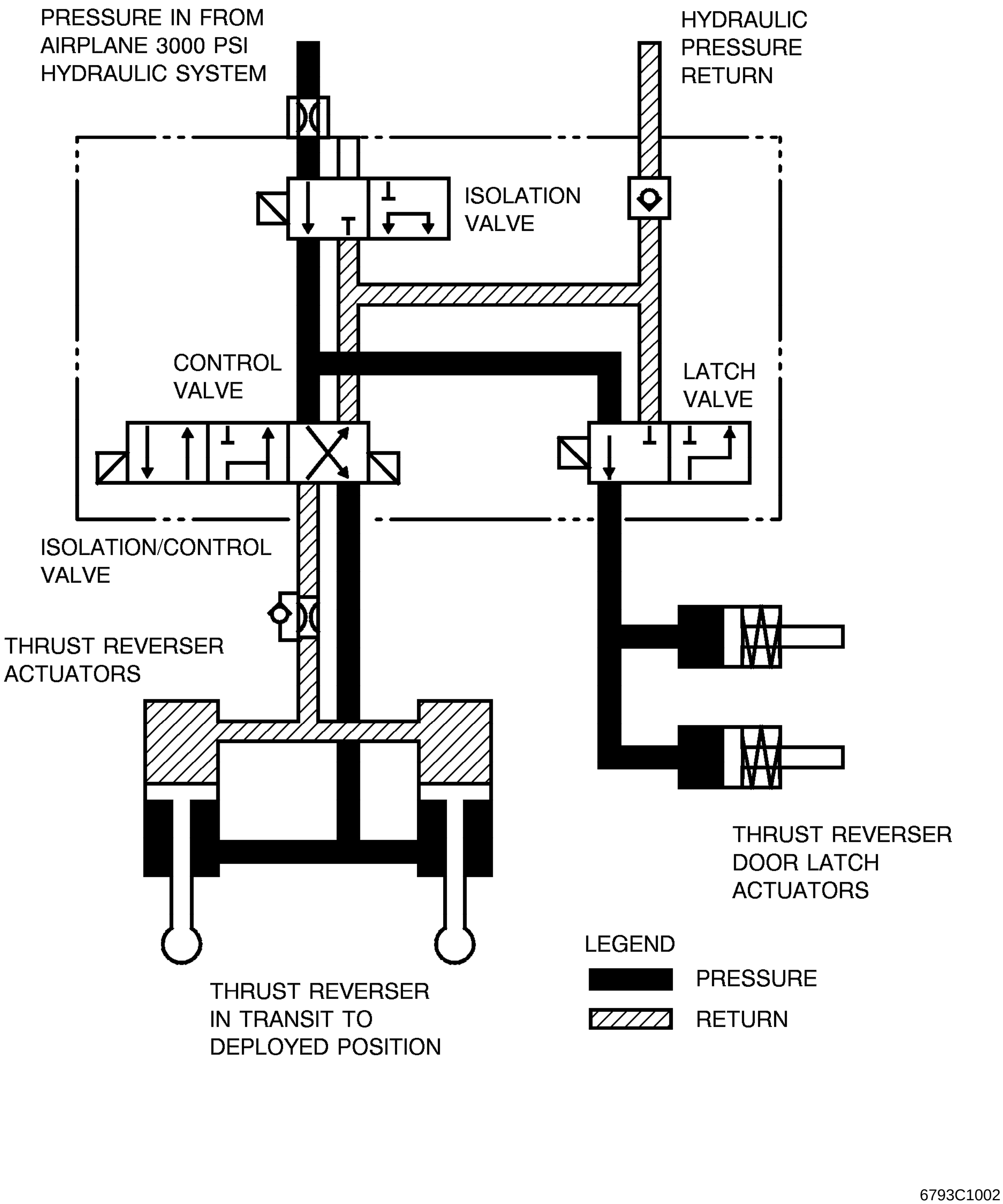


Figure 2-7 (Sheet 1 of 3)

THRUST REVERSER SYSTEM HYDRAULIC FLOW DIAGRAM

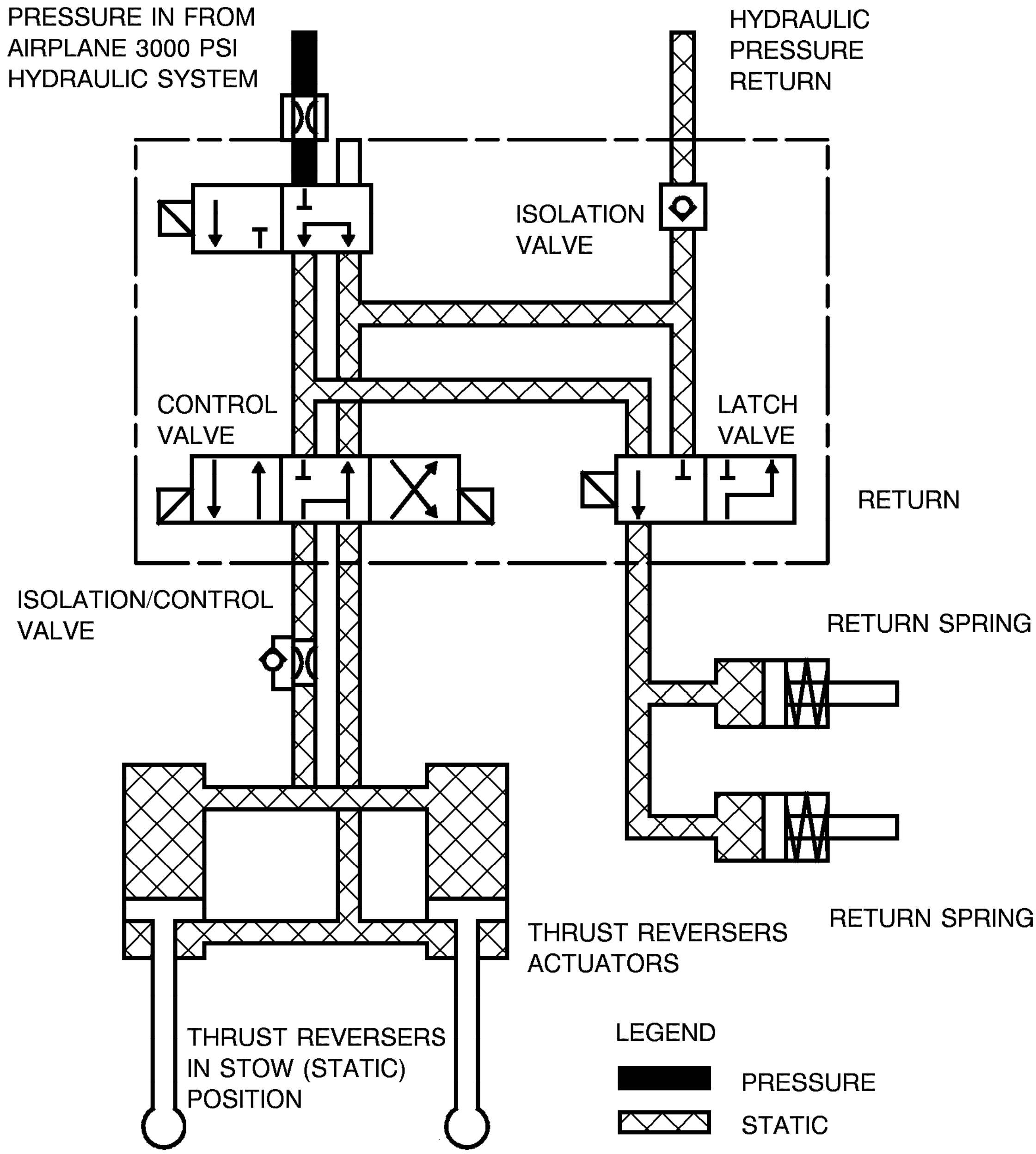


Figure 2-7 (Sheet 2 of 3)

THRUST REVERSER SYSTEM HYDRAULIC FLOW DIAGRAM

A34161

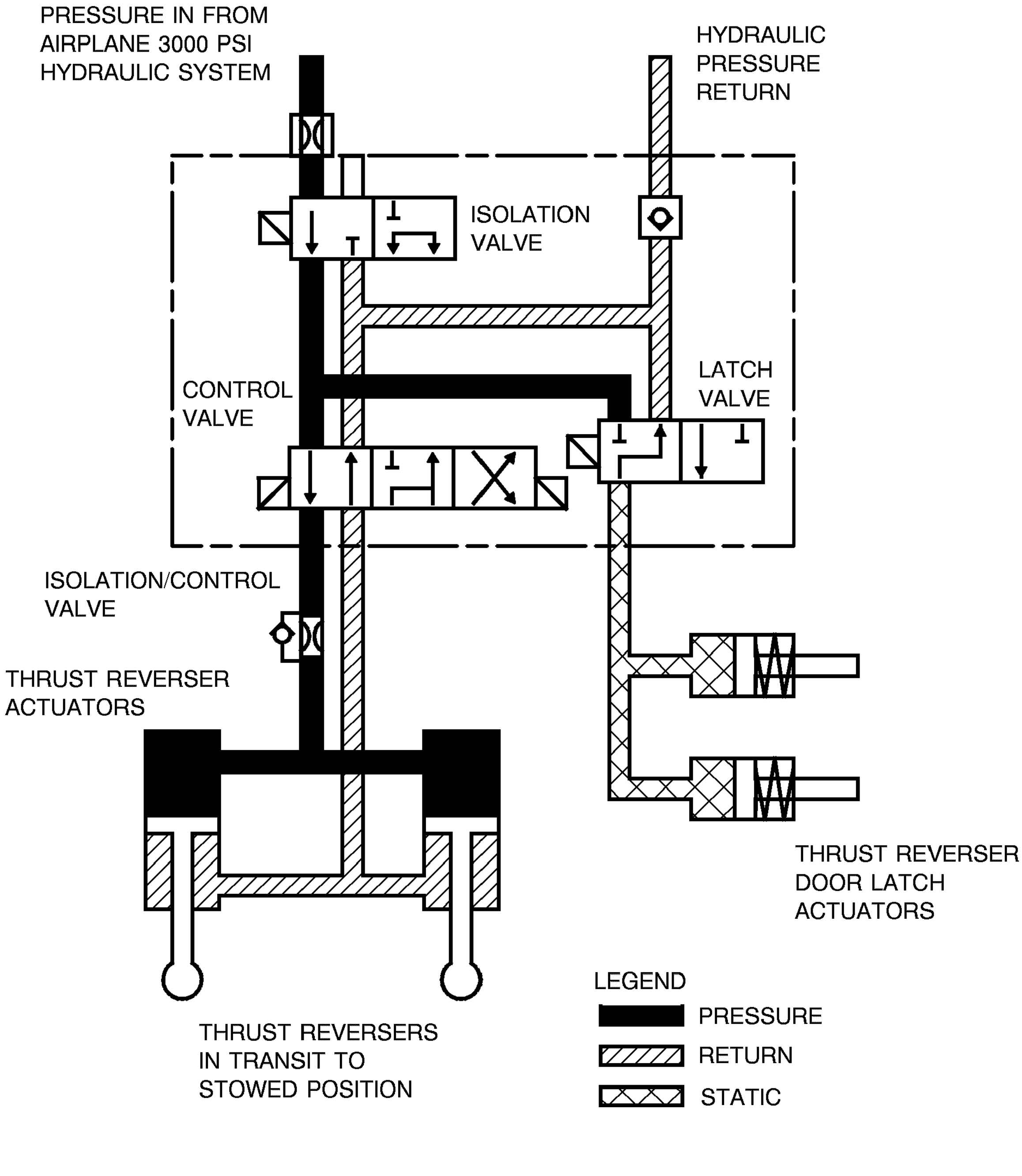
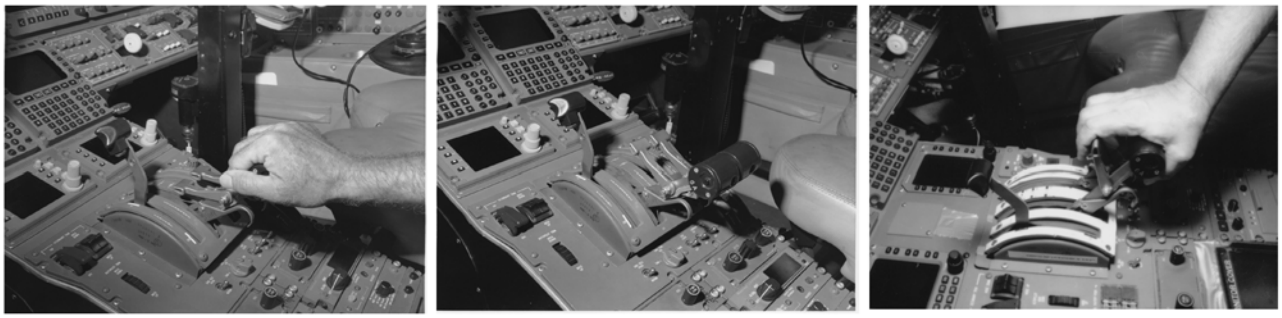


Figure 2-7 (Sheet 3 of 3)

Three reverser indicator lights, and a thrust reverser emergency stow switch, for each reverser are mounted on the cockpit glareshield for monitoring reverse functions. The lights are identified: ARM, UNLOCK, and DEPLOY.

THRUST REVERSER THROTTLE LEVERS

A3916

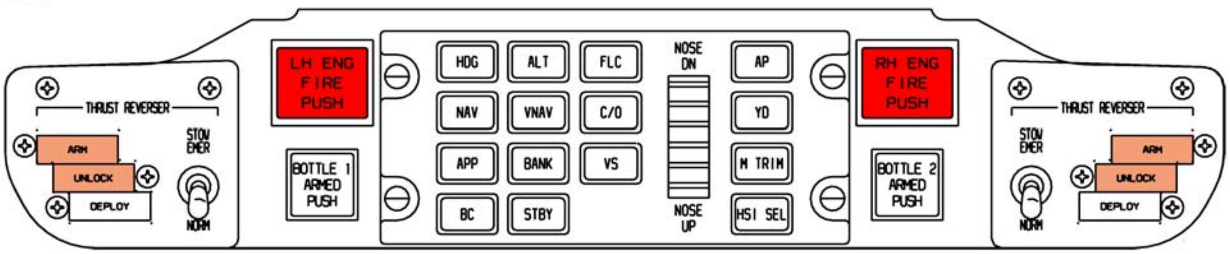


6785P1012
6785P1013
6785P1014

Figure 2-8

THRUST REVERSER STOW SWITCHES AND INDICATOR LIGHTS

A3917



6718C119-2 (2)

Figure 2-9

Moving the reverse thrust lever from the STOWED to the DEPLOY position actuates the deploy cycle. This supplies power through the thrust reverser logic modules to the thrust reverser isolation/control valves, which electrically opens the valves. A pressure switch is located in the isolation/control valve. When hydraulic pressure is sensed immediately downstream of the isolation part of these valves, it causes the amber ARM light in the cockpit to illuminate. The isolation/control valves allow the airplane hydraulic system to pressurize the thrust reverser system, and hydraulic pressure to the reverser actuator causes the actuator ram to retract slightly, drawing the thrust reverser doors into an overstow position that allows the door latches to unlock and release, activating the inboard and outboard latch switches installed on the upper and lower latch boxes (S2, S3, S5, and S6). Any combination of two switches will cause the amber UNLOCK light to illuminate. The remaining travel of the actuators deploys the reverser doors.

In flight, during forward thrust operation, power from the reverser circuit breaker is continuously present at the thrust reverser control stow array, so that an autostow sequence may be initiated in the event any combination of two latch switches move from their fully locked positions.

At full deployment of the reversers, the deploy switch (S7), which is mounted on the outboard primary actuator, is activated, which in turn illuminates the white DEPLOY light and unlocks the pedestal-mounted throttle lockout cam. The purpose of the lockout cam is to prevent increasing engine thrust, once reverser deployment has been selected, until the reversers have fully deployed. Activation of one of the landing gear squat switches (WOW switches) will complete the electrical circuit necessary to initiate deployment of the thrust reversers.

NOTE

- The DEPLOY light illuminates in 2.5 TO 3.0 seconds after the hydraulic UNLOCK light illuminates. An erroneous sequencing or a delay in the illumination of the thrust reverser lights indicates a failure in the thrust reverser system. Either or both conditions requires a maintenance check. The thrust reverser should stow in 1.5 seconds.
- Do not attempt to advance the throttles before the UNLOCK light extinguishes and the DEPLOY light illuminates.

Placing the thrust reverser levers in DEPLOY in flight will cause the MASTER WARNING light to blink. The thrust reverser levers should not be placed in the DEPLOY position in flight, since a single failure of either squat switch could, in certain conditions, permit deployment of the thrust reverser(s). During in-flight operation, the amber MASTER WARNING light will alert the crew to the presence of pressure downstream of the hydraulic control valve's isolation valve, or of a combination of any two thrust reverser unlocked signals in flight. The ARM light will also illuminate under these conditions. If a thrust reverser unlock command is sensed by the FADEC (any three of the latch switches move to an unlocked position) it will command the applicable engine to go to idle power, regardless of the throttle lever position. In this case an EICAS message TR AUTOSTOW L/R will appear. If an EICAS message ENG TR SW FAULT L/R should appear it means that the “automatic throttle-to-idle during in-flight thrust reverser deployment” circuit is disabled or that the in-flight deploy switch is faulted.

To ensure actuation of the squat switches and to eliminate any delay in the deployment of the thrust reversers, it is recommended that the spoilers/speed brakes be extended immediately following touchdown.

After deployment, power may be increased by moving the thrust reverser throttle levers aft for maximum reverse thrust. The FADEC system will govern the maximum reverse thrust according to the amount of thrust called for by the reverser lever angle, up to a percentage of takeoff power which is determined by preset stops in the throttle quadrant. This allows the pilot to keep his attention on the landing rollout instead of diverting his attention to the reverser power settings.

Single-engine reversing has been demonstrated during normal landings and is easily controllable. Also for an increased aerodynamic drag on landing roll, it is suggested that the thrust reversers remain in the deployed idle reverse power position after reverse thrust power has been terminated at 70 KIAS. Use of reverse thrust power below 70 KIAS is not recommended due to the possibility of foreign object damage caused by ingestion of debris from the runway.

To stow the thrust reversers, move the reverse thrust lever through the idle reverse detent to the stow position. Near the idle reverse detent the lever sends a signal to the deploy valve solenoid which de-energizes it, extinguishing the DEPLOY annunciation, and signals the thrust reverser control unit, via the latch switches, to energize the isolation and stow valve solenoids. Further movement terminates deploy power to the isolation and latch valve solenoids, de-energizing the unlatch valve solenoid; the isolation valve remains energized.De-energization of the deploy valve solenoid and latch valve solenoid opens the primary actuator's deploy sides and the latch actuators to hydraulic return, resulting in their depressurization. The force of the latch actuator's internal return springs, in turn, rotates the latch hooks until they contact the latchboxes' leaf springs short of their locked position, holding the latch switches depressed, and leaving power continuously on the stow valve solenoid through the position of the latch switches. Hydraulic pressure is then directed to the two actuators on the reverser which move the thrust reverser doors to the stowed position. As the thrust reverser doors approach their stowed position, the doors' receptacles engage the latchboxes' leaf springs, deflecting the springs as the doors continue into their overstowpositions, and allowing the latch hooks to return to their locked positions. Subsequently, the latch switches relax, terminating power from the thrust reverser control unit to the isolation and stow valve solenoids, and signaling the thrust reverser control unit to extinguish the armed annunciator. The FADEC will then allow thrust to be increased.

The thrust reversers are not to be used during touch-and-go-landings. A full stop landing must be made once reverse thrust has been selected. Less distance is required to stop, even on a slick runway, once the reversers have been deployed, than is required to restow the reversers and takeoff.

EMERGENCY STOW OPERATION

An emergency stow switch for each thrust reverser, located on the cockpit glareshield, will provide the same stow sequence (using the same 28 volt left and right thrust reverser power source stow circuit breakers) in the event of a failure of the pedestal-mounted deploy and stow switch.

The emergency stow function can be checked on the ground by deploying the reversers normally and then actuating each emergency stow switch. The DEPLOY and UNLOCK lights shall extinguish. The ARM lights remain illuminated. Return the thrust reverser lever to stowed position, then turn each emergency stow switch off. All lights will extinguish.

Moving the reverse thrust lever from the STOWED to the DEPLOY position actuates the deploy cycle. This supplies power through the thrust reverser logic modules to the thrust reverser isolation/control valves, which electrically opens the valves. A pressure switch is located in the isolation/control valve. When hydraulic pressure is sensed immediately downstream of the isolation part of these valves, it causes the amber ARM light in the cockpit to illuminate. The isolation/control valves allow the airplane hydraulic system to pressurize the thrust reverser system, and hydraulic pressure to the reverser actuator causes the actuator ram to retract slightly, drawing the thrust reverser doors into an overstow position that allows the door latches to unlock and release, activating the inboard and outboard latch switches installed on the upper and lower latch boxes (S2, S3, S5, and S6). Any combination of two switches will cause the amber UNLOCK light to illuminate. The remaining travel of the actuators deploys the reverser doors.

In flight, during forward thrust operation, power from the reverser circuit breaker is continuously present at the thrust reverser control stow array, so that an autostow sequence may be initiated in the event any combination of two latch switches move from their fully locked positions.

At full deployment of the reversers, the deploy switch (S7), which is mounted on the outboard primary actuator, is activated, which in turn illuminates the white DEPLOY light and unlocks the pedestal-mounted throttle lockout cam. The purpose of the lockout cam is to prevent increasing engine thrust, once reverser deployment has been selected, until the reversers have fully deployed. Activation of one of the landing gear squat switches (WOW switches) will complete the electrical circuit necessary to initiate deployment of the thrust reversers.

NOTE

- The DEPLOY light illuminates in 1.0 to 1.5 seconds after the hydraulic UNLOCK light illuminates. An erroneous sequencing or a delay in the illumination of the thrust reverser lights indicates a failure in the thrust reverser system. Either or both conditions requires a maintenance check. The thrust reverser should stow in 1.5 seconds.

- Do not attempt to advance the throttles before the UNLOCK light extinguishes and the DEPLOY light illuminates.

Placing the thrust reverser levers in DEPLOY in flight will cause the MASTER WARNING light to blink. The thrust reverser levers should not be placed in the DEPLOY position in flight, since a single failure of either squat switch could, in certain conditions, permit deployment of the thrust reverser(s). During in-flight operation, the amber MASTER WARNING light will alert the crew to the presence of pressure downstream of the hydraulic control valve's isolation valve, or of a combination of any two thrust reverser unlocked signals in flight. The ARM light will also illuminate under these conditions. If a thrust reverser unlock command is sensed by the FADEC (any three of the latch switches move to an unlocked position) it will command the applicable engine to go to idle power, regardless of the throttle lever position. In this case an EICAS message TR AUTOSTOW L/R will appear. If an EICAS message ENG TR SW FAULT L/R should appear it means that the “automatic throttle-to-idle during in-flight thrust reverser deployment” circuit is disabled or that the in-flight deploy switch is faulted.

To ensure actuation of the squat switches and to eliminate any delay in the deployment of the thrust reversers, it is recommended that the spoilers/speed brakes be extended immediately following touchdown.

After deployment, power may be increased by moving the thrust reverser throttle levers aft for maximum reverse thrust. The FADEC system will govern the maximum reverse thrust according to the amount of thrust called for by the reverser lever angle, up to a percentage of takeoff power which is determined by preset stops in the throttle quadrant. This allows the pilot to keep his attention on the landing rollout instead of diverting his attention to the reverser power settings.

Single-engine reversing has been demonstrated during normal landings and is easily controllable. The reverse thrust should be brought to idle by 70 KIAS during single reverser operations on a slippery runway surface or if the nosewheel steering is inoperative.

For an increased aerodynamic drag on landing roll, it is suggested that the thrust reversers remain in the deployed idle reverse power position after reverse thrust power has been terminated at 65 KIAS. Use of reverse thrust power below 65 KIAS is not recommended due to the possibility of foreign object damage caused by ingestion of debris from the runway.

To stow the thrust reversers, move the reverse thrust lever through the idle reverse detent to the stow position. Near the idle reverse detent the lever sends a signal to the deploy valve solenoid which de-energizes it, extinguishing the DEPLOY annunciation, and signals the thrust reverser control unit, via the latch switches, to energize the isolation and stow valve solenoids. Further movement terminates deploy power to the isolation and latch valve solenoids, de-energizing the unlatch valve solenoid; the isolation valve remains energized.De-energization of the deploy valve solenoid and latch valve solenoid opens the primary actuator's deploy sides and the latch actuators to hydraulic return, resulting in their depressurization. The force of the latch actuator's internal return springs, in turn, rotates the latch hooks until they contact the latchboxes' leaf springs short of their locked position, holding the latch switches depressed, and leaving power continuously on the stow valve solenoid through the position of the latch switches. Hydraulic pressure is then directed to the two actuators on the reverser which move the thrust reverser doors to the stowed position. As the thrust reverser doors approach their stowed position, the doors' receptacles engage the latchboxes' leaf springs, deflecting the springs as the doors continue into their overstowpositions, and allowing the latch hooks to return to their locked positions. Subsequently, the latch switches relax, terminating power from the thrust reverser control unit to the isolation and stow valve solenoids, and signaling the thrust reverser control unit to extinguish the armed annunciator. The FADEC will then allow thrust to be increased.

The thrust reversers are not to be used during touch-and-go-landings. A full stop landing must be made once reverse thrust has been selected. Less distance is required to stop, even on a slick runway, once the reversers have been deployed, than is required to restow the reversers and takeoff.

EMERGENCY STOW OPERATION

An emergency stow switch for each thrust reverser, located on the cockpit glareshield, will provide the same stow sequence (using the same 28 volt left and right thrust reverser power source stow circuit breakers) in the event of a failure of the pedestal-mounted deploy and stow switch.

The emergency stow function can be checked on the ground by deploying the reversers normally and then actuating each emergency stow switch. The DEPLOY and UNLOCK lights shall extinguish. The ARM lights remain illuminated. Return the thrust reverser lever to stowed position, then turn each emergency stow switch off. All lights will extinguish.

ENGINE FIRE PROTECTION

The engine fire detection system is comprised of a tail cone mounted fire detection control unit, and an engine mounted fire detecting assembly consisting of a sensor tube, an integral sensor element, and a responder unit. Upon detection of an overtemperature condition it illuminates the respective red ENG FIRE warning light on the cockpit glareshield, provides an EICAS message, illuminates the MASTER WARNING LIGHTS and sounds the aural warning (if installed) and/or tone.

FIRE DETECTION INDICATING LIGHTS

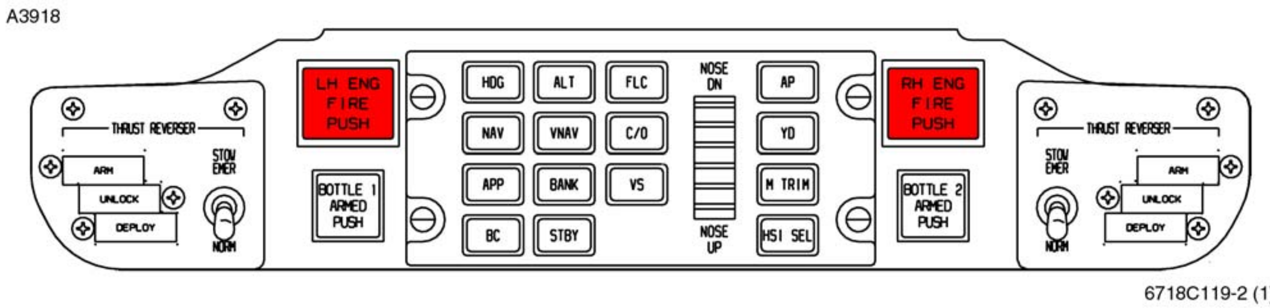


Figure 2-10

The fire warning light, under a transparent, spring-loaded guard, also serves as a firewall shutoff switch. Lifting the guard and depressing the warning light simultaneously closes the respective firewall fuel and hydraulic valves, de-energizes the generator and the thrust reverser isolation valve, and arms the two extinguishing bottles which are charged with CBrF3 (bromotrifluoromethane). System discharge is by means of pyrotechnic devices.

ENGINE FIRE EXTINGUISHING SYSTEM

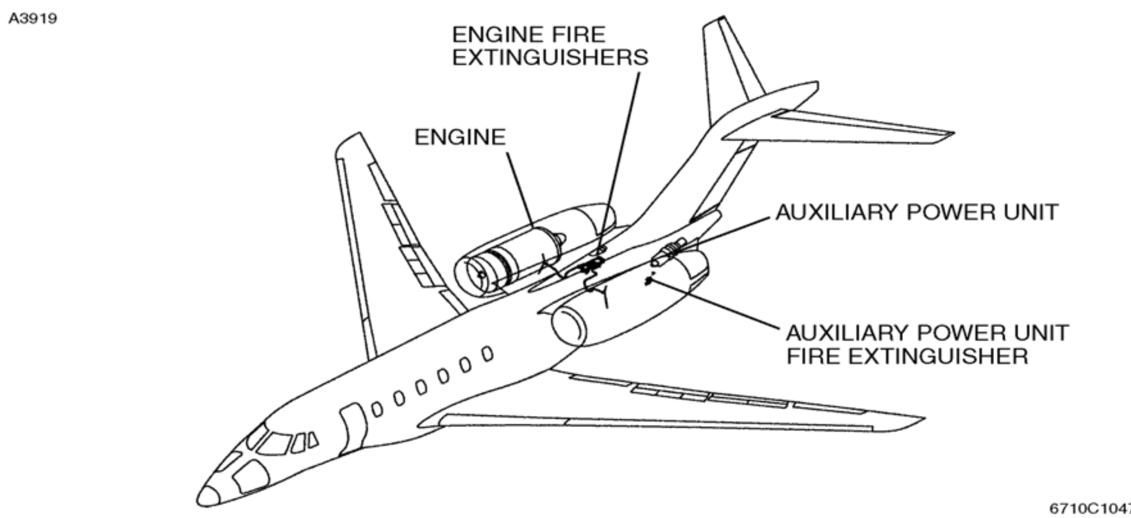


Figure 2-11

Depressing the fire warning light also sends a signal to the FADEC to shut down the respective engine.

There is logic built into the system to prevent multiple messages that would appear when an engine is shut down. When a FADEC senses idle cutoff on either engine, the messages (such as FUEL PRESS LOW, HYD PRESS LOW, and GEN OFF) will change to ENGINE SHUTDOWN L - R. This message is less distracting to the crew when an engine is shut down.

Once armed, either bottle may be discharged to the selected engine by pushing the BOTTLE ARMED light. The light will go out as the light is pushed. System plumbing is such that both bottles can be directed to the same engine if necessary. Both bottles will discharge into the nacelle having the fire switch depressed.

Function of the lights and continuity of the sensor and detector control units are checked by placing the rotary TEST selector to the SMOKE FIRE WARN position and observing illumination of both red lights and the MASTER WARN light. Depressing either fire light will then illuminate both BOTTLE ARMED lights. Since the BOTTLE ARMED lights will come on each time the system is tested or initially activated, regardless of extinguishing agent quantity, it is necessary to check proper bottle servicing during preflight inspection. Appearance of a cyan EICAS message FIRE BOTTL LOW L - R indicates that the applicable fire bottle service pressure is below acceptable tolerance. A chime will sound when the FIRE BOTTL LOW message appears. Appearance of an amber EICAS message FIRE DETECT FAIL L - R indicates that the annunciated fire detection circuit is inoperative.

All test; detection, and extinguishing features are electrically powered from the main DC Buses requiring either external power, the battery switch(es) in BATT, or a generator on the line for operation.

AUXILIARY POWER UNIT FIRE PROTECTION

The auxiliary power unit fire detection and extinguishing system is comprised of an integral sensor unit, a responder unit, an APU FIRE indicating light/switch, a fire bottle and the required electrical circuits. Its purpose is to notify the operator of an overheat condition at the auxiliary power unit (APU), which is mounted in the stinger, and to extinguish fires at the APU or in the APU area.

If the fire detection system senses an overheat condition in the APU area, the APU FIRE light on the copilot's panel will illuminate, an EICAS message APU FIRE, (red) will be annunciated on the EICAS panel, accompanied by a double chime, and the MASTER WARNING will illuminate. The fire bottle is discharged by pressing the indicating light/switch, which will go out when the fire is extinguished.

A cyan FIRE BOTTL LOW APU annunciation on the EICAS indicates that the APU fire bottle pressure is below the minimum required for safe operation. An amber FIRE DETECT FAIL A annunciation on the EICAS means that the APU fire detection system is inoperative.

The single fire extinguisher bottle is mounted below the firewall fairing, and dispenses extinguishing agent through a single tube, which has a tee fitting on the end. The extinguishing agent is Halon, which is pressurized with dry nitrogen propellant.

System test is accomplished by turning the cockpit rotary test switch to FIRE WARN. Proper system operation is indicated by illumination of the APU FIRE indicating light/switch, illumination of the MASTER WARNING light, and the appearance of the red EICAS message APU FIRE.

BAGGAGE COMPARTMENT SMOKE DETECTION

The baggage compartment smoke detection system is comprised of an optical sensor type detector, mounted on the left side of the baggage compartment in a protective housing.

The smoke detection system serves to notify the flight crew of smoke or fire in the tailcone baggage compartment. If smoke is detected, an electrical circuit is made and the sensor sends a signal to the EICAS system, which displays a red visual message BAGGAGE SMOKE, and sounds a double chime tone. The MASTER WARNING light will also illuminate.

The detection system is tested by selecting SMOKE/DET on the rotary test switch in the cockpit. If the system tests good the red BAGGAGE SMOKE CAS message will appear.

If the baggage smoke annunciator illuminates, the baggage compartment isolation (ISO) valve should be closed and the airplane should be landed as soon as possible. The valve will not reopen until zero cabin differential pressure is achieved at low cabin altitude.

FUEL

The Citation X fuel system is comprised of the storage, distribution, refueling/defueling, and indicating systems. The storage system is made up of a set of integral tanks in each wing, and a center wing tank which includes a forward fairing fuel tank. Each wing tank has a hopper tank which is integral to it. The two wing tanks incorporate check valves and baffles allowing each wing tank complex to function as a single tank. Other integral components of the storage system are the gravity fuel fillers, drain valves, flapper check valves, vent system components, positive/negative pressure relief valves and all of the associated system plumbing. Transfer capability is incorporated enabling all usable fuel to be available to either engine.

Each wing tank holds a total of 521 gallons (3518 Lbs.) of fuel, which includes the hopper tank. The center wing tank holds 888 gallons (5594 Lbs.), 207 (1397 Lbs.) of which are contained in the forward fairing tank. Total fuel capacity of the airplane fuel system is 1927 gallons; at 6.75 pounds per gallon the available fuel weight is 13,031 pounds.

System operation is fully automatic throughout the normal flight profile. Manual fuel system control and monitoring is available through the boost pump switches, wing gravity transfer switch (GRVTY XFLOW), The fuel CROSSFEED switch, the CTR WING XFER O'RIDE switch, fuel quantity and flow indicators, and EICAS messages, which warn of abnormal system operation. A low fuel level warning system, which indicates through the EICAS system functions independently of the normal fuel quantity indicating system.

FUEL CELLS

The left and right wing tanks are sealed “wet wing” tanks, integral to the wings outboard of wing station 54.85. The wing tanks are connected to hopper tanks (engine feed bays) which are remotely located in the center wing tank, but which are functionally part of the wing tanks and are physically isolated from the center wing tank.

The center tank is a sealed tank, integral to the wing center section between the front and rear spars and the left and right wing station 54.85. The separate forward fairing tank is in the forward belly fairing, forward of the wing leading edge, but is interconnected to and is functionally part of the center wing tank.

Each wing tank is vented to its respective surge tank through connecting tubes. The surge tanks are normally dry, but serve as collecting points for small amounts of fuel which may migrate from the wing tanks during maneuvers or when the airplane is in a climb attitude, or due to thermal expansion of the fuel. The surge tanks are vented to the atmosphere through flush NACA scoops on the lower surface of the wing below the tanks.

The center wing/forward fairing tank contains two independent vent systems, one at either outboard end of the tank. Each system vents to the atmosphere through a NACA scoop ineach wing trailing edge lower skin between the inboard and outboard flaps.

Each fuel tank has a pressure relief system to relieve positive and negative pressure, such as may occur during single point refueling if the system fails to shut off when the tank is full, or during other conditions if the vent system should fail closed or become blocked. The vents for the wing pressure relief valves exit through the lower wing skin forward of each outboard flap. The two center tank relief valve exits are in the lower wing skin near each center wing tank vent scoop.

Servicing may be accomplished using the single point refueling/defueling system (refer to Single Point Refueling/Defueling System below) or over the wings. Each wing is equipped with a fill port on the top of the wing. The center fairing tank is filled through the right wing only. A manual valve must be opened by pulling a handle under a door in the bottom of the fuselage near the single point refueling panel, allowing fuel to pass from the right wing to the center fairing tank. The valve must be closed, by pushing the handle up, when over-the-wing refueling is complete. The door will not close unless the handle is stowed.

FUEL DISTRIBUTION SYSTEM

The fuel distribution system normally operates using motive flow powered ejector pumps and performs the following functions: fuel supply to the engines, fuel crossfeed from each wing to the opposite engine or feeding both engines from a single tank, fuel scavenge from each wing tank to its respective hopper, fuel transfer from the center tank to each wing tank, and fuel gravity crossflow between the two wing tanks.

The pilot controls the fuel supply to the engines by the fuel crossfeed switch (LH TANK-RH ENG/OFF/RH TANK-LH ENGINE) on the fuel control panel. With the crossfeed switch in its normal position, OFF, fuel is supplied from each hopper tank to its respective engine. Fuel flow is maintained by a motive flow primary ejector pump located in the hopper tank. Motive flow pressure is provided by an engine driven motive flow fuel pump which taps a small amount of the fuel supply to the engine, boosts its pressure and returns it to the hopper tank for operation of the primary ejector pump. An electric fuel boost pump is mounted in each hopper tank parallel to the primary ejector and is powered in the event of failure of the primary ejector pump or the motive flow pump, or during crossfeed operation and engine start. The fuel boost pump can also be turned on manually by the pilot, using the LH and RH FUEL BOOST ON/OFF/NORM switches. In the ON position the fuel boost pumps will run whenever there is power on the electrical bus. In the OFF position, the boost pump is always off. In the NORM position, the boost pumps are normally off, but may be automatically turned on if one of the following conditions exists: the engine supply fuel pressure falls below approximately 9 PSI, engine start sequence is initiated, CROSSFEED position is selected on the FUEL CROSSFEED switch, or the auxiliary power unit (APU) is in operation and the left engine is not running (LH boost pump only).

Operation of the fuel boost pumps is indicated by a white FUEL BOOST ON L - R engine indicating and crew alerting system (EICAS) message unless the boost pump is automatically turned on due to low engine supply fuel pressure. In this case, the FUEL BOOST ON EICAS message will be amber with illumination of the MASTER CAUTION. The FUEL PRESS LOW L - R EICAS message is inhibited for two seconds and will not be displayed if the boost pump restores the fuel pressure.

Scavenger ejector pumps, which are located at the inboard edge of each wing tank, transfer fuel from each wing into the respective hopper tank. The primary ejector pump, or the boost pump in the hopper tank in each system, provides motive flow for operation of the scavenge pumps.

Electric Boost Pumps

The electric boost pumps provide fuel pressure for engine starting, fuel transferring and act as a backup for the primary ejector pumps. When the pump is intentionally put into operation its operation is indicated by a white FUEL BOOST ON L - R annunciation in the EICAS system. If the pump is automatically activated by low fuel pressure, an amber FUEL BOOST ON L - R will be annunciated.

The pumps are controlled by a pair of three-position switches (LH and RH) located low on the pilot's instrument panel. The switches are marked ON, OFF, and NORM. In the OFF position, the boost pump is de-energized except when activated by the engine start system or by selection of transfer from that tank. In NORM, function is also automatic for start and transfer and is activated by the pressure switch should output from the primary ejector pump be insufficient. The respective boost pump when in NORM is disabled any time the throttle is in cut-off to preclude pump activation by low pressure sensing during shutdown. The ON position causes the selected pump to operate continuously regardless of throttle position.

FUEL SYSTEM SCHEMATIC

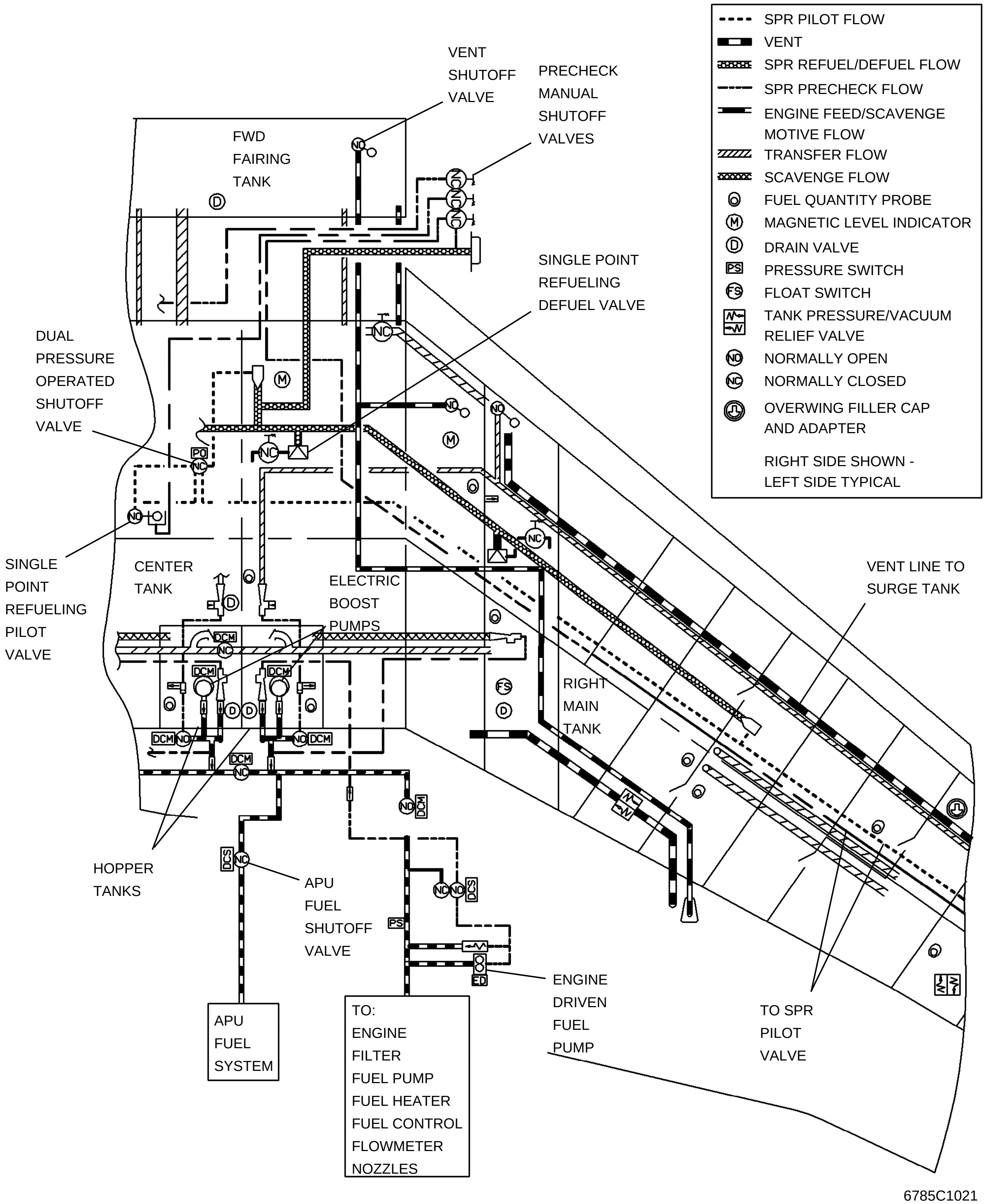


Figure 2-12 (Sheet 1 of 3)

FUEL SYSTEM SCHEMATIC

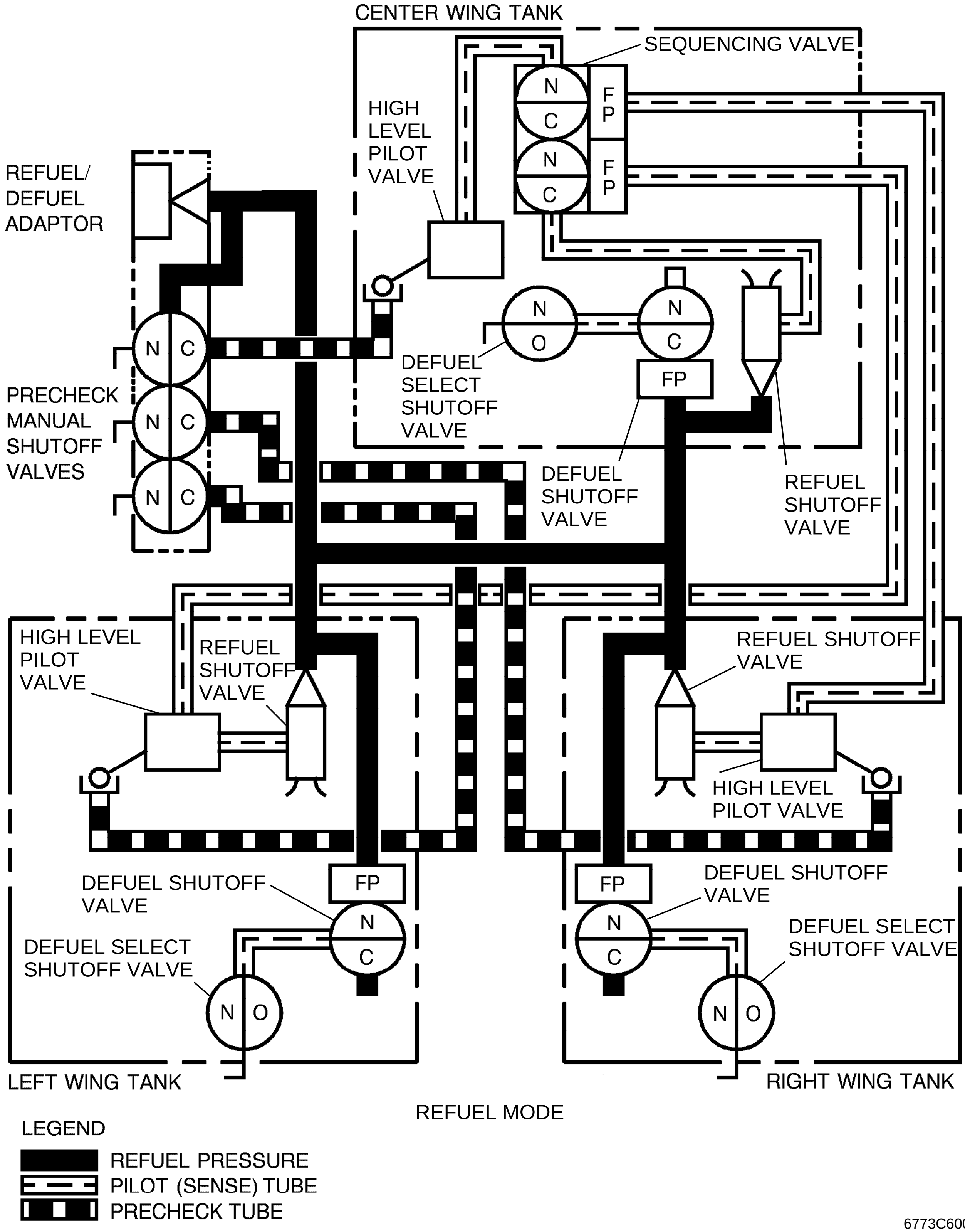


Figure 2-12 (Sheet 2 of 3)

FUEL SYSTEM SCHEMATIC

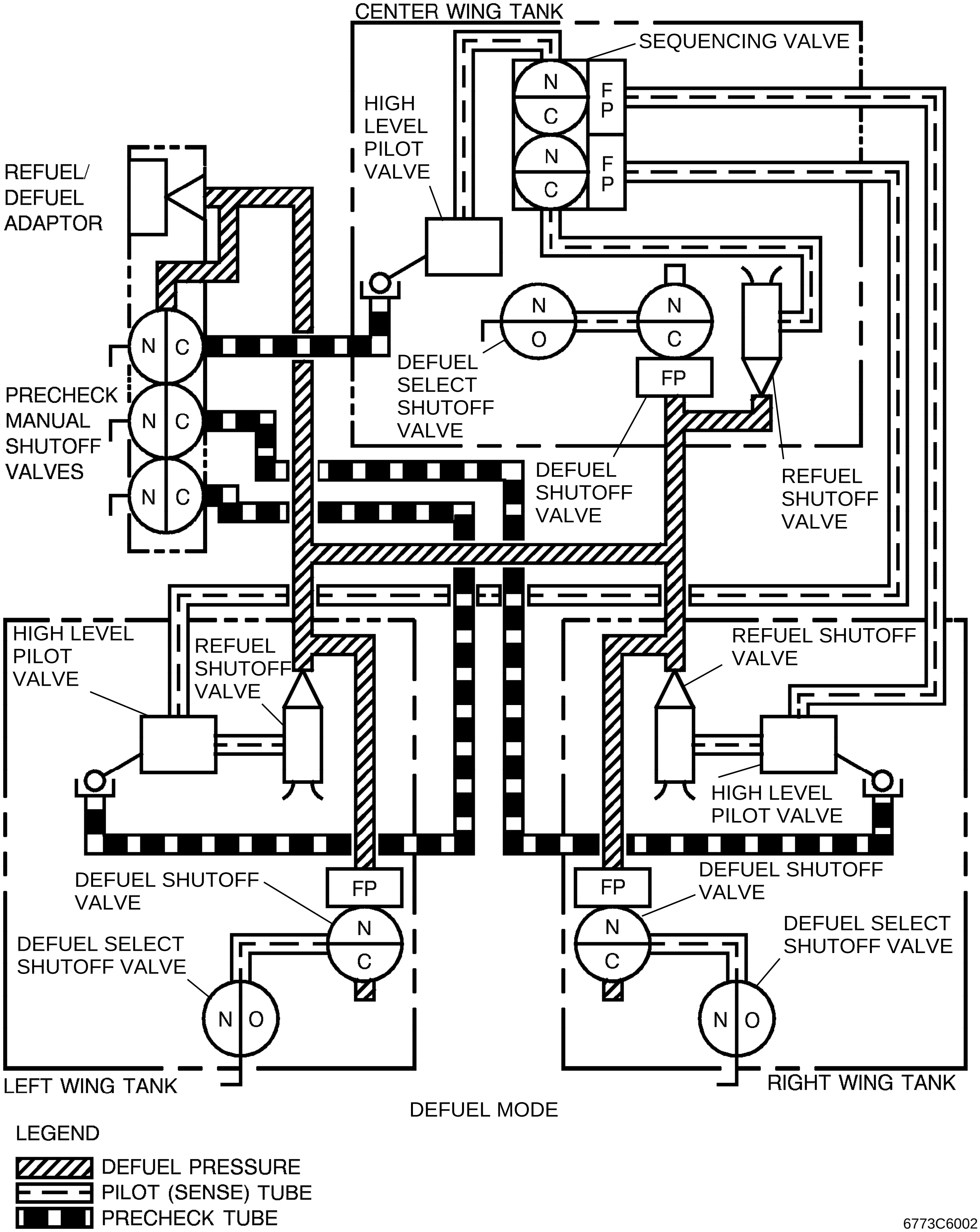


Figure 2-12 (Sheet 3 of 3)

Ejector Pumps

Two primary ejector pumps (one in each wing fuel hopper tank) utilize existing fuel pressure in conjunction with a venturi to produce a high-volume flow. The original pressure to drive the ejector pumps is generated by the engine driven fuel pumps, or in some circumstances the electrical boost pumps. As high pressure fuel (350 - 500 PSIG) is forced through the ejector orifice, a low pressure area is created at the pump inlet, drawing in a comparatively large volume of fuel and pushing it out at low pressure (12 - 22 PSIG). The motive flow pumps are controlled by the motive flow shutoff/bypass solenoid valves, one of which is located in each pylon. These valves shut off motive flow to the primary ejector pump in the non-feeding tank when crossfeed is selected. During normal operation the motive flow shutoff/bypass solenoid valves are deenergized and fuel flows from the inlet to the outlet port. When the valve is energized, fuel flows from the inlet to the bypass port and then recirculates back to the inlet port.

Two transfer ejector pumps (one each for the left system and right system) are mounted in the center wing tank in a location just forward of the respective hopper tanks. These transfer pumps transfer fuel from the center tank to the outer sections of the wing tanks. Motive flow is provided by the system primary ejector pump and/or the boost pump in the pertinent hopper tank.

A scavenger ejector pump, powered by the same fuel source as the primary ejector pumps, is located in each wing tank and is used to move fuel from the wing tank to the hopper. The scavenger pumps are designed to keep the hoppers full under all operating conditions, and to provide a slight pressurization to the hopper tank in order to improve the high altitude performance of the primary ejector pumps. These pumps, and the outboard ends of the hopper vent and the gravity flow lines, are protected by large area screens which minimize contamination reaching the hopper tank and other fuel system components. If the ejector pump should fail or become blocked, fuel will gravity flow into the hopper from the main tank.

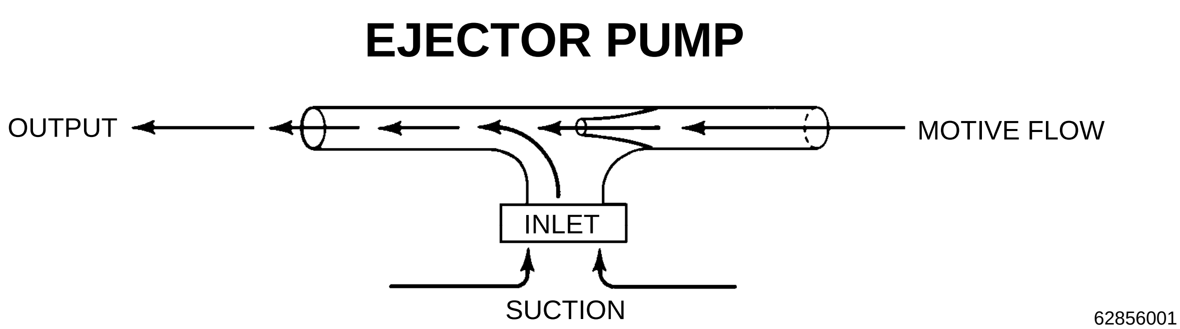


Figure 2-13

Transfer System

The transfer system allows fuel to be transferred from the center tank to both main wing tanks. The system operates automatically (if the CENTER WING XFER O'RIDE switches are in NORM position), in that fuel will normally feed from the wings first until wing fuel reaches approximately 3100 - 3400 pounds (deviations of several hundred pounds can occur due to variations from 0^{o} pitch). The center wing tank transfer system will then start and maintain approximately 3100 - 3400 pounds (deviations of several hundred pounds can occur due to variations from 0^{o} pitch) wing fuel until all center tank fuel is transferred.

FUEL SYSTEM CONTROL PANEL

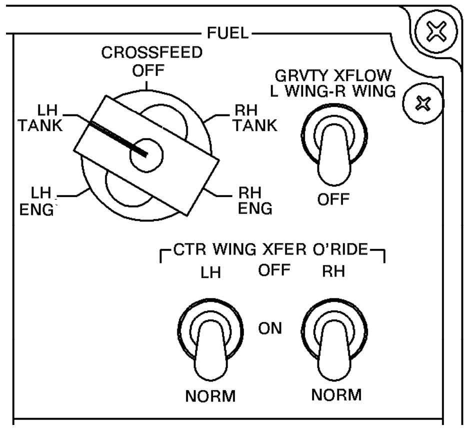


Figure 2-14

The transfer rate is designed to keep the wing tanks approximately at the level they were when transfer began, until the center wing fuel is exhausted. This keeps the airplane center-of-gravity in a favorable condition. Transfer is effected by the transfer ejector pumps discussed under Ejector Pumps, above.

The rate of transfer is regulated by the transfer float valves (two in each tank - one outboard and one inboard). They operate by controlling the discharge rate of each ejector pump. If the tank wing level decreases the float valve opens, admitting more fuel; if the level increases, the float valve closes off, slowing the rate of pumping and causing the relative fuel level in the center and the wing tanks to change more slowly.

As discussed above, center wing transfer is normally automatic, however, in unusual circumstances manual control may be desired. Manual control can be exercised through operation of the LH and RH CENTER WING XFER O'RIDE OFF/ON/NORM switches on the fuel control panel. These switches control the respective transfer ejector pump by operating shut-off valves which control fuel to the ejector pumps. In OFF transfer will not occur. In NORM transfer will occur unless there is less than 500 pounds fuel in the respective wing tank. The ON position will override the NORM position, where 500 pounds of fuel would remain in the tank. In ON position all of the fuel will be pumped out of the tank. The valve's usual position should be NORM, to allow automatic operation. If the wing tank fuel quantity falls below 500 pounds during transfer, however, the respective valve will close in order to prevent motive flow fuel from being trapped in the center wing tank. If either transfer valve should fail to fully operate to the open or closed position, an EICAS message CTR XFER XSIT L, R will be displayed.

Engine Crossfeed System

A crossfeed system allows the left engine to be fed from the right tank or the right engine to be fed from the left tank. If crossfeed is selected (LH TANK - RH ENG or RH TANK - LH ENG), the selected engine is fed from the opposite tank, which also continues to feed its respective engine. No wing-to-wing fuel transfer occurs during crossfeed operation.

Once crossfeed is selected, the boost pump in the selected hopper tank is turned on, a crossfeed valve opens to supply fuel to the opposite engine, and the opposite engine motive flow shutoff valve closes to disable the primary ejector pump in the opposite hopper tank. Crossfeed is possible without the boost pump being in operation but the boost pump should always be on, automatically or manually, in order to preclude having both engines supplied by a single ejector pump. A FUEL XFEED OPEN white EICAS message indicates that the crossfeed valve has opened. The crew should verify that the selected tank white FUEL BOOST ON message is displayed and the opposite boost pump is not operating. Operation of the opposite boost pump will stop crossfeed from occurring. If a cyan FUEL XFEED XSIT message should appear, it indicates that a failure has caused the crossfeed valve to remain between the fully open and fully closed positions. If the fuel motive flow valve fails to stop motive flow to the non-feeding side, an amber CAS message FUEL MOTV FAIL L-R will appear. In this case crossfeed will likely be impossible.

Gravity Crossflow System

The gravity crossflow system permits gravity flow between the left and right hand wing tanks for backup to the crossfeed system, and to equalize wing tank levels during conditions which could occur if a center-to-wing tank transfer pump were to fail on one side. Control of gravity crossflow is by the GRAVITY CROSSFLOW L WING - R WING/OFF switch on the fuel control panel. The L WING - R WING position causes the gravity crossflow valve in a line between the two wing tanks to open. A white EICAS message (FUEL XFLOW OPEN) will appear to remind the pilot that the valve is open. If the fuel quantity differential is small, gravity leveling will be slow. The process can be accelerated by sideslipping the airplane. If a cyan EICAS message (FUEL GRV XFLW XSIT) appears it means that the gravity crossflow valve did not fully open or close. To preclude fuel vent spills, the gravity crossflow valve must be closed whenever the airplane is parked on uneven ground.

Engine-Driven Fuel Pump

The engine-driven fuel pump is a high capacity positive displacement vane-type pump which supplies the high pressure (350 to 500 PSIG) motive flow for the primary ejector pump. It is driven by a shaft off the engine accessory gearbox and is piggybacked to the hydraulic pump. A fail safe shear section allows continued operation of either pump in case of seizure of the other one. The fuel pump has a built-in bypass relief valve to regulate pressure at high engine speeds and to bypass fuel in case of the plugging of the primary ejector orifice.

Fuel Flow Indicators

Fuel flow rate is measured by a fuel flow transmitter in the fuel inlet line to the engine and is presented in pounds-per-hour in the FUEL portion of the (EICAS).

Quantity Indicators

The fuel quantity gaging/indicating system is a capacitance system. There are three independent channels; left wing, right wing, and center wing. The left and right wing systems consist of six sensing probes in each wing tank and one in each hopper tank, which is considered part of each wing tank. The center wing tank has four probes; two in the center of the tank and one on each side at the outboard edge of the tank.

There is one signal processing unit for each independent system. It provides conditioned electrical power to the sensing probes and computes fuel quantity based on the sensing probe output data, and provides ARINC 429 bus output signals for the quantity indications as well as for the built-in-test (BIT) functions which aid maintenance in troubleshooting the system. Aircraft pitch data is provided to the processing units from the AIRINC 429 bus in order to enable it to provide more accurate fuel quantity indications in all aircraft attitudes. Fuel quantity readings can be corrected for airplane attitudes from +10 to -10 degrees of pitch.

Fuel quantity is presented in pounds in the FUEL portion of the engine indicating and crew alerting system (EICAS). Indications are given for both the total fuel quantity and for the amount in each tank. If the fuel quantity of the left or right wing tanks should fall below 500 pounds, the indication of that tank will be presented in amber. If the total fuel falls below 1200 pounds, the total fuel reading will be displayed in amber digits. If an indicating system should fail, the quantity in that tank will be indicated by amber dashes, to indicate that the amount is unknown. The total quantity will be presented as amber dashes, since it is also unknown.

Magnetic Fuel Level Indicators

Magnetic fuel level indicators are installed in four locations on the lower surface of the outer wing and the center wing fuel tanks. The indicator consists of a calibrated stick and magnet, and a float with magnet attached. These level indicators allow ground calculation of the tank fuel levels, independent of the electronic system.

Level indicators are installed in the left and right main wing fuel tanks between the forward and center (main) spar, just outboard of center wing station 178, and two in the center wing tank; one just inboard of wing station 19.00 and one just inboard of wing station 55.00.

To read the magnetic fuel level indicator the calibrated stick and magnet must be lowered by using a straight bladed screw driver, or other suitable tool. Insert the screw driver in the slot, push upward (against spring tension) and rotate until the assembly is free of its housing and drops to the lowered position. When the assembly drops, the float magnetic will engage the magnet on the calibrated stick resulting in a reading of the fuel quantity on the stick. The calibrated stick can be pulled free of the float magnet, but with practice it can be determined by “feel” when the magnet is engaged.

Low Fuel Warning System

Two float switches are installed in the left and right outboard wings. They are designed to actuate at a fuel quantity of approximately 500 pounds remaining in the respective tank. Actuation of the switches initiates an amber EICAS system message FUEL LEVEL LOW L - R, and after a five-second delay turns off the center wing transfer system. The delay in turning off the center wing transfer is designed to prevent nuisance activation due to fuel sloshing in the tank.

The warning from the low fuel warning system is separate from, and in addition to, the amber EICAS annunciations in the fuel quantity indicating system which occurs when fuel quantity falls below 500 pounds in a tank.

Wing Overfull Warning Switches

Two wing overfull float switches are located in the left/right outboard wing. They are designed to actuate when the wing vent surge tanks are almost full and are at the point of impending overflow.

Actuation causes an amber engine instrument and crew alerting system (EICAS) message WING TANK O'FULL L - R to be annunciated. This advises the flight crew that the fuel transfer system has malfunctioned and is overfilling the wing fuel tank(s) to the point of impending overflow.

Fuel Temperature Indicating System

There are two temperature sensing bulbs in the aircraft fuel system. They are mounted near the fuel gravity crossfeed valves with the temperature bulbs extending into the respective left and right fuel hoppers.

The fuel sensors are designed to operate in a temperature range of between -70°C and +300°C. If the temperature drops below -60°C or rises above +70°C an amber engine instrument and crew alerting system (EICAS) message (FUEL TEMP L - R) will be annunciated. Refer to the Section 1, Limitations, to determine the temperature limitations of the particular fuel in use.

When FUEL HYD is selected on the bezel button below the EICAS display tube, the temperature indications of fuel in the airplane tanks (TANK °C) and at the engine fuel control unit (ENGINE °C) will be added to the fuel display on the EICAS tube. Temperatures of fuel in the tanks between -35°C and +52°C will be in green. Indications below -35°C and above +52°C will be in amber. Engine fuel temperatures of from +4°C to +99°C will be in green, and those above or below these numbers will be shown in amber.

Fuel Shutoff Valves

Electrically operated firewall shutoff valves to each engine are controlled by the LH or RH ENG FIRE button. Pressing the fire button will shut off the respective fuel and hydraulic valves and disconnect the generator. The switch also sets up the fire extinguisher bottles to be discharged into the selected engine.

When the firewall shutoff valve has been used to close the fuel firewall shutoff valve, a white engine instrument and crew alerting system (EICAS) message (FUEL FW VLV CLSD L - R) will be displayed. Other status messages will also be displayed, but these are discussed under their individual systems headings.

Single-Point Refueling/Defueling System

The single-point refueling system is provided to enable the airplane to be refueled or defueled more safely and conveniently by connecting to one port, which is not open to the atmosphere. Advantages of a single-point refueling and defueling include minimized refuel/defuel time, reduced possibilities of fuel contamination, reduced static electricity hazard, less airplane skin damage, and there is no personnel contact with the fuel.

The refueling/defueling system is independent of the airplane system. It is designed for refueling with a truck or refueling hydrant (pit) having single point provisions. The major components of the system include the refueling/defueling adapter (receptacle), the precheck control panel, refuel shutoff valves, the pilot (precheck) valves, defuel valves, a sequencing valve, manual defuel select shutoff valves, internal drain valves and associated system plumbing.

Single-point refueling is accomplished by connecting the refueling truck or refueling pit equipment to the airplane at the single-point refuel/defuel adapter on the right side of the fuselage just forward of the wing leading edge.

CAUTION

IF SINGLE-POINT REFUELING IS CONDUCTED WITH THE AUXILIARY POWER UNIT (APU) OPERATING, SELECT THE LH CENTER-WING XFER SWITCH TO OFF. THE COMBINATION OF HIGH-LEVEL SHUTOFF DUE TO PRECHECK, SINGLE-POINT SHUTOFF AND TRANSFER SHUTOFF MAY CAUSE FUEL OVERBOARD VENTING. APU ON CAUSES THE LEFT-HAND BOOST PUMP TO OPERATE.

Prior to beginning refueling a precheck of system operation is accomplished at the precheck panel located adjacent to the adapter. A successful precheck indicates that the system is working properly and that system shutoff will occur when the tanks are filled. If the precheck is not successful, the system must not be used until repaired. System damage or dangerous spills can occur.

Precheck is accomplished by lifting the precheck handles (left wing, center wing and right wing) and applying fuel pressure. Flow should stop within approximately thirty seconds. During the precheck operation fuel is pumped into a small bowl at the high level pilot valve, which will operate the refuel shutoff valve, stopping the flow of fuel just as it does when the tank is full. Sequencing is automatic; the two wing tanks will fill first, followed by the center wing tank.

When one or both wing tanks reach the full level and flow is discontinued, the opposite wing (if not yet full) will receive the full refueling flow until it also reaches the full level. As pilot pressure builds up in other wing tank pilot tubes, the sequencing valve will open the center fuel tank pilot line and allow center tank pilot flow. When full the center wing will shut off in the same manner as the other tanks. When refueling the wings to less than full, small differences in fuel flow within the single point distribution system may result in more fuel entering one wing tank than the other. Placing 75 to 100 gallons of fuel in the center tank will allow fuel transfer from the center tank to the appropriate wing tank to balance this condition.

Defueling Operation

Single-point defueling is accomplished using the same adapter as the single-point refueling system. When defueling is desired, the manual defuel select valves must be opened for each tank not requiring defueling. When any of the manual defuel select shutoff valves are opened, the corresponding defuel valve is deactivated.

When negative pressure is applied through the defueling equipment, the defuel shutoff valves are opened and fuel is drawn from the tank through the open defuel shutoff valve. When the tank is depleted of its fuel, the defuel shutoff valve is pressurized by tank pressure. The resulting force imbalance closes the defuel valve and terminates the defueling operation.

Fuel tank drains (push to drain, turn to lock) are located below each wing approximately parallel to the outboard edge of the inboard flap (2), and parallel to the side of the fuselage (2), and under the fuselage just forward of the wheel wells (2).

Engine Indicating and Crew Alerting System (EICAS) Indications

There are other indications, concerning the fuel system (and other aircraft systems) which have not been discussed here. These are colored (green, amber, red, cyan, white) digital messages located in the crew alerting system (CAS) section of the EICAS display. For continuity and convenience, all airplane system EICAS indications are grouped together and discussed under Engine Indicating and Crew Alerting (EICAS) in this section.

HYDRAULIC

The main hydraulic system is comprised of two independent systems; system A and system B. Hydraulic power is used to power the primary flight controls (rudder, elevators, ailerons, and roll spoilers), the landing gear, the leading edge slats, the speed brakes, the nose wheel steering and the main wheel brakes. A rudder standby sub-system is installed in the aft section of the right pylon to provide redundancy for the system B power control unit (PCU) of the lower rudder. The electric motor/pump unit provides 3000 PSI to the system B (lower rudder) PCU. It is fully automatic and is powered on when the accumulator pressure falls below 2300 PSI. During normal operation, even when the standby system is not required, the motor pump runs periodically to keep the standby accumulator charged so that the system will be ready if a failure occurs. The entire hydraulic system requires servicing with hydraulic fluid specified in Section I (Limitations).

Tubing which carries full system pressure is of titanium, except in wheel well areas where it is stainless steel. Return lines carry a pressure of 50 PSI, and therefore, except for those in the wheel well area, can be made of aluminum. All of the system one-quarter inch lines are pressure lines and are of titanium or stainless steel. There are no one-quarter inch aluminum lines in the system.

Both systems are powered by engine driven pumps; one mounted on each engine accessory gear box. The pump driven by the left engine supplies pressure to the A system and the pump driven by the right engine delivers pressure to the B system. System A is the primary system and powers the landing gear, nose wheel steering, main wheel brakes, the outboard speed brakes and the outboard roll spoilers. System B powers the inboard roll spoilers and the two inboard speed brakes. Both systems independently actuate the rudder, elevator and ailerons through redundant actuators. The slats are extended or retracted using either system, since the slat control valve is a single unit with dual valves to accommodate both system A and system B pressure.

System A may be powered redundantly by two methods. In the event of a left engine or hydraulic pump failure, pressure can be restored to system A through the power transfer unit (PTU). The PTU is fundamentally a hydraulic pump driven by system B pressure. With system B operating at 3000 PSI the PTU can generate 2600 ±400 PSI to system A. The second backup system is an electrically driven auxiliary pump that can provide 3000 PSI hydraulic pressure to all of system A. Due to low system capacity when the auxiliary pump is the only source of hydraulic power, the landing gear should not be lowered hydraulically or the thrust reversers deployed, since it would result in slow operation of other more critical systems.

The main system is equipped with pressure and return filters to ensure system cleanliness. They are located in the aft fairings and have a filtration capability of 5 microns nominal and 15 microns absolute. All filter elements are disposable and non-reusable and are equipped with indicators which pop up at 70 ±10 PSI differential. Once tripped they must be manually reset. The indicators have thermal lockouts which prevent inadvertent indication if the fluid temperature is below 85°F.

Depressurization of the nose wheel steering accumulator can be accomplished, if needed, without turning on airplane power, by pressing and holding (20 to 25 seconds) a bleed switch located in the left hand forward avionics bay, near the pressure bulkhead. In some cases activating this bleed switch will accomplish release of the airplane hydraulic system pressure, but it should not be depended upon to do so.

HYDRAULIC SYSTEM

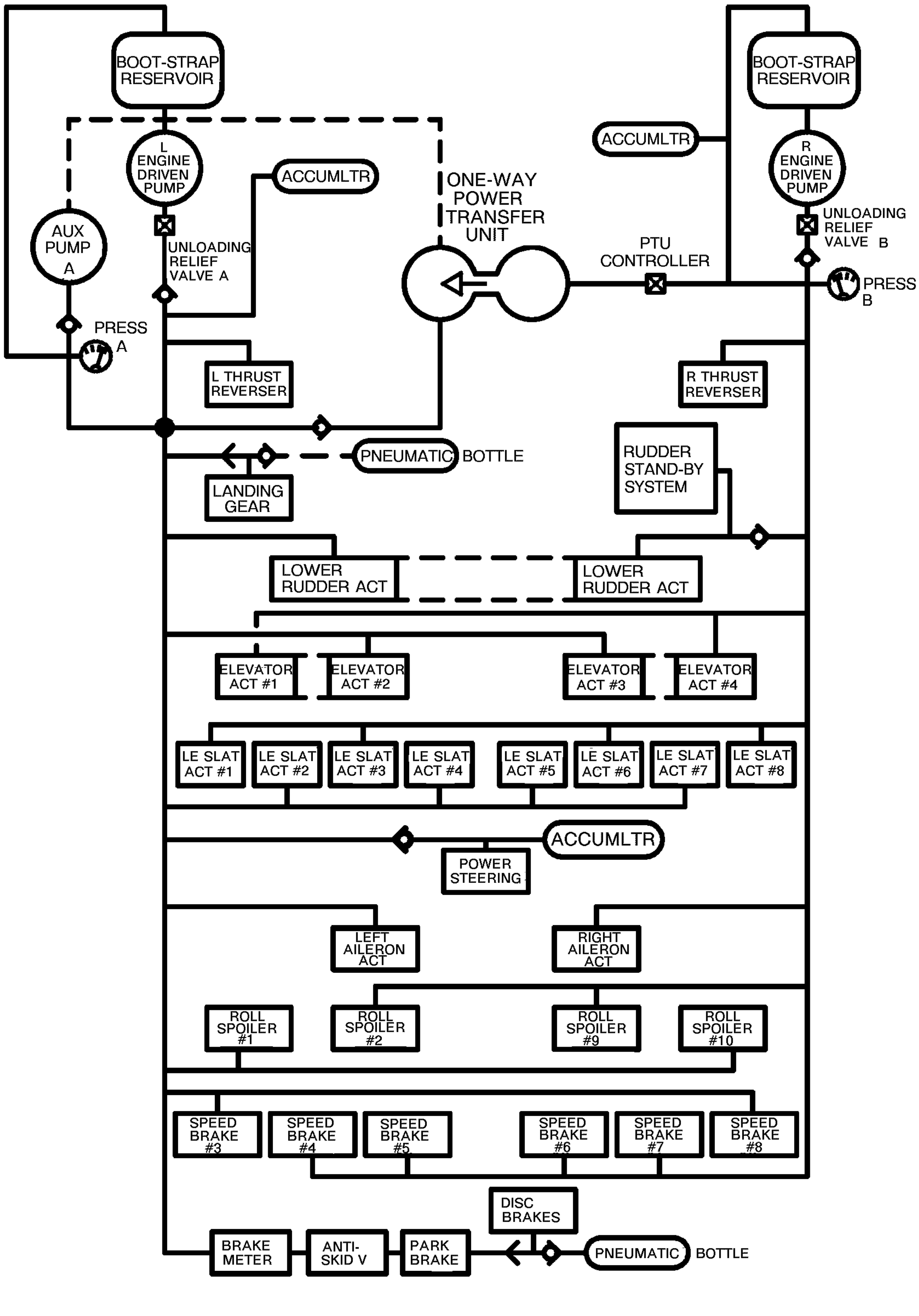


Figure 2-15

The nose gear torque links must be disconnected during towing operations or the system may be damaged. They are disconnected by removing a safety pin from the torque link shaft, by pushing a release button and pulling out the pin. The torque links are spring loaded to extend horizontally from the nose gear strut when the pin is removed.

RESERVOIRS

The fluid for the main system is contained in two cylindrical bootstrap reservoirs located in each engine pylon. Each reservoir has an internal volume of 400 cubic inches. A properly serviced system reservoir, at 3000 PSI, contains between 160 and 210 cubic inches of fluid. The reservoirs, located above panels in the bottom of the respective side engine pylons, are translucent and have indications of fluid level, which correspond to different stages of system and accumulator pressurization, marked on the bottom of the reservoir. When the bootstrap (smaller) cylinder is pressurized to 3000 PSI, the return side of the cylinder is pressurized to 50 PSI, since the ratio of the piston areas is 60 to one. The level of fluid and system pressure are transmitted by transducers and are shown in the cockpit on the engine instrument and crew alerting system (EICAS).

Servicing of the reservoirs can be checked through a door on the bottom of the engine pylons. The piston can be seen through the opaque sides of the reservoir, its position noted in relation to marked indices and compared to the servicing placard on the outside of the reservoir.

The hydraulic system reservoirs are serviced through a hydraulic service panel (pressure and return quick disconnects) located behind a door in each side of the aft fuselage, below the engine pylons. A hydraulic service cart, capable of providing fluid under pressure, is required for system servicing. Servicing is accomplished through a spring loaded manual fill valve controlled from the hydraulic system servicing panel. The valve must be held open, in order to discourage overfilling. A reservoir bleed handle, which is used to bleed air or excess fluid from the system, is also located at the service panel.

The airplane is serviced with the spoilers retracted, the thrust reversers retracted, and the system accumulators serviced to 1500 PSI. Should the system become overfilled the excess fluid will be vented overboard through the fluid overboard drain, located just below the hydraulic service panel.

If reservoir pressure exceeds 120 PSI, a reservoir over-pressure relief valve (120 PSI cracking pressure) will actuate and relieve pressure overboard.

A low limit volume switch in the reservoir will actuate when the fluid level drops below 16%. It will cause an amber (HYD VOLUME LOW A - B) engine indicating and crew alerting system (EICAS) digital message in the cockpit.

The auxiliary system has its own small reservoir of 25 cubic inches capacity. It is a spring loaded reservoir; the function of the spring is to provide slightly pressurized fluid to the rudder standby system motor pump.

SYSTEM INDICATIONS

To read the hydraulic system pressure and quantity (volume) the pilot may select FUEL HYD by pressing the bezel button so identified on the crew alerting system (CAS) display tube. NORM is the default selection which appears upon system initiation, and will display the pressures of the A and B systems (and rudder hydraulic system if the B system pressure is low) as well as the DC electrical system voltage and amperage readings. If NORM is displayed the hydraulic volume will not be shown.

The FUEL HYD selection will cause the EICAS system to show the A and B systems pressures as well as their hydraulic fluid quantities in terms of percent fully serviced. Pressure is shown in increments of 100 PSI. If the B system pressure is low (below 2200 PSI), it will display the rudder (RSS) system pressure. There will be no rudder system quantity indication. The temperature of the fluid in the A and B systems will also be shown in degrees Celsius. In this selection, the temperature of the fuel in the tanks and at the engine fuel control will also be added to the fuel display which is always present.

Normal hydraulic pressure (2600 to 3200 PSI) and quantity (16% to 100%) indications are in green. If the engines are not running, the hydraulic pressure indications will also always be in green. Pressures of less than 2600 PSI or more than 3200 PSI will be shown in amber; quantities of less than 16% will be also shown in amber. Hydraulic fluid temperatures of up to 82°C will be shown in green; 82°C or above will be shown in amber. If the engines are running and both system pressures are below 2600 PSI, the pressure indications will be in red.

There are other indications, concerning the hydraulic system (and other aircraft systems) which have not been discussed here. These are colored (green, amber, red, cyan, white) digital messages located in the crew alerting system (CAS) section of the EICAS display. For continuity and convenience, all airplane system EICAS indications are grouped together and discussed under Engine Indicating and Crew Alerting (EICAS) in this section.

PUMPS

Each engine drives a variable displacement (wobble plate) hydraulic pump providing continuous system pressure of approximately 3000 PSI. Each pump can deliver from 0 to 15.5 gallons per minute of fluid flow, depending upon system demand. The pumps are driven any time the engines are rotating; an engine speed of approximately 20% N_2 RPM will produce 3000 PSI system pressure, if system demand is not high.

The A system has for one backup system a power transfer unit driven by the B hydraulic system. This system-to-system hydraulically driven pump (no fluid is exchanged between systems) will come into operation if the A system pressure falls below the breakout point (the point at which the pump overcomes static friction). It will pressurize system A to 2600 ±400 PSI. The second A system backup is an electrically driven motor pump which can maintain 3000 PSI in the A system for emergency operation. During system operation when the auxiliary pump is the only source of hydraulic pressure, simultaneous operation of systems which could cause overloading and thereby slow operation of critical systems, should be avoided. For instance, the landing gear should not be lowered hydraulically or the thrust reversers deployed under these circumstances.

The B system lower rudder backup system also is powered by a small electric motor pump which will come on, when B system pressure drops below 2300 PSI. This pump powers the lower rudder in the B system to its regular 3000 PSI and charges the standby rudder system accumulator. It has a maximum flow capability of 0.2 gallons per minute.

FIREWALL SHUTOFF VALVES

Firewall shutoff valves, when closed, cut off hydraulic fluid (and fuel) to the engine nacelle area in the event of an engine/nacelle fire or loss of fluid through a ruptured or leaking line. The firewall shutoff valves are controlled, individually, by the corresponding left and right engine fire buttons. They operate by closing off the intake side of the pumps and are powered closed when the pilot presses the LH ENG FIRE or RH ENG FIRE button, which also arms the fire bottles. When the firewall shutoff valve closes, a white HYD FW SHUTOFF A - B annunciation will appear in the engine indicating and crew alerting system (EICAS).

THRUST REVERSER CONTROL VALVES

The thrust reverser control valves contain four internal solenoid valves. Two of the solenoids open pathways to the stow and deploy hydraulic lines. One valve routes pressure into the latch lines. the remaining valve blocks the inlet pressure port to avoid inadvertent deployment. Refer to Thrust Reversers in this section for thrust reverser operation.

HYDRAULIC ACCUMULATORS

The purpose of the hydraulic accumulators is to store hydraulic fluid under system pressure; to absorb system shock during a component cutoff, reducing the magnitude of spikes and transients, and to have instant system pressure available upon actuation of the component(s). There are four accumulators in the system; the left and right main systems, the nose wheel steering, and the the Rudder backup system. The main system accumulators are 25 cubic inch units located in the aft fairings. They are the free sliding piston type and are precharged with nitrogen. There are gages in the aft fairings by which the nitrogen charge may be verified prior to flight. The main system accumulators are charged through schrader valves located inside the door of the hydraulic service panels.

The rudder standby sub-system accumulator is a 12 cubic inch free sliding piston type which is serviced with nitrogen to a pressure corresponding to the stated temperature/pressure table affixed near the service valve. The service pressure is shown on a gage in the bottom of the right engine pylon, which can be checked prior to flight.

The nose wheel steering accumulator is a 50 cubic inch free sliding piston type, which is precharged to 1500 PSIG with nitrogen. The pressure gage is located near the service valve which is mounted in a line leading to the accumulator, near the nose compartment bulkhead in the left forward avionics bay. A temperature/pressure service table is located near the pressure gage.

UNLOADING RELIEF VALVES

Both systems A and B have an unloading relief valve which protects the system from excessive pressures. The valves are manually controlled by a two-position cockpit switch (UNLOAD A/NORM and UNLOAD B/NORM). The switches, normally left in the NORM position, are used to manually depressurize the systems, if desired, or they will automatically depressurize the system(s) if pressure should reach approximately 3750 PSI, as discussed below.

If the system should fail to regulate at 3000 PSI, due to failure of the normal system pressure regulating valve, a backup regulator will attempt to maintain a system pressure of 3400 (±100) PSI; this is the cracking pressure of the backup relief valve. If system pressure does continue to climb and reaches 3750 PSI it will maintain that pressure, which represents the maximum possible flow rate. At this pressure heat buildup will be rapid, resulting in an overtemperature message, upon the appearance of which the pilot should depressurize the affected system. The fluid will then circulate in the system at a susbstantially lower pressure and will cool. Temperature sensing is provided to trigger an amber CAS message (HYD O'TEMP A-B) if system hydraulic fluid temperature reaches 200°F (93°C), and a red CAS message (HYD O'TEMP A-B) if system fluid temperature reaches 265 °F (130°C). If the amber overtemperature message appears, the pilot should carefully monitor system temperature. If the red CAS message appears, the hydraulic system should be depressurized, if conditions allow, in order to let the fluid cool.

The situations, discussed in the following sentences, are possible in which it is beneficial that the system(s) be unloaded. If a pump runaway should occur, caused by the swash plate going to full deflection, the pump will immediately try to deliver full capacity which cannot be accommodated in the system at normal pressure. An overpressure will ensue, and the excessive pressure will cause an overtemp condition. Upon this occurrence the system should be depressurized to allow the system to cool. Also, in case of a jammed flight control power control unit (PCU), the control surface would be jammed. Relieving the pressure by manually dumping the system pressure will free the flight control surface.

The manual relief valve (which is the only “automatic” feature of the unloading valve) will crack open at 3400 PSI (minimum) and regulate pressure, if the 3000 PSI pressure regulating system fails. This relief valve is also designed for full flow (15.5 GPM) relief at a maximum of 3750 PSI. When the manual relief valve is regulating pressure, temperature will rise rapidly and continue to rise until the pilot opens the unloading valve using the cockpit switch.

AUXILIARY SYSTEM

The auxiliary pump is located outside the boundaries of a potential damage zone in case of catastrophic engine failure. The auxiliary pump is controlled by a two-position switch on the hydraulic control panel. The pump is a variable displacement type with a maximum capacity of one gallon per minute of flow. The entire hydraulic system is serviced by the auxiliary pump, however discretion must be used if the auxiliary pump is supplying pressure for the system, due to its limited capacity. For example, the landing gear should not be lowered hydraulically when the hydraulic system is powered by the auxiliary pump, due to the fact that the other systems will operate slowly, since operating the landing gear absorbs considerable hydraulic power. The same is true of the thrust reversers. The auxiliary pump is primarily for emergency use and is also used to set the parking brakes. The control switch positions are A AUX PUMP and OFF.

In OFF position, power is removed from the motor and it will not operate; the pump does not have an automatic starting function.

When the auxiliary pump is running the EICAS system displays a white HYD AUX PUMP ON message. This message is intended as a reminder to the crew that the auxiliary hydraulic pump is in operation. The message is caused by the application of electrical power to the auxiliary pump motor.

POWER TRANSFER UNIT (PTU)

As described under the general Hydraulic System heading above, the power transfer unit (PTU) transfers hydraulic power from the B system to the A system without any exchange of fluid. The system is essentially a hydraulic motor in the B system powering a hydraulic pump in the A system. The pump is protected by a 1-amp circuit breaker (HYD B/PTU CONT) on the left circuit breaker panel. The PTU system will automatically go into operation when the A system pressure falls below a predetermined point. If it is desired that PTU system operation be prevented or stopped, the only way to accomplish it is to pull the HYD B/PTU CONT circuit breaker.

The B system has an integral flow limiter which is a part of the PTU shutoff valve and which prevents excessive power absorption from the B system if the A system has a situation in which pressure is unrecoverable, such as a line failure. The outlet of the PTU pump is equipped with a fluid filter.

HYDRAULIC SYSTEM CONTROL PANEL

The hydraulic system control panel (HYDRAULIC PUMPS) is located to the right of the landing gear control handle on the lower section of the copilot's instrument panel. It has mounted on it the unloading switches (UNLOAD A/NORM and UNLOAD B/NORM) which are used to unload (depressurize) the main systems, and the auxiliary pump control switch (A AUX PUMP/OFF) which controls operation of the A system electric auxiliary pump . All of the systems and control switches are discussed above.

In the closed (UNLOAD) position of the loading valves, fluid will flow from the pumps to the distribution lines. If the unloading valves are opened, pressurized fluid continues to flow from the pumps to the distribution lines. However, restrictions in the system will cause the fluid to flow through the unloading pressure relief valves and back to the inlet side of the pumps at a pressure of less than 100 pounds.

LANDING GEAR AND BRAKES

The landing gear is controlled from the landing gear control panel located on the tilted panel, which forms the lower part of the copilot's instrument panel. The landing gear is normally electrically controlled and hydraulically actuated by the airplane A system. A pneumatic alternate system is incorporated to extend the gear in the event of a hydraulic or electrical failure which might otherwise disable the landing gear. Each landing gear uses a dual wheel assembly. The nose gear has chined tires for water and slush deflection. The main landing gear is of the articulated trailing link type. The two-piece main landing gear doors are mechanically connected to the main gear trunnion and extend and retract with the individual gear assemblies. The nose gear utilizes three doors. The rear door is mechanically connected to the nose gear actuator and extends aft, or retracts forward with the nose gear assembly. The two forward side doors are operated mechanically by extension and retraction of the nose gear by rollers mounted on the landing gear trunnion, which operate the left and right bellcrank assemblies. The doors remain open when the gear is down and are closed when the gear is retracted.

The nose and main gear actuators each incorporate an internal lock to hold the gear in the extended position. Once the gear is locked in the down position, no hydraulic pressure is required to maintain the lock. Hydraulic pressure is required to unlock the down locks. The gear is held retracted by mechanical uplocks that are normally released hydraulically, but in case of hydraulic or other malfunction, can be unlocked mechanically through pull cables. The gear is locked up mechanically, after which the pressure is neutralized. The landing gear completes a retraction or extension cycle in less than six seconds. The gear can be operated at airspeeds up to 210 KIAS (V_{LO} /V_{LE}).

CONTROL

The landing gear control panel contains the landing gear handle, three green gear safe indicators and a red unlocked indicator. The landing gear handle has two positions: full down and full up; it must be pulled out to clear a detent before it can be repositioned. Operation of the gear and doors will not begin until the handle has been positioned in one of the two detents. A gear handle locking solenoid activated by either main gear squat switch and the nose gear squat switch, physically prevents inadvertent movement of the gear handle while on the ground. When the gear is retracted hydraulic pressure not only retracts the landing gear, but is also used to center the nose wheels prior to nose gear retraction, actuate the brake metering valve to provide anti-spin brake pressure, and to pressurize the retract side of the uplock actuators in order to ensure the uplock hooks are in the proper position to receive the gear.

NOTE

> The nose gear torque links must be disconnected during towing operations or the system may be damaged. The torque link disconnect pin is removed by removing a safety pin from the shaft by pushing a release button and pulling out the pin. The torque links are spring loaded to extend horizontally from the nose gear strut when the pin is removed.

LANDING GEAR EXTENSION AND RETRACTION FLOW

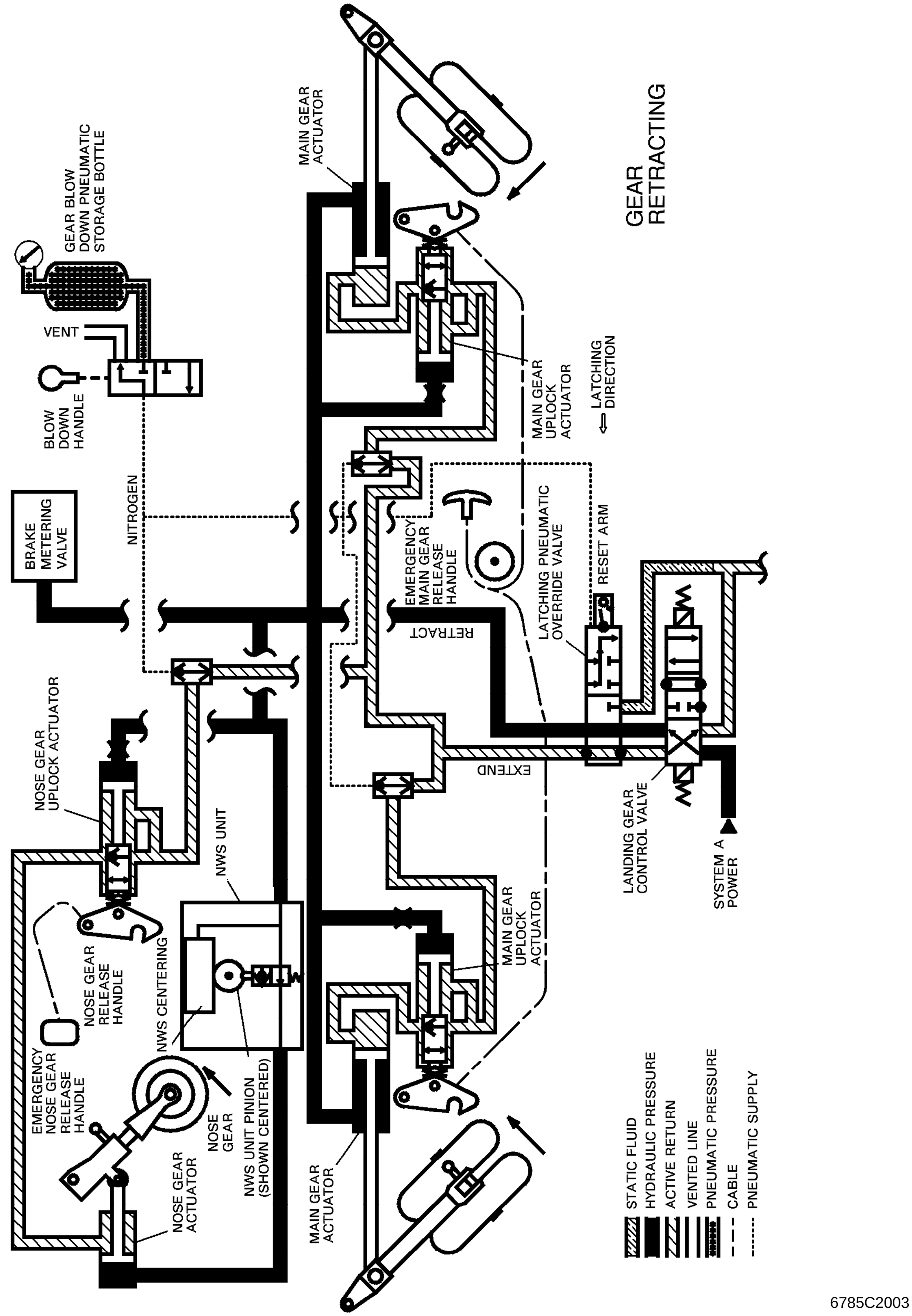


Figure 2-16 (Sheet 1 of 6)

LANDING GEAR EXTENSION AND RETRACTION FLOW

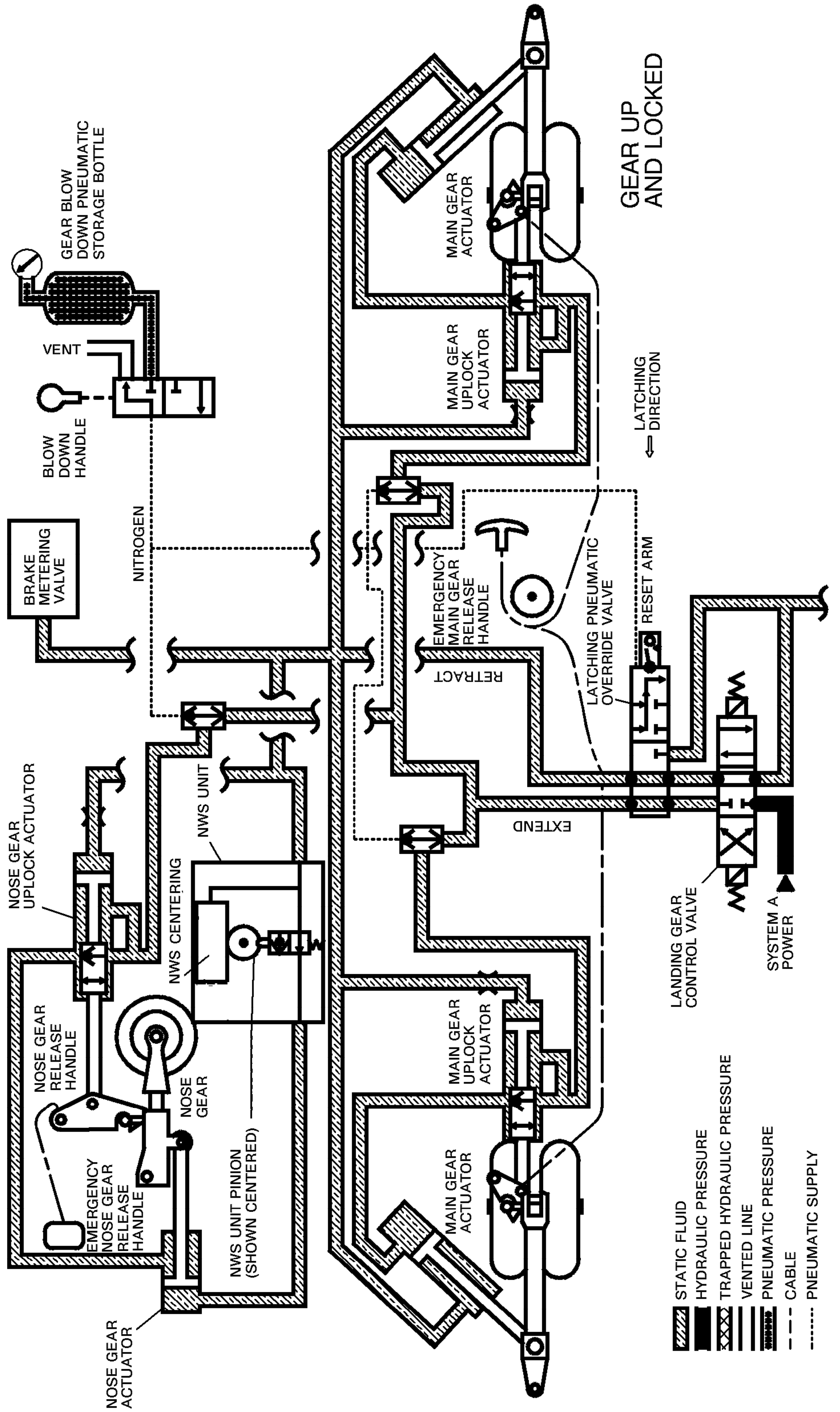


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Figure 2-16 (Sheet 2 of 6)

LANDING GEAR EXTENSION AND RETRACTION FLOW

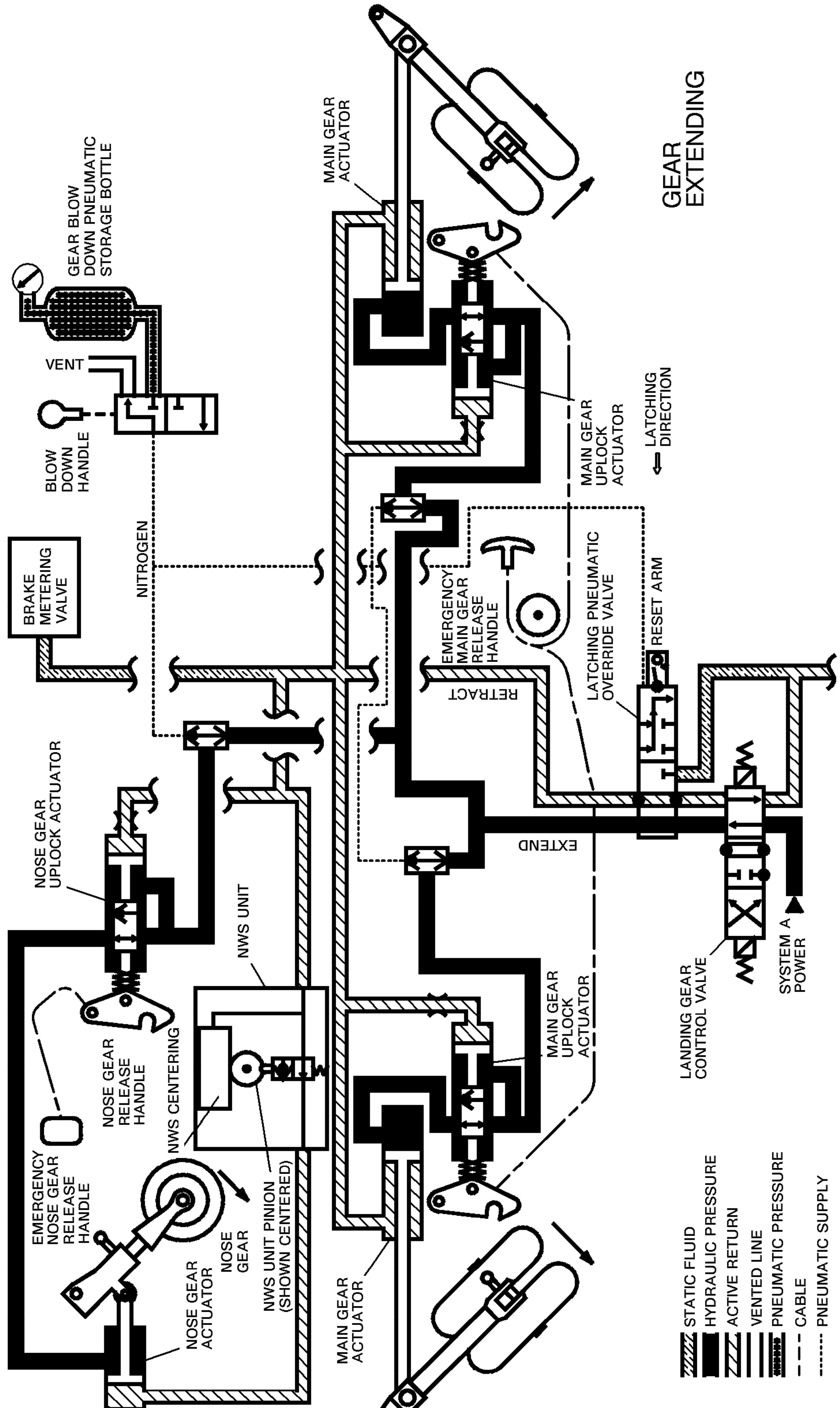

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Figure 2-16 (Sheet 3 of 6)

LANDING GEAR EXTENSION AND RETRACTION FLOW

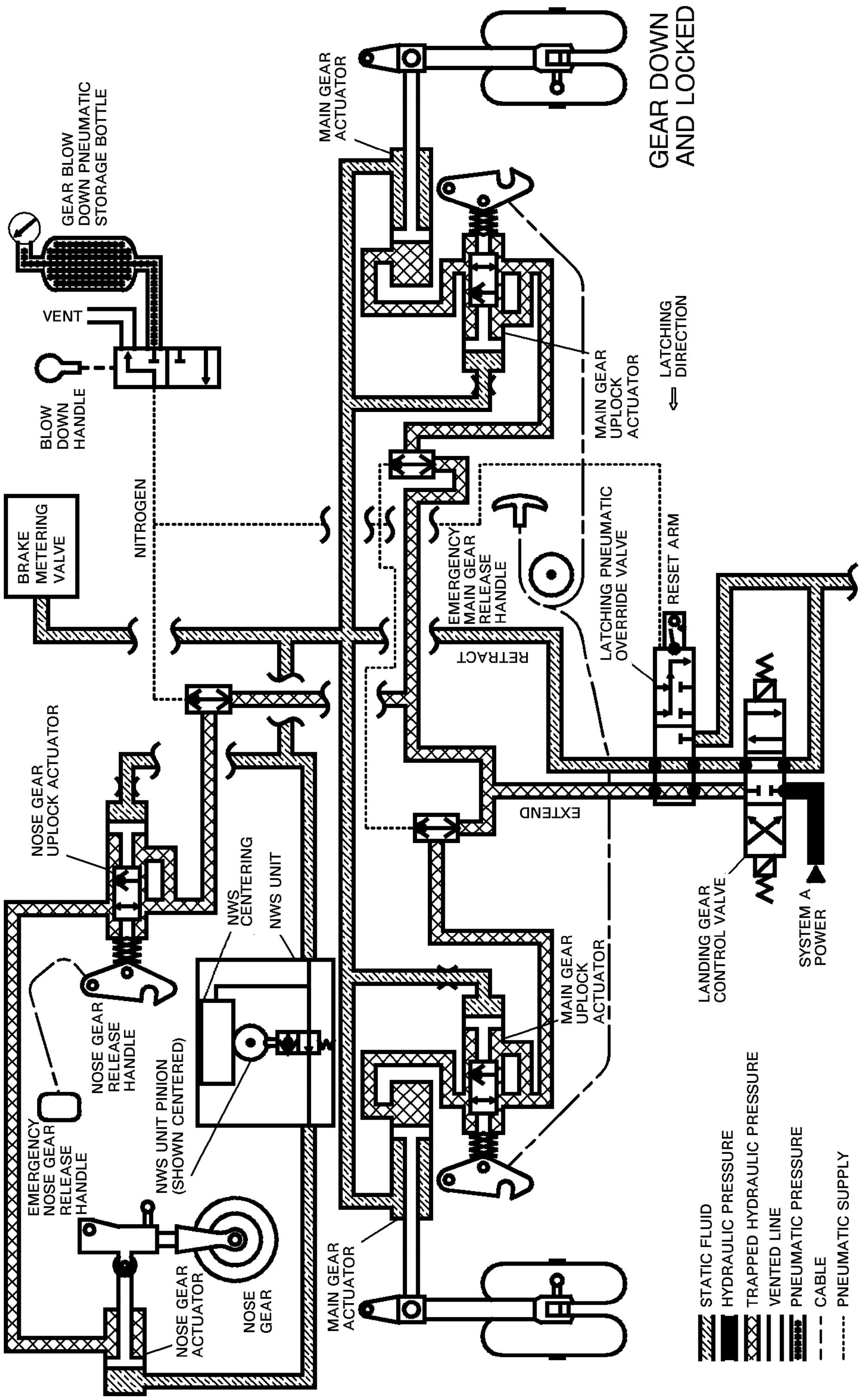

Figure 2-16 (Sheet 4 of 6)

LANDING GEAR EXTENSION AND RETRACTION FLOW

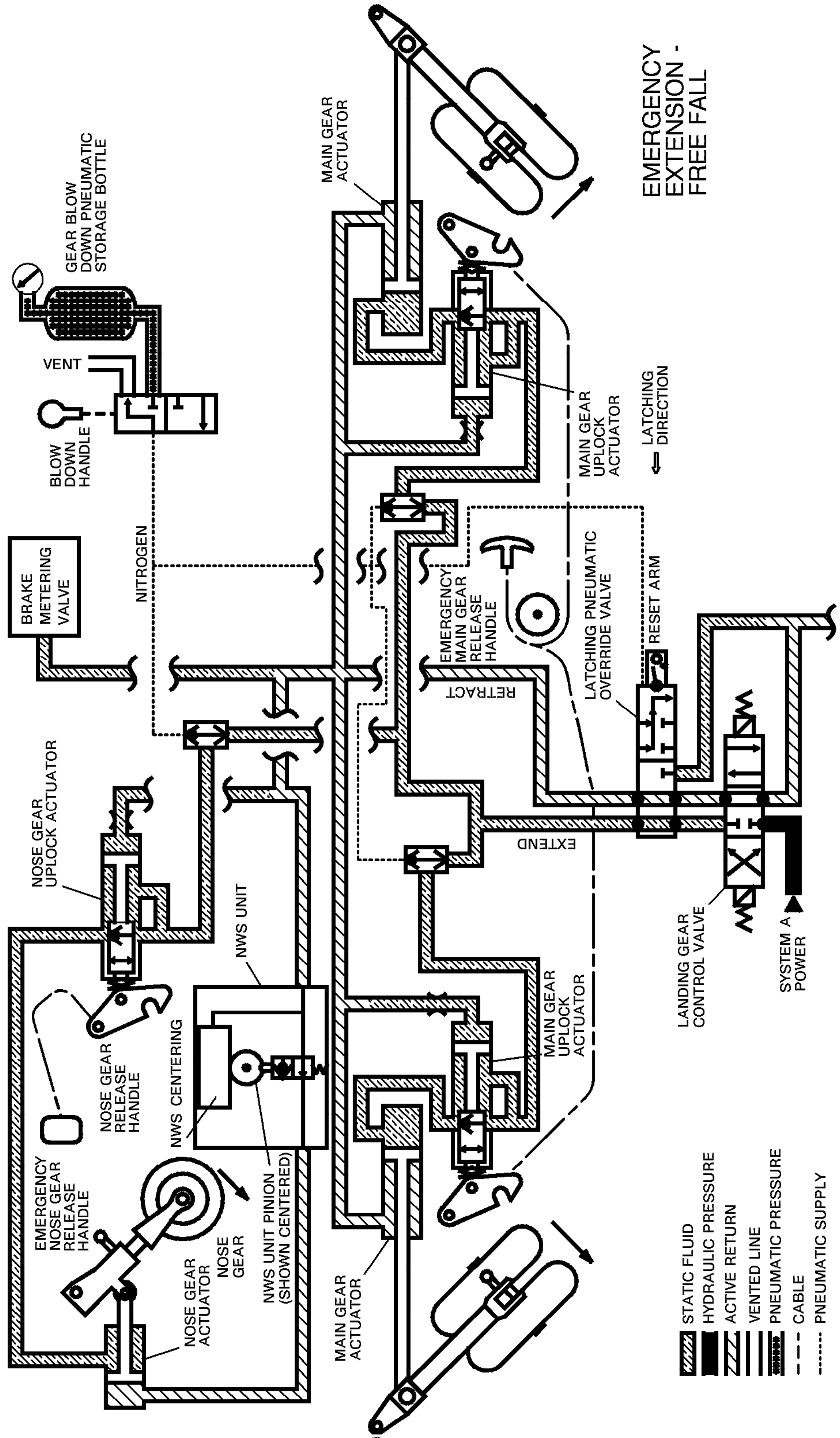

Figure 2-16 (Sheet 5 of 6)

LANDING GEAR EXTENSION AND RETRACTION FLOW

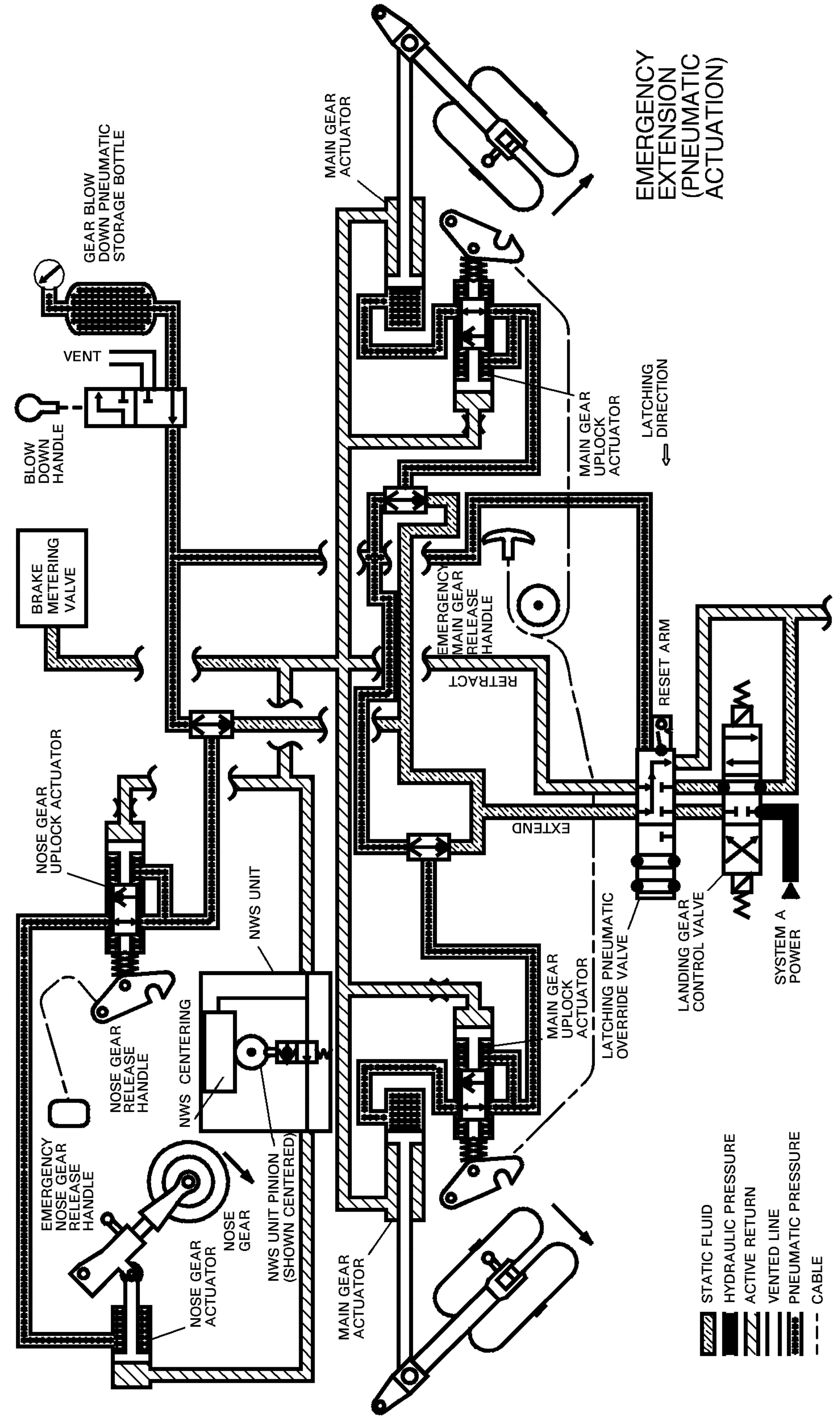

Figure 2-16 (Sheet 6 of 6)

EXTENSION AND RETRACTION

In a landing gear retraction cycle, the following takes place:

1. With the weight off the landing gear, the main gear and nose gear squat switches close. Power is applied to the lockout solenoid allowing the landing gear handle to be placed in the UP position.
2. Actuation of the UP microswitch by the gear handle simultaneously:
   a. Lights the gear UNLOCK warning light.
   b. Positions the landing gear control valve to route hydraulic fluid to the retract side of the the nose gear and main landing gear actuators. Landing gear retract pressure is routed through the power steering unit and is prevented from reaching the nose landing gear actuator until the nose wheels are in the centered position.
   c. Momentarily applies the main wheel brakes.
3. Upon retraction the landing gear are latched and mechanically held in place by the uplock hooks. Hydraulic unlatching occurs at the beginning of the extension cycle.
4. Actuation of the three gear up microswitches:
   a. Removes power from the landing gear control valve, which removes hydraulic pressure from actuators and main gear uplock hooks.
   b. Extinguishes gear UNLOCK indicator light.

The reversed sequence during a gear extension is identical with the following exceptions:

1. Solenoid lock on landing gear handle is not in use.
2. Fluid is routed by the control valve through the uplocks to release them, and then to the extend side of the actuating cylinders.
3. GEAR DOWN microswitches extinguish gear UNLOCK light and illuminate the green LH, RH and NO gear indicating lights.

POSITION AND WARNING SYSTEM

The landing gear position and warning system provides visual and audible indication of landing gear position. Three green safe lights and a red gear UNLOCK light are located in a group adjacent to the gear control handle. Each green light corresponds to one gear, NO (nose), LH or RH and indicates that it is in the down-and-locked position. The red light indicates an unsafe gear position (in transit or not locked). The landing gear warning system sounds an audible warning if the gear are not down and locked and the throttles are retarded past a certain point. The warning horn can only be silenced by advancing power, which will reset the horn, or by clearing the condition which has caused the warning.

The warning horn will sound when any of the following conditions exist:

1. The flaps are >24° and the landing gear are not down and locked.
2. Radar altitude is valid and radio altimeter is below 500 feet, the TLA (throttle lever angle) of both throttles is less than 30 degrees, and the gear are not down and locked.
3. The radar altitude is not valid, the flaps are <24°, both throttles TLA IS <30°, both angle-of-attack probes are sensing >0.4, and the gear are not down and locked.
4. If the rotary test switch is placed in the LDG GR position, (electrical power available) all green and red gear lights will light. If the flaps are <24° the horn will sound. Also if both throttles =TLA <30°, radar altitude is valid, and the radio altimeter <500 feet, the horn will sound.

LANDING GEAR POSITION WARNING

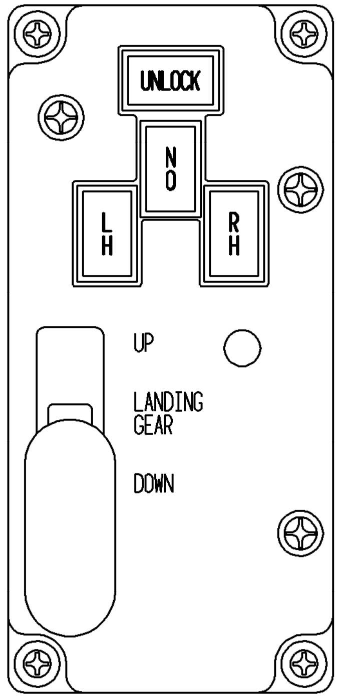

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Figure 2-17

EMERGENCY EXTENSION

In the event of normal system malfunction, an emergency (nitrogen bottle) backup system is provided to unlock the gear, blow it down, and lock it into place. Two manually operated systems (nose and main gear) are provided to release the landing gear for free-fall if the blowdown system did not unlock the uplock hooks.

The landing gear is extended with the blowdown system by first placing the gear handle down. The auxiliary gear control knob under the left side of the copilot's panel is then pulled to blow the gear down.

NOTE

> If the gear handle is locked up, the blowdown will bypass the hydraulic system. After the gear blowdown has actuated, the gear cannot be retracted.

If the blowdown system does not unlock and extend the gear, the manual unlocking cables may be used to pull the uplock hooks. Manually releasing the landing gear from the up locks requires two separate actions. For the nose gear, the manual release is actuated by pulling the O-ring located under the left side of copilot's instrument panel. The main gear are released by pulling a T-handle which is located in the left aft cabin and is accessed through the left hand sink cabinet in the passenger compartment. These actions mechanically disengage the main landing gear uplocks, allowing the gear to free-fall. After all three of the gear are released, yawing the airplane may be required to achieve green light indications for the main gear. This will cause the gear strut doors to pull the gear to the LOCK position. After all gear indicate safe the auxiliary gear knob is pushed in to stow it. It is not mechanically required that the landing gear handle be down to operate the manual system; however, it is recommended that the handle be placed down to properly position the landing gear control valve and to cause correct gear indications.

Once the pneumatic system is used, the pneumatic override valve will be locked into override position and must be reset (by maintenance personnel) by pulling it back to the normal position.

CAUTION

THE LANDING GEAR MUST NOT BE RETRACTED AFTER THE PNEUMATIC BLOWDOWN SYSTEM HAS BEEN USED UNTIL A MAINTENANCE INSPECTION IS PERFORMED.

WHEEL BRAKES

Toe-actuated multiple-disc self adjusting carbon disc brakes are installed on the main gear wheels. Braking can be accomplished by either of two independent systems: the power brake hydraulic system or the back-up pneumatic system. Normal braking can be applied from either cockpit seat. The emergency brake control is installed below the left instrument panel only.

ANTISKID/POWER BRAKE

The power brake metering valve accepts 3000 PSI hydraulic pressure from the airplane A system and uses it to regulate the brake pressure by metering the pressure, which it provides to the antiskid control valve, proportional to pilot/copilot pedal deflection. The brake metering valve can also receive system hydraulic pressure from the auxiliary hydraulic pump when required.

The antiskid system provides power assisted braking with skid protection. It is designed to provide maximum braking efficiency on all runway surfaces. It prevents skidding by limiting application of brake pressure to a specific wheel whenever a skidding of that wheel is detected. The system consists of four wheel speed transducers, two antiskid valves, a control box and an indicating system. The transducers, in the axles of each main landing wheel, generate current proportional to rotational speed of the wheel. These currents are monitored by a control box, and when a skid condition is detected (excessive deceleration of wheel rotation), the control box generates a signal to the appropriate antiskid control valve to modulate pressure to the skidding wheel(s). Below a taxi speed of approximately 12 (10 ± 2) knots, the antiskid system performance will be slightly degraded but it will still function.

To ensure proper braking on water, snow, and ice-covered hard-surface runways and all unimproved surfaces, it is necessary for the pilot to apply maximum effort to the brake pedals throughout the braking run. When the system anticipates a skid and releases the applied brake pressure, any attempt by the pilot to modulate braking can result in an interruption of the applied brake signal and may increase stopping distance significantly.

A switch on the instrument panel (HYDRAULIC PUMPS control panel) allows the pilot to select ANTISKID OFF or NORM. When the switch is in the NORM position, the antiskid function is operational. With the control switch in the OFF position, the pilot has power braking available without the antiskid function.

If the hydraulic system should fail due to failure of the pumps in both the A and B systems, the auxiliary pump may be used to operate the power brake system. Antiskid braking is still available when the auxiliary hydraulic pump is used.

Locked brake touchdown protection is provided by the antiskid control box. It prevents pilot input of hydraulic pressure to the brakes until the squat switches signal that a landing has occurred. Prior to touchdown and wheel spinup it commands the antiskid valves to block all pressure from the brake metering valve and to release any pressure within the brake assembly into the system return line. This touchdown protection mode remains in effect for five seconds after main landing gear strut compression, to allow adequate time for wheel spinup when landing on wet or icy runways. However, touchdown protection mode is overridden when the wheel rotation reaches a speed equivalent to above thirty knots, at which time the touchdown protection mode will no longer be in operation and wheel braking will become effective.

During the antiskid system self-test CAS messages are inhibited.

PARKING BRAKE

The parking brake is a part of the normal brake system and employs controllable check valves that can prevent the return of fluid after the brakes have been set. Parking brakes are set by depressing the toe brakes and pulling out the parking brake handle located at the aft end of the center pedestal, or by pulling the handle and then applying the brake pressure. The brakes are released by pushing the handle in. If engines are not running, the auxiliary hydraulic pump must be turned on in order to set the parking brakes. Subsequent application of brake pedal pressure will restore or increase pressure at the brake assemblies by actuating check valves within the parking brake valve. The parking brake should not be set if the brakes are very hot. This increases brake cool-down time due to decreased airflow, and may result in sufficient heat transfer from the brakes to cause the parking brake thermal relief valves to open or to melt the thermal relief plugs in the wheel, causing deflation of the tire. A situation of this sort is most likely after a rejected takeoff or a maximum effort stop on landing.

If pressure should increase in the parking brake system, due to an increase of temperature after the brakes are applied, thermal relief valves in the parking brake valve will relieve the excessive pressure.

When the parking brakes are set and there is electrical power to the engine indicating and crew alerting system (EICAS), a cyan EICAS message PARK BRAKE ON will be displayed. The message is activated by a pressure switch (1200 - 1500 PSI) in the right brake line; it operates in conjunction with a position switch on the parking brake valve input lever to provide input logic to the EICAS system. If the parking brake handle is pulled up in flight, an amber PARK BRAKE ON EICAS message will appear. In this case a chime will also sound.

ANTISKID BRAKE DIAGRAM

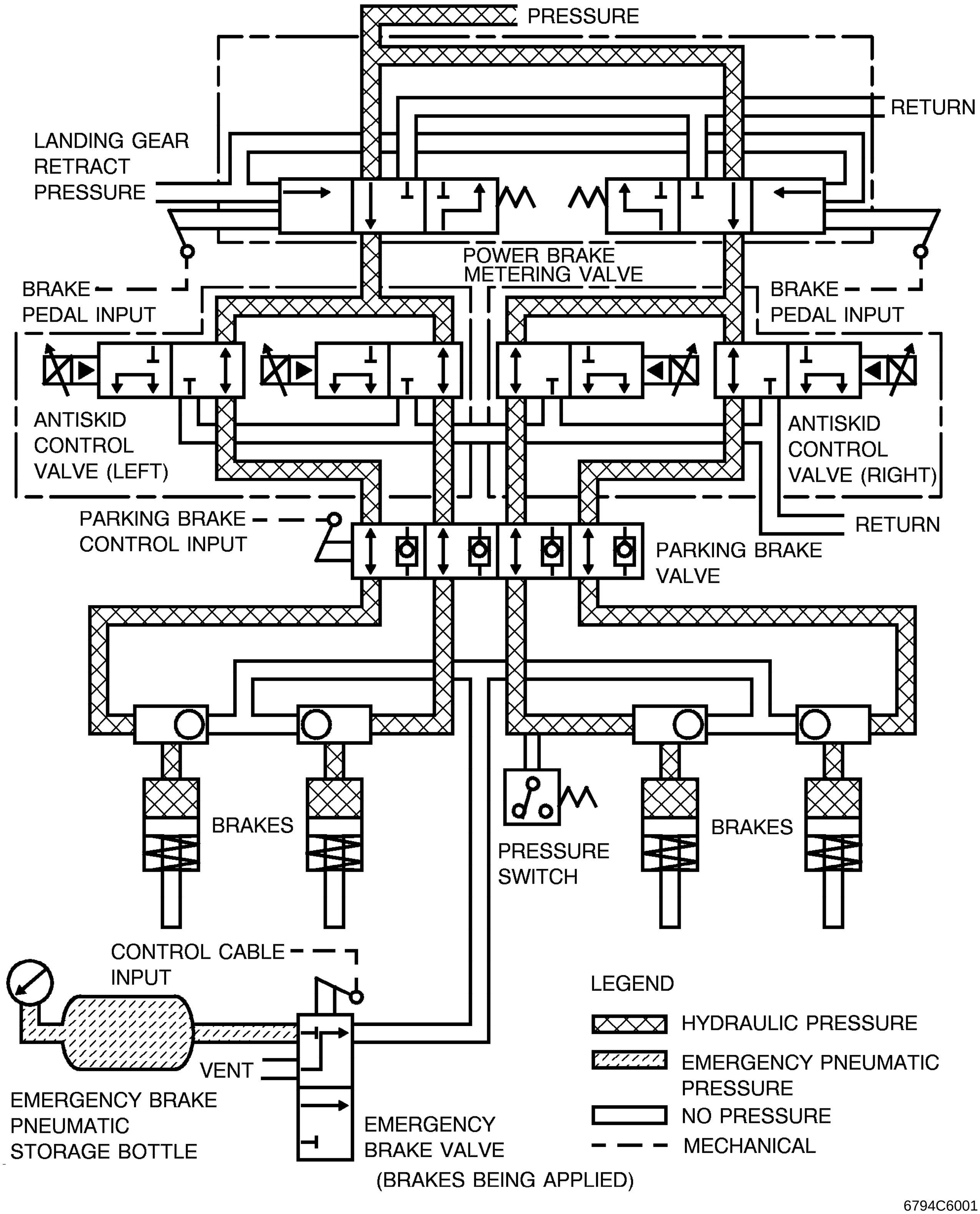

Figure 2-18 (Sheet 1 of 4)

ANTISKID BRAKE DIAGRAM

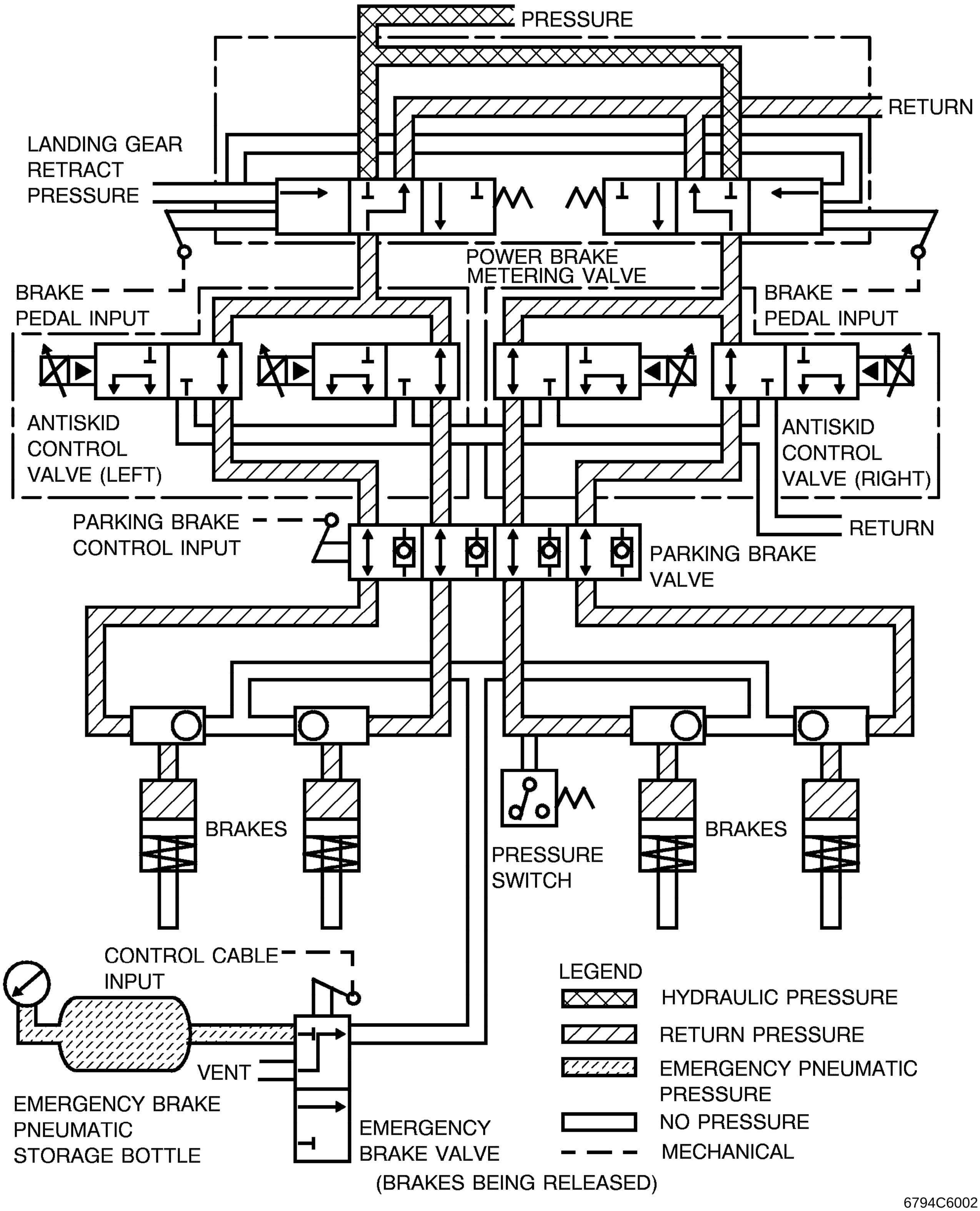

Figure 2-18 (Sheet 2 of 4)

ANTISKID BRAKE DIAGRAM

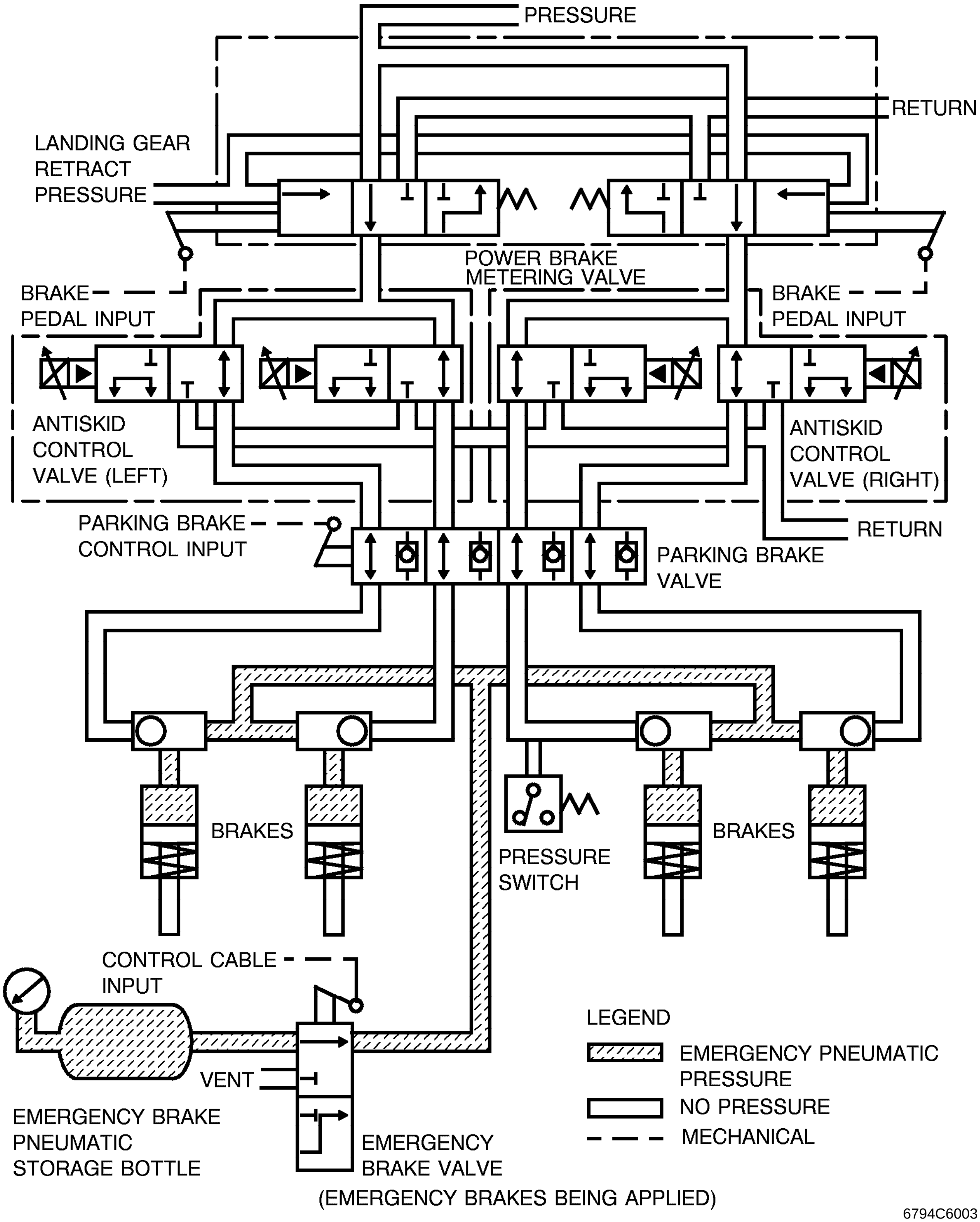

Figure 2-18 (Sheet 3 of 4)

ANTISKID BRAKE DIAGRAM

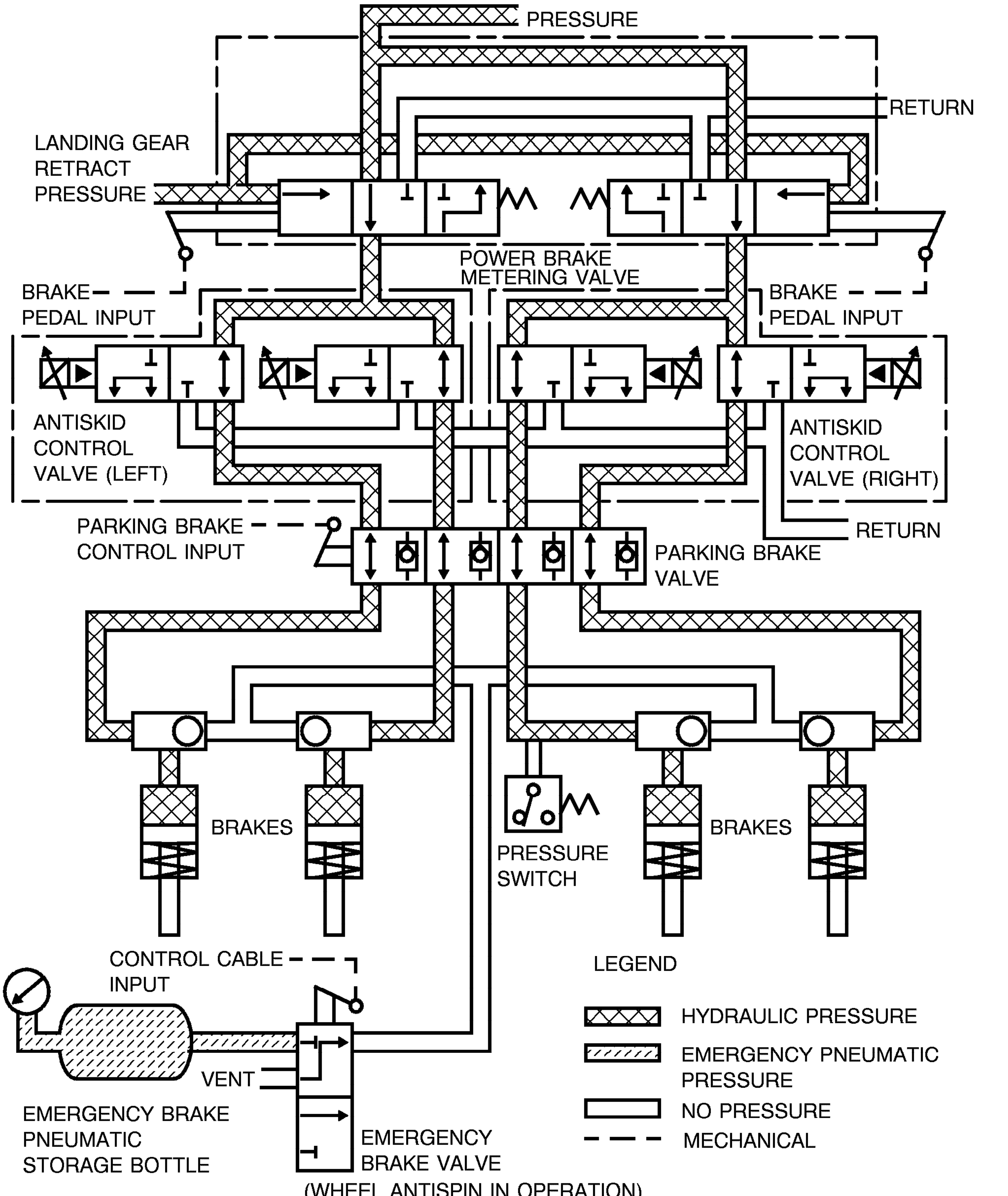

Figure 2-18 (Sheet 4 of 4)

If the parking brakes are set and the hydraulic pressure to the parking brake is less than 2350 PSI, when the lever is pulled an amber EICAS message PARK BRAKE/LOW PRESS will be presented. A chime tone will sound. The same two switches which illuminate the PARK BRAKE ON message also cause the low pressure annunciation.

EMERGENCY BRAKING

In the event of normal hydraulic braking system failure, a pneumatic brake system is installed. The pneumatic pressure required is contained in two emergency nitrogen bottles and is controlled by a lever with a red knob, located below the pilot's instrument panel. Pulling the lever aft will apply equal pressure to all four main landing gear brake assemblies. Releasing the back pressure on the lever and allowing it to move forward will relieve the pressure. The pressure to the brakes may be modulated to provide any braking rate desired, but differential braking and antiskid will not be available. The emergency nitrogen bottles, when fully charged, contains sufficient pressure for six full brake applications. For the most efficient use of the system, apply sufficient pressure to the brakes to obtain the desired deceleration rate. Maintain that pressure until airplane is stopped. When the handle is released, residual nitrogen pressure from the brakes is exhausted overboard.

NOTE

Pneumatic brake pressure is proportional to the lever position. Use caution in initial application of the emergency braking until a "feel" for the deceleration rate is obtained. Too sudden application can result in blown tires.

A fully serviced emergency brake bottle will initially provide approximately 95 cubic inches of nitrogen in each bottle at a maximum of 1800 to 2050 PSIG. The amount of brake application by the emergency brake handle is mechanically restricted in order to limit the amount of pressure metered to the brakes. Under normal braking conditions, full handle travel will result in braking that is short of that which would cause tire skidding, however caution should still be used so as not to over brake, since the antiskid will not function with emergency braking. When surface conditions are other than dry and normal, braking application should be adjusted accordingly.

PNEUMATIC

Two nitrogen bottles are located on the left side of the forward pressure bulkhead and one in the forward left side of the nose compartment. One nitrogen bottle provides for emergency extension of the landing gear and the two other bottles (which are connected by pneumatic tubes), are for emergency braking. Each nitrogen bottle is properly serviced at 1800 to 2050 PSI and can be checked on preflight by gages located in the left nose compartment. A temperature/pressure service table is provided for reference. A relief valve on any of the bottles will rupture at 4000 PSI if the bottle becomes overpressurized.

The nitrogen bottles have outlets to the vent lines, the gear emergency extension line and the brake pneumatic pressure line. In its normal position, the emergency brake handle connects the brake pneumatic lines to the vent lines.

When the auxiliary gear control knob under the copilot's instrument panel is pulled, a valve is positioned to direct nitrogen from the bottle through the emergency extension lines to the release side of the gear down lock and then, after the gear is unlocked, to the extend side of the landing gear actuators. When the blowdown knob is pulled the valve is opened and locked in the open position by a detent pin on the operating lever. Pressure will remain on the landing gear actuators until the valve on the nitrogen bottle is reset on the ground. At the end of the gear lowering procedure the knob is reset, however, so that it will not interfere with the copilot's knee.

Emergency braking is controlled through a manually operated, three-way pressure regulating valve. Nitrogen from the nitrogen bottle is connected directly to the inlet port of the valve by the brake pneumatic pressure line. The outlet port is connected to the brakes and is normally vented to an exhaust line. When the emergency brake handle is pulled, the vent is closed, the inlet port opens, and high pressure nitrogen is applied to shuttle valves in each brake line; the shuttle valves are displaced, opening the brake lines to the nitrogen, blocking off hydraulic fluid to the brakes, and the brakes are applied. Releasing the emergency brake handle opens the vent, relieving pressure. This allows modulation of the system to obtain the desired braking force. Each time the handle is cycled, some nitrogen pressure is vented overboard, reducing the emergency bottle supply.

EMERGENCY AIR BOTTLE CONTROL VALVE

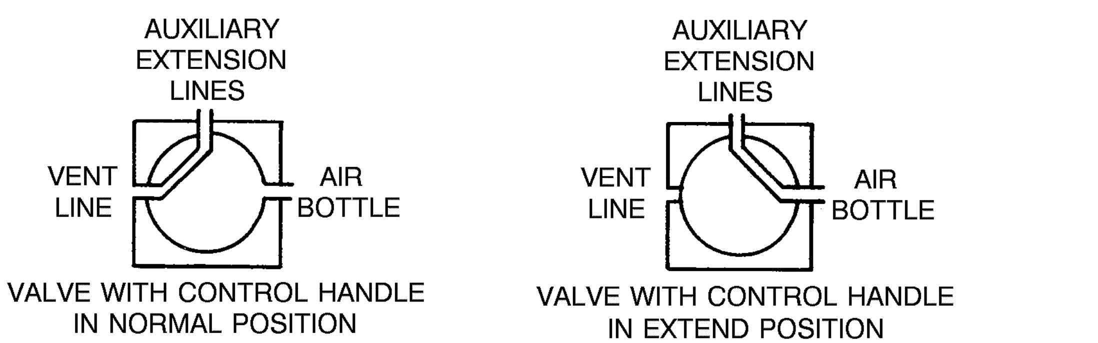

Figure 2-19

PNEUMATIC SYSTEM SCHEMATICS

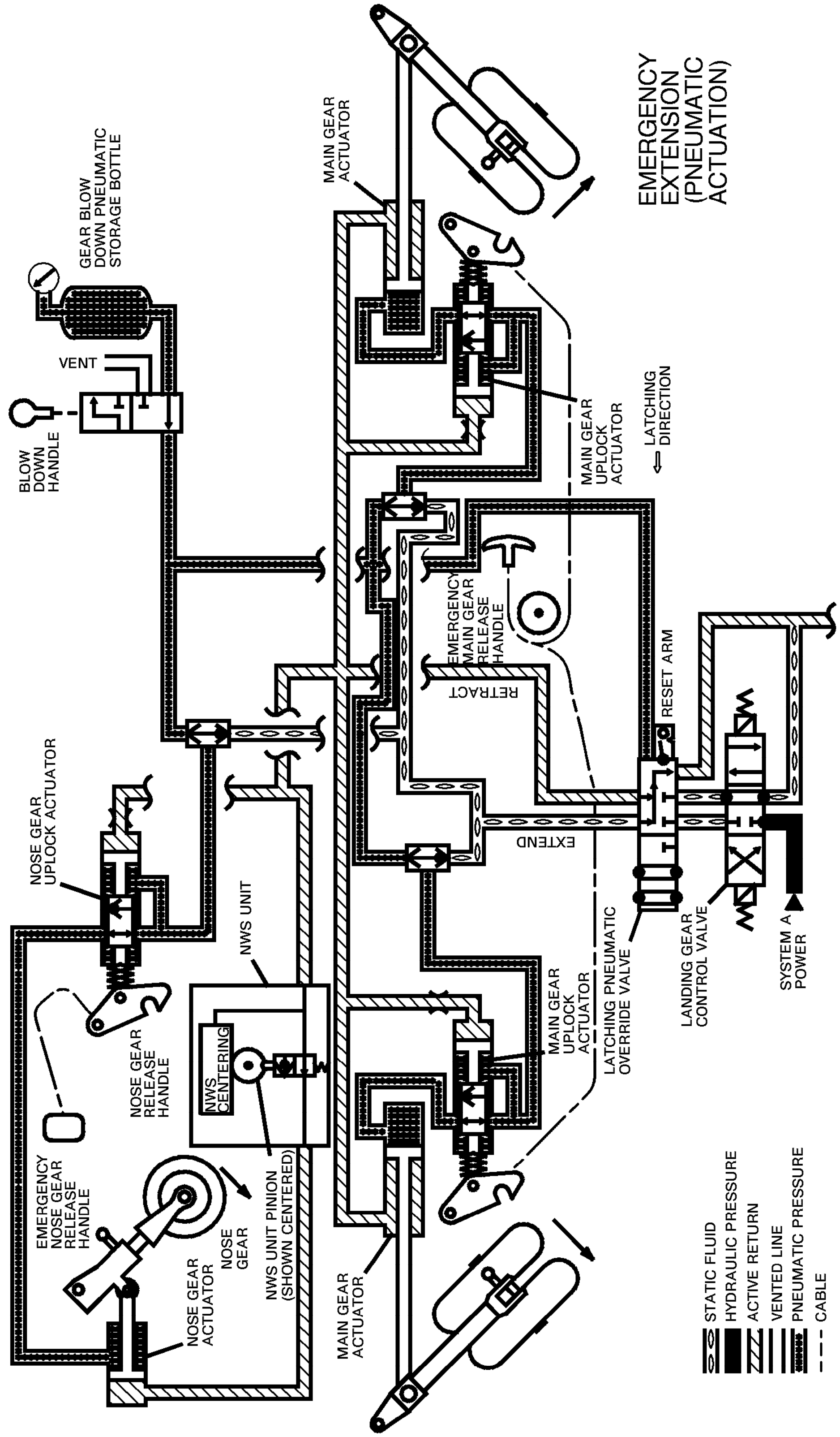

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Figure 2-20 (Sheet 1 of 2)

PNEUMATIC SYSTEM SCHEMATICS

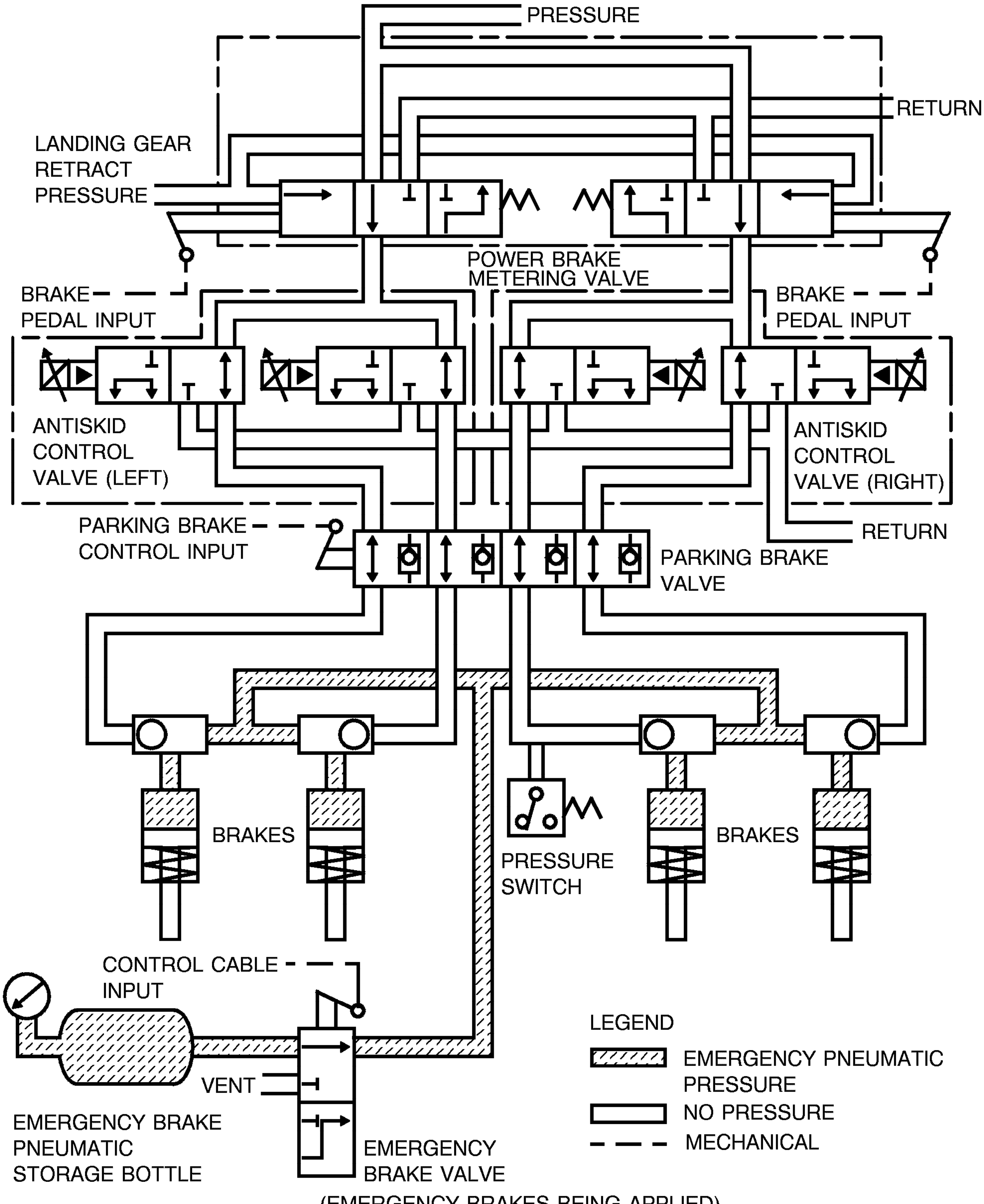

Figure 2-20 (Sheet 2 of 2)

FLIGHT CONTROLS

The flight control system of the Citation X is conventional in that it has a rudder, elevators, ailerons, and roll spoilers. It is unconventional in that they are completely redundantly powered and that the airplane is equipped with dual rudders, both powered from different sources, the lower rudder having an additional independent backup system. The upper rudder is electrically driven. All controls have redundant sources of operating power, as well as having manual backups (except the upper rudder) by conventional cable and follow-up systems. The horizontal stabilizer is of the movable type, powered by dual motors, and is trimmed by an electromechanical linear actuator which is installed at the top of the vertical fin. The actuator operates in response to command inputs from the pilot and copilot trim switches and from the automatic flight control system (AFCS). The secondary trim system (the second motor with its own control module) is controlled by a switch on the pedestal, and receives power from the emergency DC bus. A stabilizer trim indicator is presented on the central engine indicating and crew alerting system (EICAS) display unit (DU); a trim clacker gives audible indication if the autopilot trims for over three seconds.

Lateral and directional trim are achieved by shifting the neutral position of a feel and centering mechanism, by means of a linear electric actuator. The trim switches are located on the aft end of the center pedestal.

All primary control surfaces are powered by the airplane's dual hydraulic systems, power responsibility being approximately divided between the two systems. The two elevators and the lower rudder are each driven by two separate power control units, (PCUs), each one being powered by a different hydraulic system. The lower rudder, which is normally powered by both hydraulic systems, can be powered by an electrically driven self contained, independent hydraulic system which is isolated from the other systems. It is located out of the potential engine rotor burst area. The left and right ailerons are connected together at a central-output-quadrant which is driven by two separate PCUs, each powered by a different hydraulic system. The roll spoilers (panels 1, 2, 9, and 10) are each driven by a single PCU. The roll spoilers operate in conjunction with the ailerons and augment their roll control function.

Speed brake panels 3 and 8 are powered by the A hydraulic system, and panels 4, 5, 6, and 7 are powered by the B hydraulic system.

Pressure loss of one hydraulic system has no major effect on operation of the elevators, ailerons, and rudder. In the event of total hydraulic pressure loss, the surfaces can be controlled manually with some limitations. In case of failure of a hydraulic system controlling a roll spoiler, the roll spoiler will be held in the stowed position. In case of loss of both A and B systems pressure the lower rudder is automatically powered by its own independent electrically driven backup hydraulic system.

The leading edge slats are extended or retracted using either hydraulic system, since the slat control valve is a single unit with dual valves to accommodate both system A and system B pressure.

The airplane is also equipped with dual yaw stability augmentation systems (YSASs), or yaw dampers, which continuously provide additional yaw control and Dutch roll damping by electrically driving the upper and lower rudders.

A pitch and roll disconnect handle, located at the aft end of the center pedestal, allows disconnection, and thereby isolation, of the pilot's and copilot's pitch and/or roll controls.

FLIGHT CONTROLS

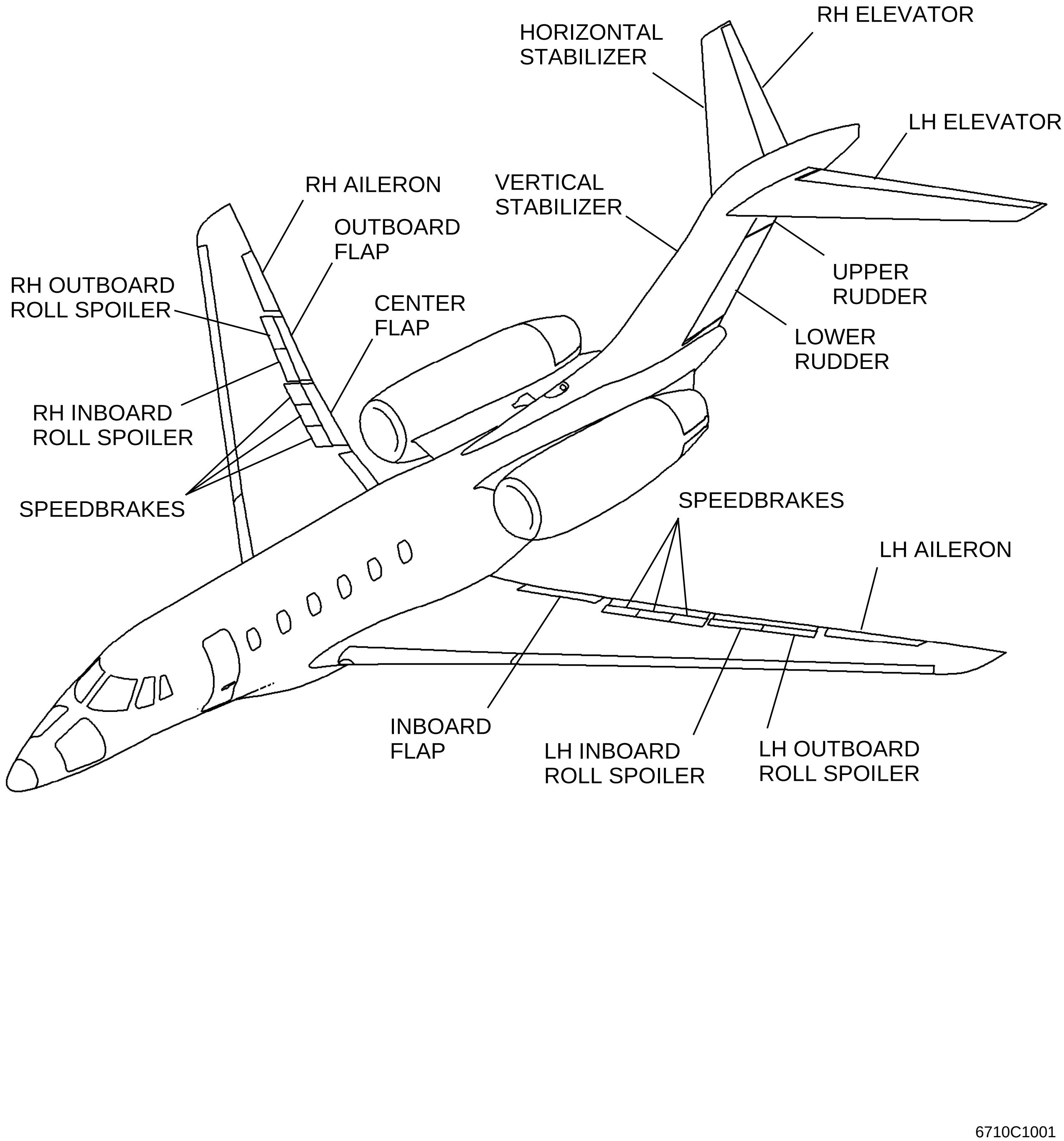

Figure 2-21

The flaps are electrically powered and are composed of six segments which move simultaneously. They are driven from a DC power drive unit (PDU) through a flexible shaft drive. Detents for the flap handle are provided at the UP, SLAT, 5-degree and 15-degree positions and a stop detent is installed at the FULL position.

The system power control units (PCUs) have a bungee pushrod installed to connect each PCU input link to an input bellcrank or input quadrant. The pushrod normally works as a solid pushrod to transmit the control signal to each PCU. In the event of a PCU input link jam, which causes the PCU to run away, the pilot can apply a counteracting column force to extend or contract the corresponding pushrod. This allows the other power control unit to force-fight with the runaway PCU. The PCU forces cancel each other out and pilot manual effort is required to counteract aerodynamic forces in one direction, in addition to the normal feel forces.

One of the selectable pages of the engine indicating and crew alerting system (EICAS) is a page which gives a cockpit visible indication of the flight control positions. This indication is primarily designed to enable the crew to see the positions of the flight controls on preflight, since it is not possible for the crew to otherwise visually check the control positions, and to visually indicate failure of the rudder limiter mechanism. Rudder limits and limit displays are discussed under Rudder in this section.

POWER CONTROL UNIT (PCU) MONITOR SYSTEM

The power control unit (PCU) monitor system is an integrated hydraulic pressure sensing and manual shutoff control system. Sensors, which are pressure transducers, are located in all of the PCUs. They sense hydraulic pressure and react to a difference in the pressure. There are two transducers in each PCU; one in the extend port and one in the retract port. If one PCU in a pair has sustained a runaway, or is force fighting the other PCU, the two adjacent force ratio pressures will be different. If such an abnormal condition exists the monitoring system will cause an amber alerting message (FLT CONTROL FAULT) to appear on the engine indicating and crew alerting system (EICAS) and in the switch/light (flashing mode) of the applicable flight control annunciator. The annunciators are located on the lower center part of the pedestal. The switch/light annunciators are: AILERON/OFF, RUDDER/OFF, LH ELEV/OFF, and RH ELEV/OFF; they serve as annunciators to alert the crew which PCU pair is affected, and as switches to shut off hydraulic power to the affected pair. The top half of the switch will flash. Pressing the illuminated switch will shut off power to the affected control surface, and the control will revert to manual mode. When the control is shut off, OFF will also be illuminated in the switch/light. The EICAS message will not be removed from the display when the PCU Is turned off. This is to act as a reminder to the crew, concerning the status of the PCU.

The PCU monitor system is in operation only if both PCUs in each control surface pair are operating at greater than 1000 PSI hydraulic pressure.

AILERONS AND ROLL SPOILERS

Lateral control is provided by the combined actuation of the ailerons and the roll control spoilers (the two outboard spoiler segments on each wing). Full control wheel rotation in either direction results in 15 degrees travel of the ailerons up or down, and 0 to 40 degrees up travel of the roll control spoilers. Movement of the outboard roll spoiler starts after approximately 3 degrees of aileron displacement, and the inboard roll spoiler starts at approximately 6 degrees of aileron deflection; both are at a maximum at 68 degrees of wheel deflection. The roll spoilers do not operate as speed brakes, in flight or on the ground.

The pilot's and copilot's roll control systems are independent except for the point at which the two systems are interconnected. A manual disconnect handle, which can be used to disconnect both the pitch and roll controls of the pilot's and copilot's respective controls, is located on the aft section of the center pedestal, to be used in the event of a system jam of either the pitch control, aileron, or the roll spoiler system. Both the pilot's and copilot's systems will then operate independently, and the jammed system will be isolated. Pulling the T-handle disconnects both the roll and pitch axes. To re-engage the roll systems in flight, the T-handle must be turned 90 degrees clockwise (to ROLL RECONNECT), which is opposite of the direction for the pitch reconnect.

The pilot's control wheel is connected to the dual aileron power control units (PCU), which are mounted in parallel in the center wing area, by a cable system, bungee pushrods, and a central-input-quadrant. The PCUs drive a central-output-quadrant which mechanically drives the ailerons. The copilot's control wheel is connected to the roll spoiler PCUs through a spoiler mixer assembly. Each spoiler PCU drives an individual roll spoiler panel.

An artificial feel (bungee) unit is linked to the aileron system to provide artificial feel to the lateral control system.

Upon the complete failure of the A and B hydraulic systems the ailerons automatically enter a manual reversion mode.

Lateral trim is electrically operated by an aileron trim switch on the pedestal. Actuation of the trim switch relocates the aileron neutral position, which is reflected in the control wheel position, and shifts the neutral point of the feel and centering unit to move the ailerons and roll spoilers together with the control wheel. An indicator on the pedestal shows the amount of trim displacement in relation to the original neutral position.

ELEVATORS

Pitch control is accomplished through conventional forward and aft movement of the control columns, which operate separate left and right elevators, through two separate power control units, (PCUs) on each elevator. The pilot's control column is linked to the left elevator and the copilot's is linked to the right one. Each of the two PCUs powering a control surface receives hydraulic pressure from a different system. Full elevator travel is through a range of 19 degrees nose up to 15 degrees nose down.

Elevator feel is provided by pitch feel units incorporated in each elevator control system to provide artificial feel for the pilots. The feel units are of electromechanical design, consisting of a mechanical spring cartridge and a linear electric actuator. They work in conjunction with the PCU centering springs, located in each side of the horizontal stabilizer, and generate a feel force pattern in relation to the airplane speed and the elevator position, similar to that which would be present in a manual control system. The electrical inputs to the feel units are generated by the micro air data computers (ADC).

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An artificial feel (bungee) unit is linked to the aileron system to provide artificial feel to the lateral control system.

Upon the complete failure of the A and B hydraulic systems the ailerons automatically enter a manual reversion mode. A pilot operated T-handle is provided to operate a mechanical latch-up system which allows the ailerons to operate without the lost motion that would otherwise be in the system in the case of total loss of hydraulic pressure. This mode is entered by pulling the AILERON LATCH PULL handle on the left side of the aft end of the center pedestal. This allows the ailerons to be driven manually from the control wheels with some limitations, and eliminates the lost motion of the PCUs and the input bungees.

Lateral trim is electrically operated by an aileron trim switch on the pedestal. Actuation of the trim switch relocates the aileron neutral position, which is reflected in the control wheel position, and shifts the neutral point of the feel and centering unit to move the ailerons and roll spoilers together with the control wheel. An indicator on the pedestal shows the amount of trim displacement in relation to the original neutral position.

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Elevator feel is provided by pitch feel units incorporated in each elevator control system to provide artificial feel for the pilots. The feel units are of electromechanical design, consisting of a mechanical spring cartridge and a linear electric actuator. They work in conjunction with the PCU centering springs, located in each side of the horizontal stabilizer, and generate a feel force pattern in relation to the airplane speed and the elevator position, similar to that which would be present in a manual control system. The electrical inputs to the feel units are generated by the micro air data computers (ADC).

AILERON POWER SYSTEM

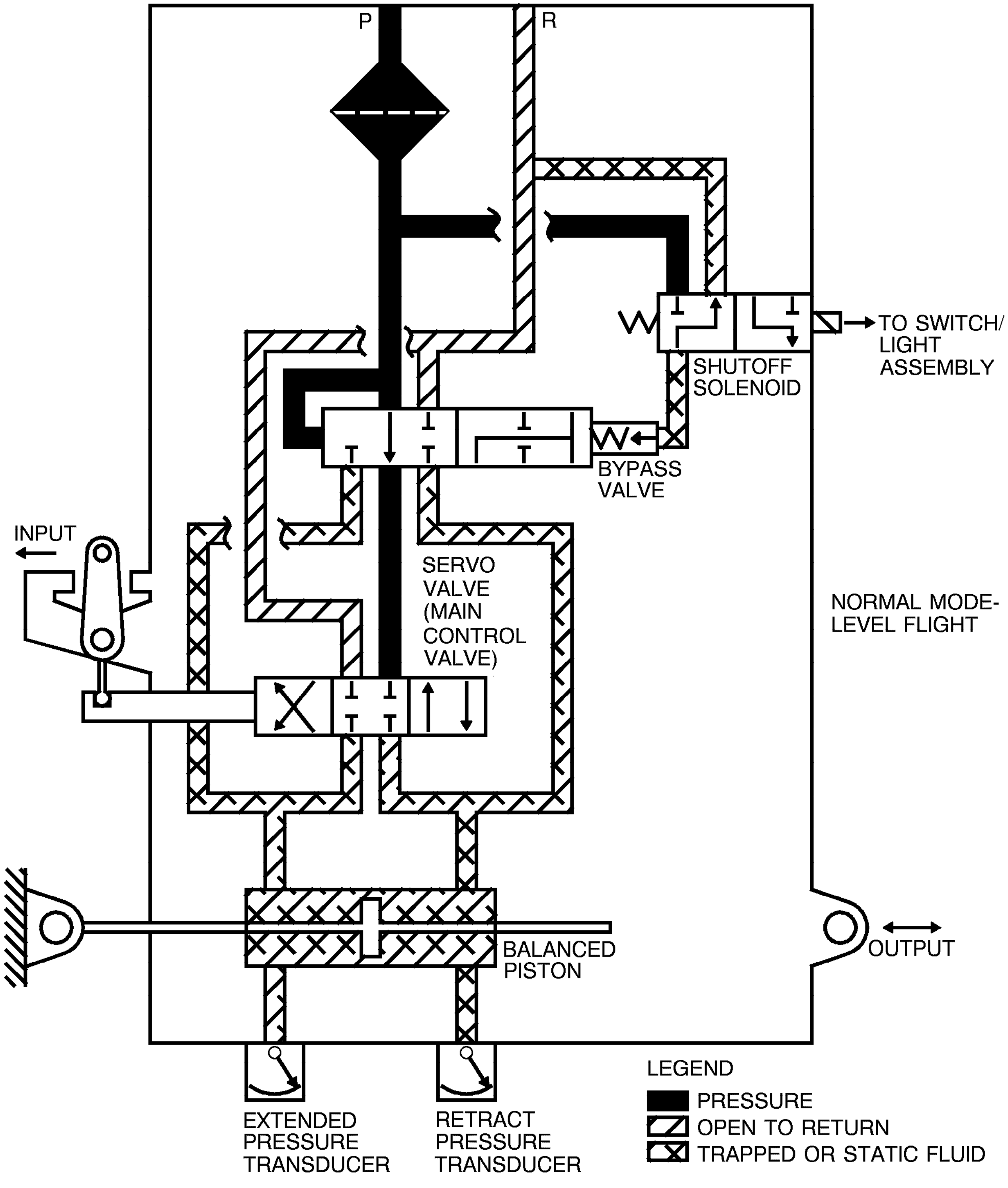


Figure 2-22 (Sheet 1 of 3)

AILERON POWER SYSTEM

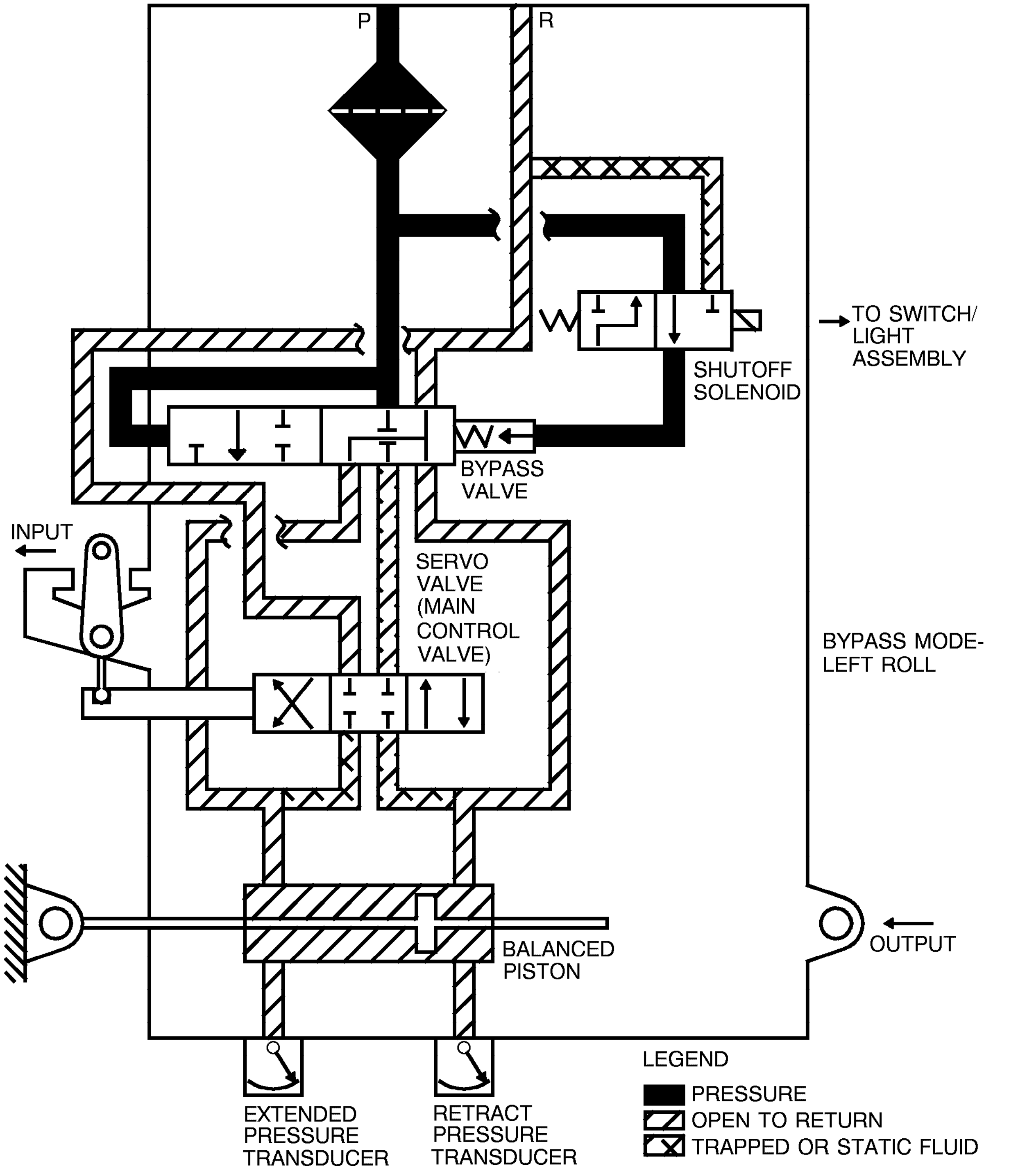


Figure 2-22 (Sheet 2 of 3)

AILERON POWER SYSTEM

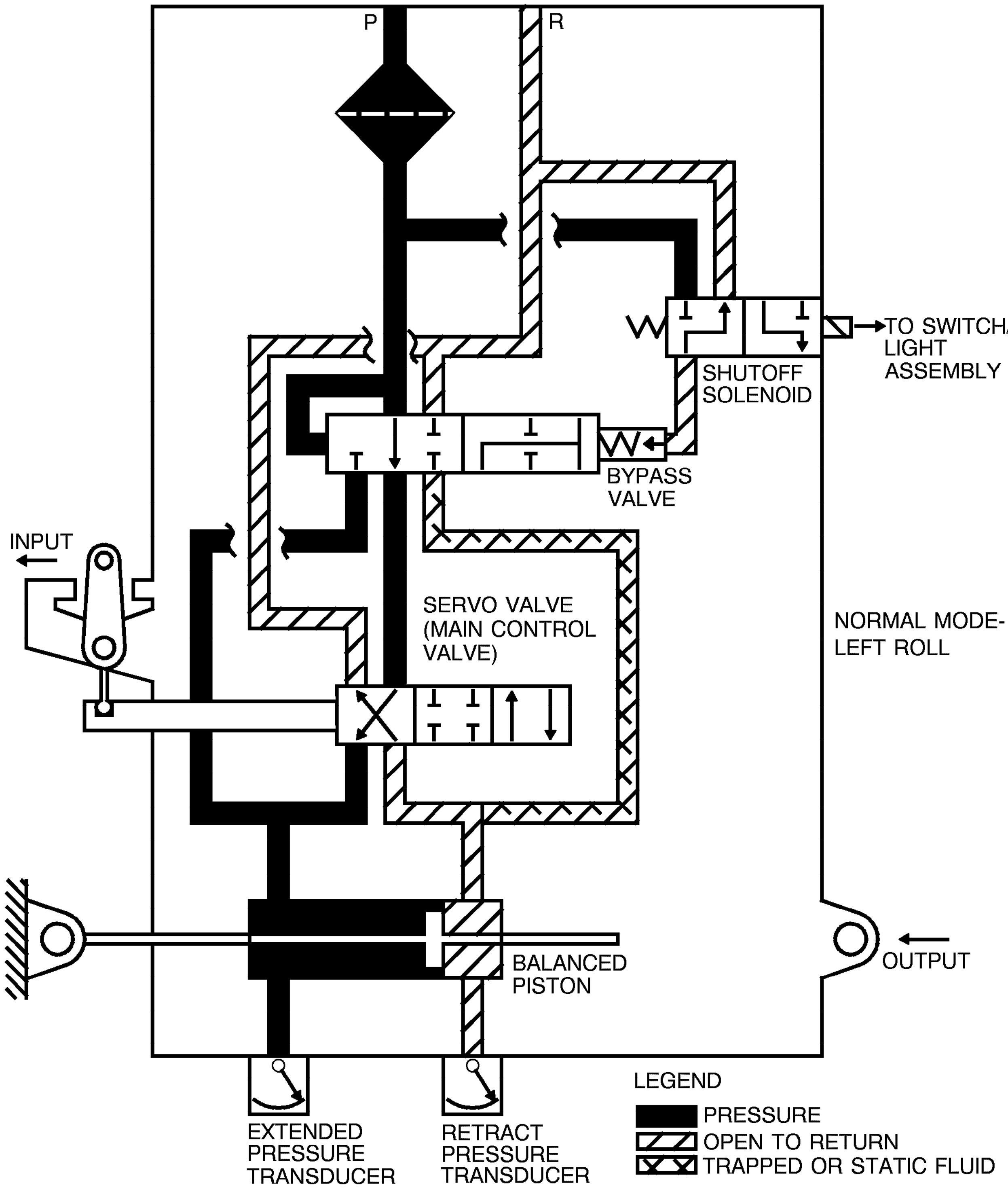


Figure 2-22 (Sheet 3 of 3)

AILERON/SPOILER ROLL CONTROL SYSTEM

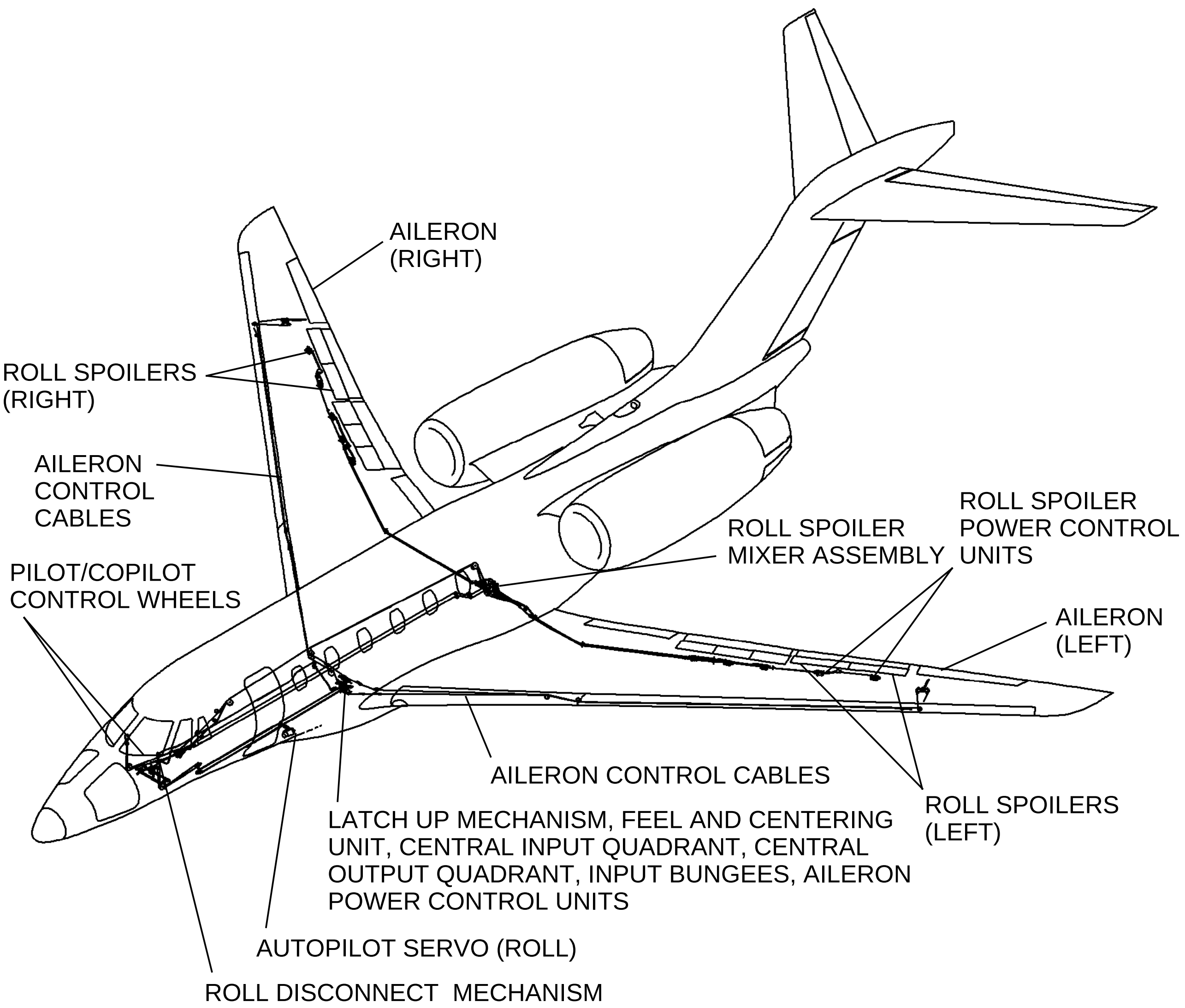


Figure 2-23

AILERON/SPOILER ROLL CONTROL SYSTEM DIAGRAM

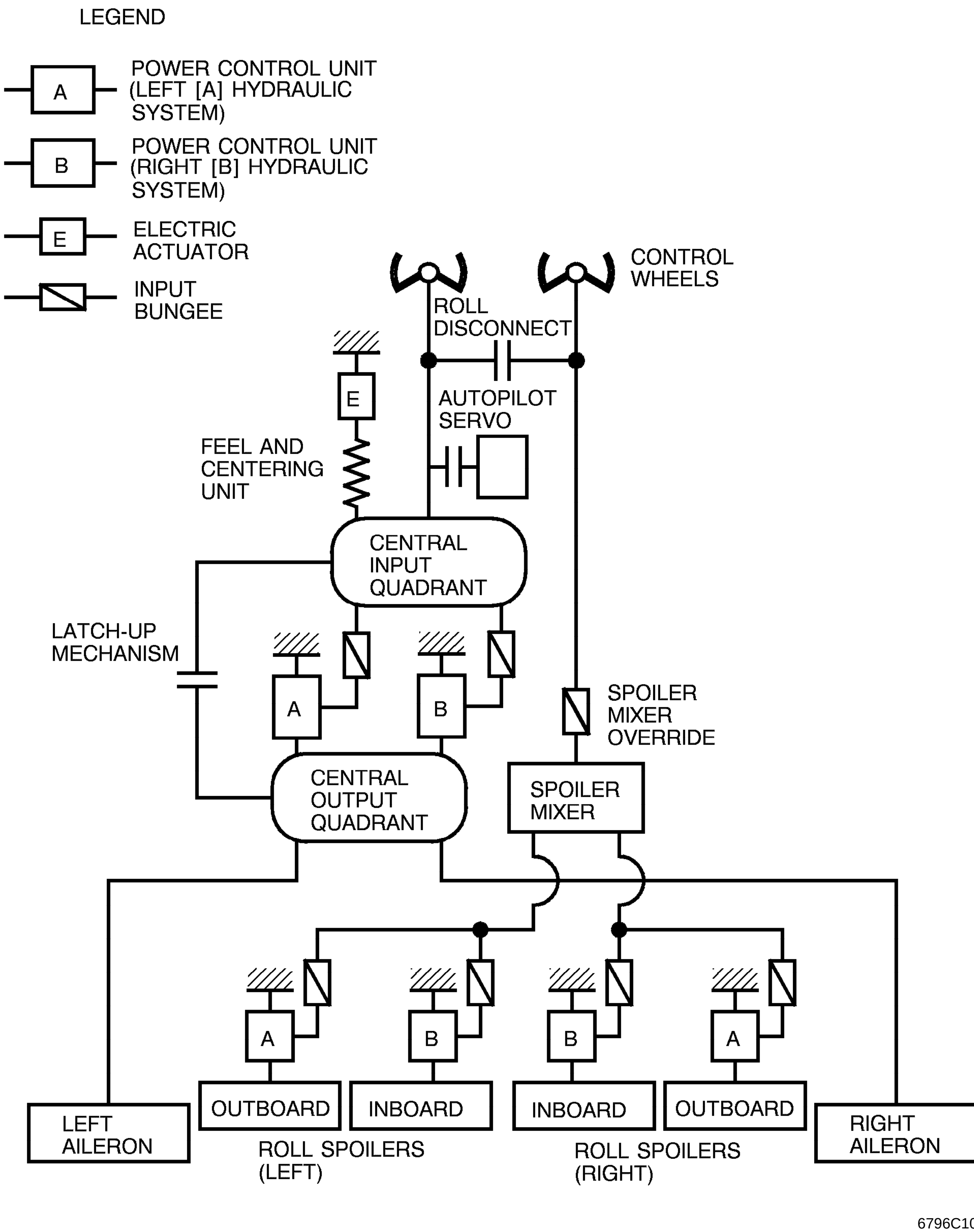


Figure 2-24

Control column movement is transmitted to the elevator PCUs through control cables, and through bungee pushrods, to the left and right dual PCUs, which drive the left and right elevators in proportion to the amount of input. The bungee pushrods operate under normal conditions as a solid rod to transmit the control inputs to the PCU. In the event of a PCU input link jam the pilot can apply a counteractive force which extends or compresses the bungee pushrod which will allow the operable PCU to assume control of elevator operation.

The pilot and copilot control columns are interconnected through a torque tube which incorporates a pitch/roll disconnect mechanism. In the event of a control system jam, the disconnect mechanism separates the two control systems and allows independent operation of the systems. Pitch disconnect is achieved by pulling a T-handle on the aft right side of the pedestal. The pitch disconnect system can be re-engaged in flight.

Since each pair of elevator PCUs is driven by separate hydraulic systems, loss of one hydraulic system has no major effect on elevator control system operation. In the event of a total hydraulic system failure, the control systems are operable in the manual reversion mode. Both elevators, in this case, are operated by means of cable transmitted control inputs which manually move the actuators. No switch positioning or other act of the pilot is required to cause reversion to the manual mode.

Pitch trim is accomplished by repositioning the entire horizontal stabilizer. Full travel of the stabilizer is from 12 degrees in the airplane nose up direction to 2 degrees in the airplane nose down direction. Primary pitch trim is controlled by switches on the control wheels. The trim switches are in two segments which must be actuated simultaneously. A SECONDARY TRIM ON/OFF switch on the left side of the pedestal, when ON, disengages the primary pitch trim system and arms the secondary system. Pitch trim, with the secondary system, is controlled by a two segment NOSE UP/NOSE DOWN switch on the pedestal. The primary system can thus be disengaged by arming the secondary system, by depressing either the pilot or copilot A/P/TRIM/NOSE WHEEL STEERING DISC switch on the pilot's or copilot's control wheel, or by pulling the PRIMARY STAB TRIM circuit breaker. The secondary system is disengaged by placing the ON/OFF switch to OFF. Pulling the SECONDARY STAB TRIM circuit breaker will also disengage that system.

Pitch trim indication is provided to the pilots on the center display unit (DU) of the engine indicating and crew alerting system (EICAS) display. A calibrated (analog) scale with pointer is always present, displayed in white, on the left side of the display. The STAB trim setting is also presented in digital display. A green area, showing the takeoff trim setting range on the scale, is present on the analog display when the airplane is on the ground, i.e., when the takeoff phase inhibit (TOPI) system is active. In this case T/O will also be annunciated in the display. The digital display will follow the color scheme of the analog pointer, and the pointer will be displayed in the color range of the arc where it is pointing. If stabilizer trim data become invalid or miscompare, the digital display will be dashed out with amber dashes and the analog pointer will be removed from the display.

A clacker sound is provided through the audio to alert the pilots any time the stabilizer trim is actuated by the autopilot for a period longer than three seconds. The avionics power switch must be on for the clacker to sound. Normal trimming by the pilots using the control wheel trim buttons will not actuate the trim clacker.

ELEVATOR CONTROL SYSTEM

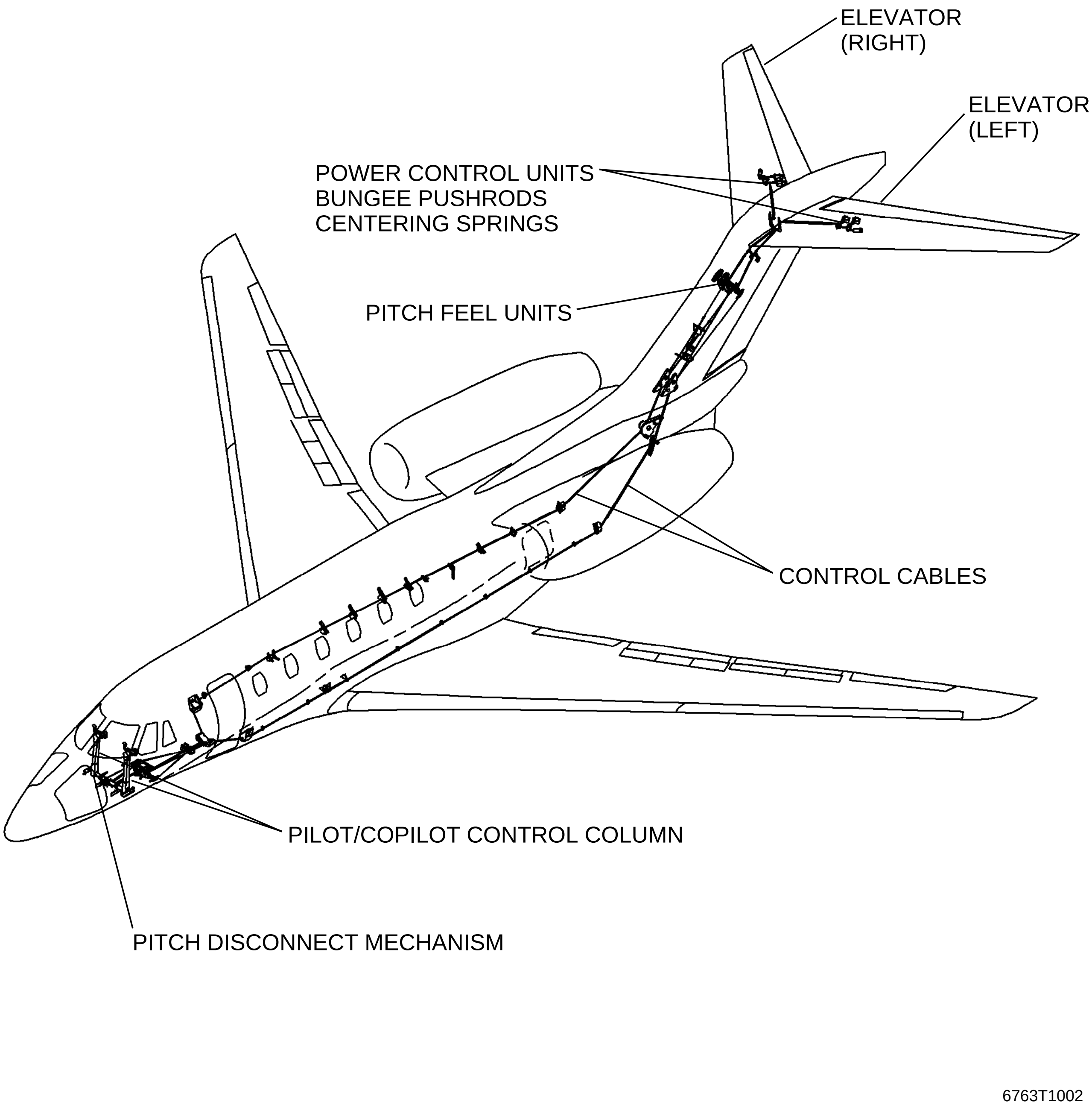


Figure 2-25

ELEVATOR CONTROL SYSTEM DIAGRAM

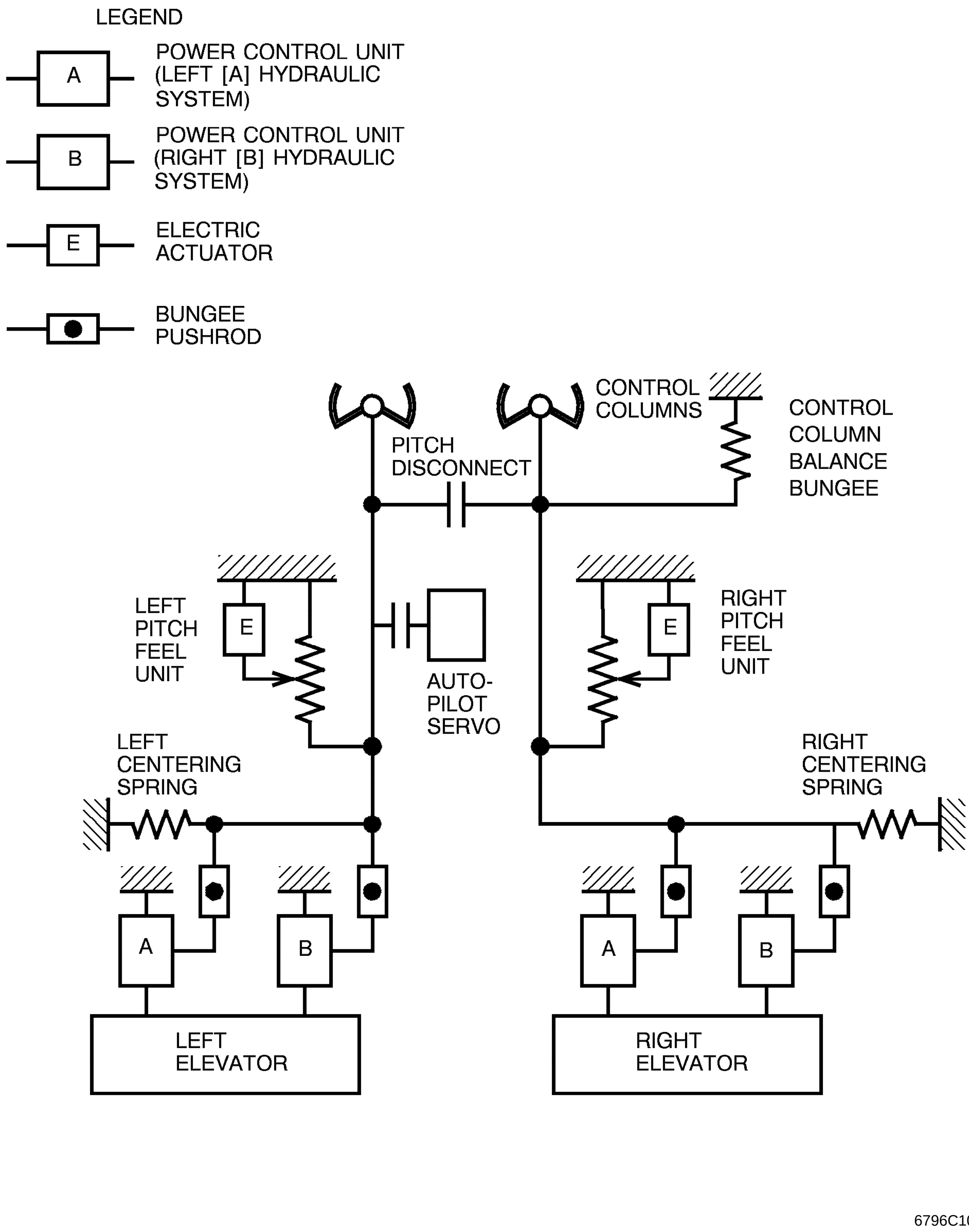


Figure 2-26

RUDDER SYSTEM

The airplane yaw control is provided by two separately controlled rudders; an upper and a lower. The lower rudder has the larger area and is positioned by two identical power control units (PCUs), each of which is powered by a different hydraulic system. The PCUs are installed in the vertical fin. Both pilots' rudder pedals are connected to the PCUs through a single mechanical control path which includes bungee pushrods.

A yaw feel and centering unit is linked to the lower rudder system to provide artificial feel to the pilots. The feel and centering unit changes the amount of rudder pedal effort required for differing rudder deflections and thereby simulates the feel of a non-powered system. Maximum rudder deflection is 30° for the lower and 18° for the upper, in either direction. Dual yaw damper servos are linked to the lower rudder system (in series) to provide Dutch roll damping and turn coordination.

The smaller upper rudder is driven electrically by two stand alone yaw stability augmentation systems (YSAS). The yaw dampers are referred to as the primary (A) and the secondary (B). Each YSAS has a yaw stability augmentation computer (YSAC) and a servo actuator as component parts. Either the primary or the secondary YSAS continuously provides Dutch roll damping of the airplane as well as tracking of the upper rudder to the rudder pedal commands from the pilots. Selection of the yaw damper is controlled by an amber lighted switch (UPPER YAW DAMP/A/B) on the upper center instrument panel. The selected yaw damper annunciation will be illuminated in the switch. Default selection alternates at each power up in order to even out system usage. The lower rudder also provides yaw damping stability augmentation, however, its yaw damping is provided through PCU displacement of the rudder and is therefore not available in the event of complete hydraulic failure. Normally both the lower and upper rudder systems provide yaw damper function at the same time. If the yaw damper on either rudder competely fails, however, the other system will provide adequate control to maintain the yaw stability of the airplane.

Due to the critical nature of the yaw damper system, several engine instrument and crew alerting system (EICAS) messages are designed to appear in order to alert the crew to any system difficulty. The EICAS messages which are possible in respect to the yaw dampers are: (1) YD FAIL LOWER A (and/or B) (amber), which indicates that either of the yaw dampers has failed in flight, both have failed on the ground, or the selected one has failed during power up. (2) YD FAIL LOWER A (or B) (cyan), message indicates that one yaw damper has failed; (3) YD NOT CENTERED (amber), indicates upon power up that one or more of the linear actuators is/are not centered. Do not dispatch in this case, until the problem is repaired. (4) YD UPPER FAIL A (or B) (amber) will appear on the ground if the non-selected yaw damper should fail before takeoff. (5) An amber message YD OFF LOWER indicates that the yaw damper is not in operation.

Dual electromechanical rudder travel limiters are installed on the lower rudder to limit the maximum rudder deflection, depending upon the airplane speed. At low airspeed the rudder can deflect to its full limit; at higher airspeeds, the rudder is limited in travel to a variable percentage of its maximum deflection. This protects the airplane structure from being overloaded by excessive rudder input at high speeds. The upper rudder is thereby also protected in its range of movement, which is less than the lower rudder, because the upper rudder receives its inputs electrically from the rudder pedals, which are mechanically limited at higher speeds by the lower rudder limiters. In case of one limiter failure, the remaining one will operate with no loss of efficiency. The rudder travel limiter operates on the principal of a triangular shaped probe, which moves in a slot which travels with the rudder. As the triangular probe moves deeper into the slot, available rudder travel is restricted. The electromechanical limiters receive their airspeed data from the automatic flight control system (AFCS) and translate it into a mechanical limiter position.

The available deflection versus airspeed information is depicted in Figure 2-28 in this section. Airspeed data for the rudder limiters is obtained from the automatic flight control system (AFCS).

Rudder deflection and, - in case of failure of the rudder limiter mechanism - the range of failure, is indicated on the control deflection page of the EICAS system. This page is selected by selecting CTL POS on the bezel button of the EICAS display unit (DU). The percentage of

RUDDER SYSTEM

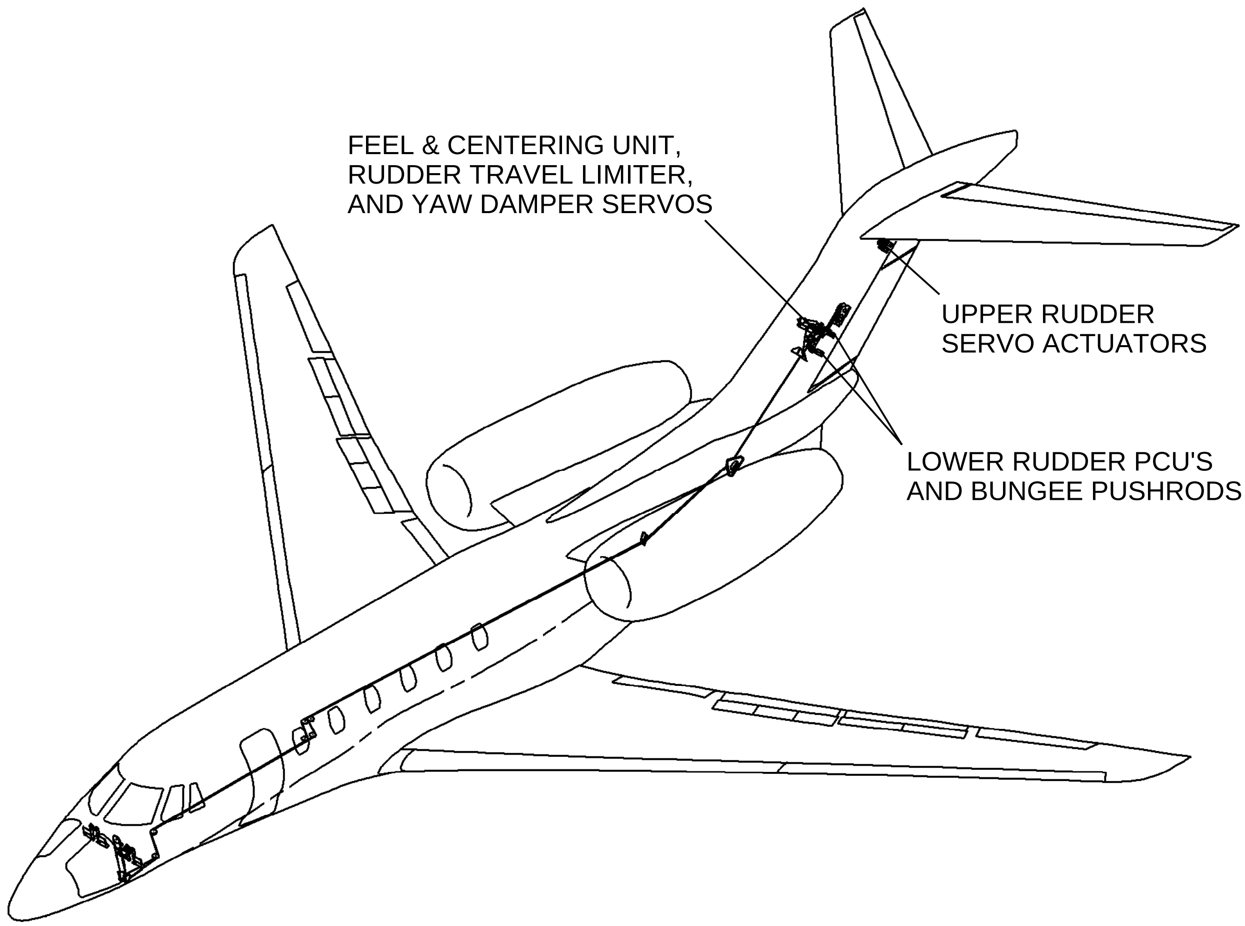


Figure 2-27

RUDDER CONTROL SYSTEM SCHEMATIC

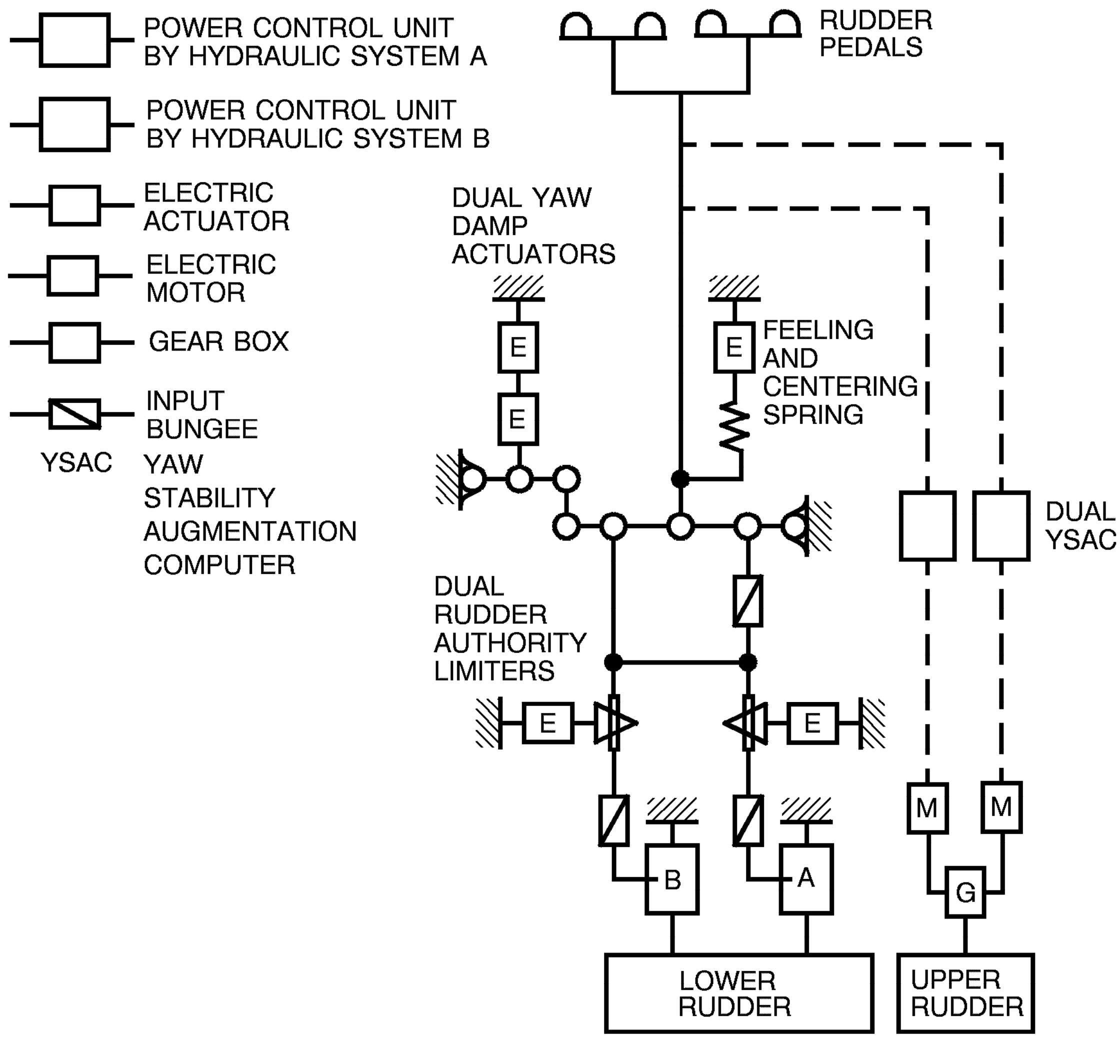


Figure 2-28

available rudder which may be used will be indicated in both digital and analog display. In the case of a single failure the digital display will be in amber, and the analog display will remain green. In case of a dual failure the horizontal bar will become red in the area which represents the portion of the rudder arc which should not be used, and the digital display will also be in red. The pointer will follow the color of the area of the indicator where it is at any time. A red digital indication of 80%, for instance, indicates that the rudder limiter has failed at the 80% point of full rudder throw, at which point the rudder will be blocked mechanically. The green area of the analog display will vary with the desired limits of the rudder depending upon the present airspeed. The pilot will then, based on the display, be able to keep application of the rudder out of the restricted (red) range.

RUDDER TRAVEL LIMITING

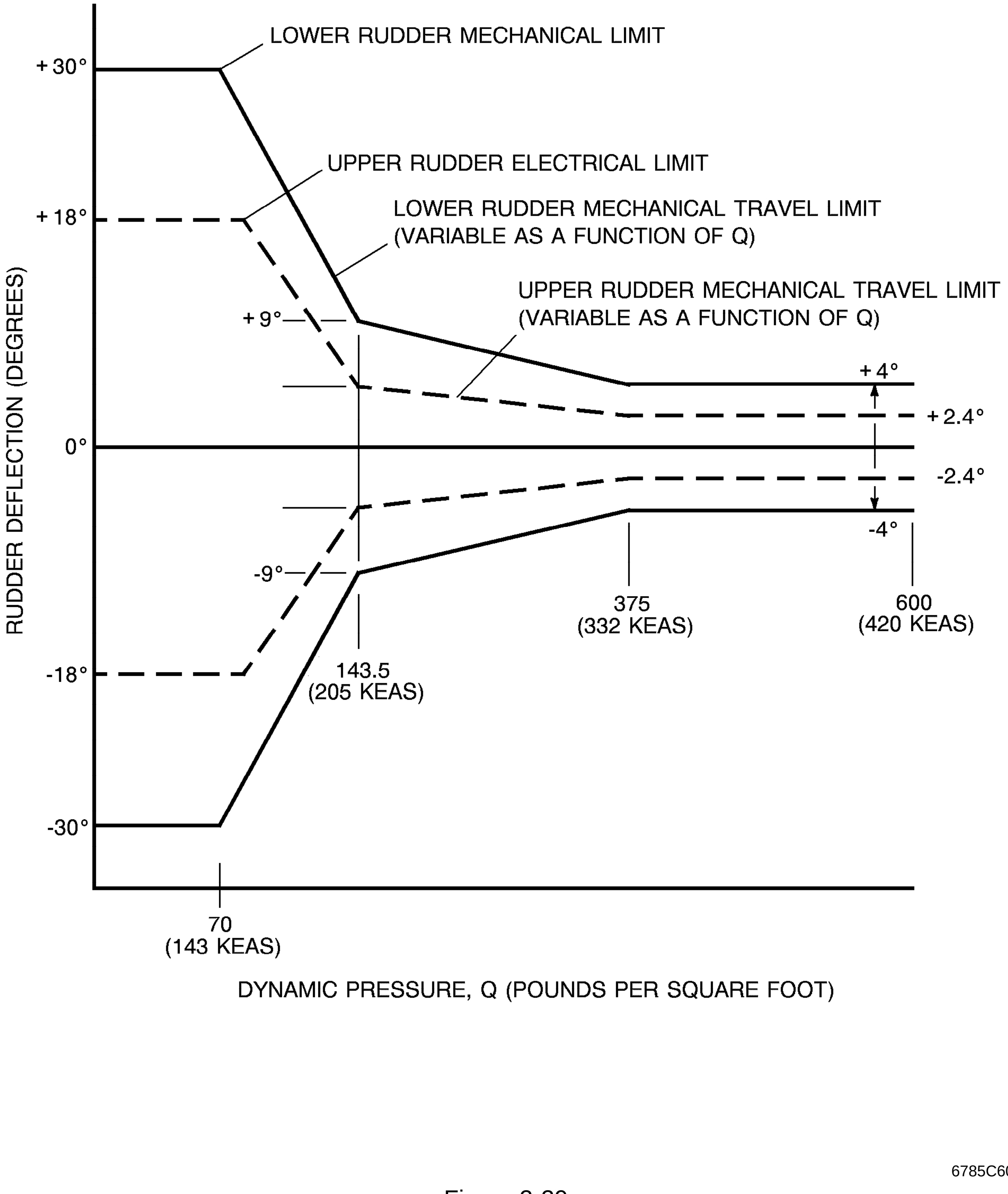


Figure 2-29

An amber RUDDER LIMIT FAIL message indicates a single limiter failure; a red message indicates a dual limiter failure. The indications discussed above will not be available without a RUDDER LIMIT FAIL message; the control deflection indications will always be available upon selection of CTRL POS on the bezel button. If the data being received by the CAS system is invalid or there is sensor disagreement, the bugs will be changed to amber or will be removed from the display. The digital crew alerting system (CAS) indications will follow the EICAS message color.

Rudder trim is applied through a left-right momentary switch on the lower center pedestal. Trim is displayed on the rudder trim portion of the consolidated aileron/rudder trim indicator, also located on the lower center pedestal. Movement of the lower rudder trim is displayed in units from neutral. An indication of one unit or more of the trim will trigger a no takeoff warning on the EICAS. The rudder trim is achieved by electrically displacing the trim actuator, moving the whole lower rudder control system and shifting the neutral point of the feel and centering unit.

NOSE WHEEL STEERING

The nose wheel steering is powered by the A hydraulic system. Steering is accomplished through a hydraulic rack and pinion type power steering unit mounted on top of the nose landing gear assembly. The unit is controlled by a steering handwheel mounted on the pilot's side console and/or through the pilot's or copilot's rudder pedal inputs. The handwheel provides steering of up to 80 degrees in either direction and the rudder pedals provide a maximum of 12 degrees of steering. The inputs are cumulative through a cable and pulley mixer assembly, so by using the handwheel and the rudder pedals a total of 90 degrees of turn of the nose wheel are possible.

The power steering unit also provides nose gear centering upon retraction, since the nose wheels must be centered in order to enter the nose wheel well. With the gear fully extended the centering function is accomplished by allowing retract pressure on both sides of each rack, which forces them to the centered position. A centering logic valve, which is located within each steering rack, regulates the differential pressure by venting one side or the other to return until the racks are centered.

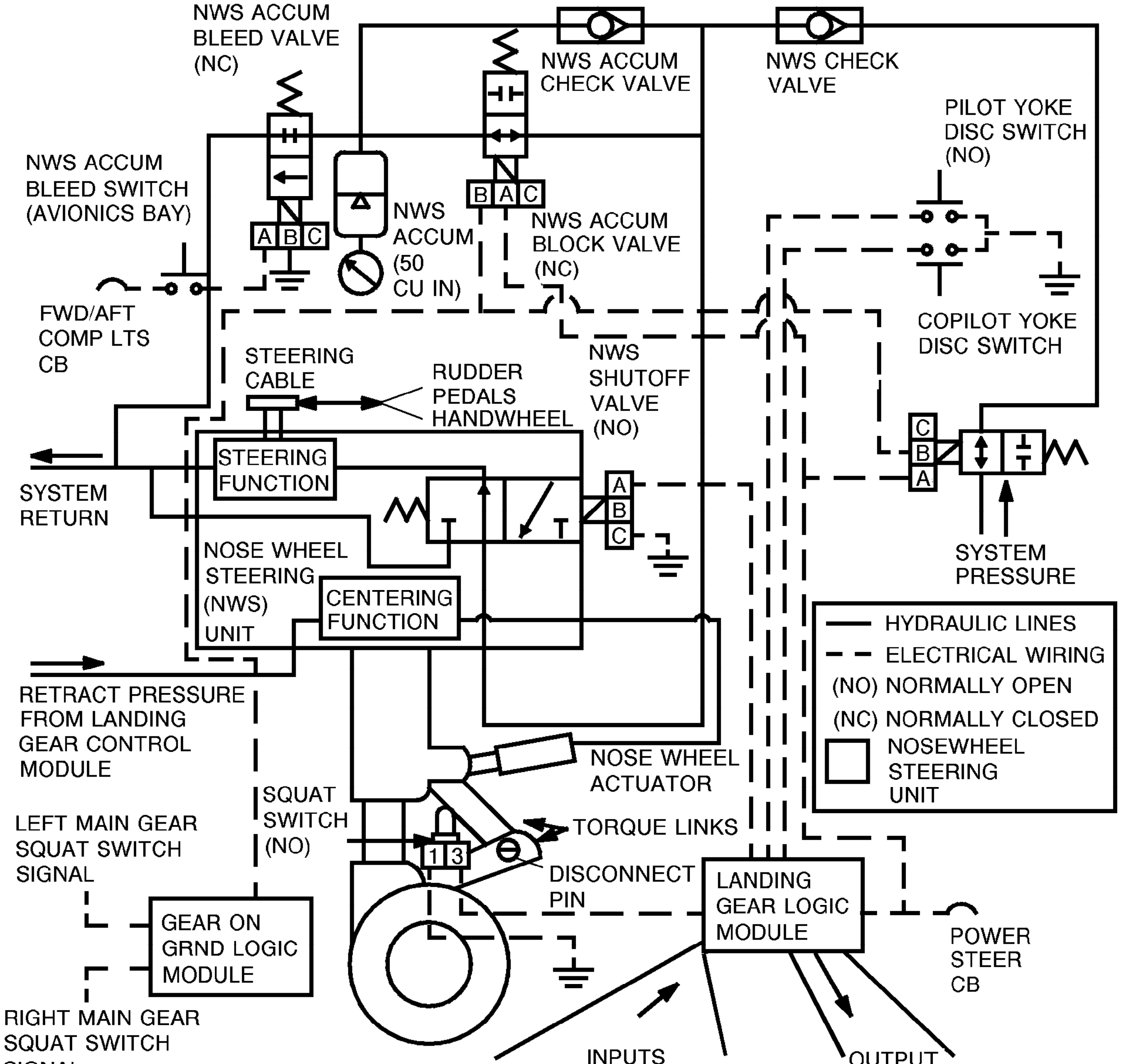
A nose wheel accumulator is installed in the system in order to absorb shocks in the system and to provide a separate trapped source of hydraulic power in case of complete system failure. The accumulator is of the sliding piston type and is serviced with 1500 PSIG of nitrogen.

NOTE

> The nose gear torque links must be disconnected during towing operations or the system may be damaged. The torque link disconnect pin is removed by removing a safety pin from the shaft by pushing a release button and pulling out the pin. The torque links are spring loaded to extend horizontally from the nose gear strut when the pin is removed.

The nose wheel steering accumulator bleed switch is powered through the FWD/AFT COMP LTS circuit breaker which is on the hot battery bus, so power is available to it at all times.

NOSE WHEEL STEERING FUNCTIONAL DIAGRAM



NOSE SQUAT SWITCH	YOKE DISC SWITCH	NWS ISO VALVE	NWS SHUTOFF VALVE	STEERING AVAILABLE
ON GRND	RELAXED	OPEN	OPEN	YES
ON GRND	RELAXED	CLOSED	OPEN	NO
ON GRND	PRESSED	OPEN	CLOSED	NO
IN AIR	RELAXED	OPEN	CLOSED	NO
IN AIR	RELAXED	CLOSED	CLOSED	NO

ACCUMULATOR BLOCKING VALVE AND NWS ISOLATION VALVE LOGIC TABLE

LH MAIN SQUAT	RH MAIN SQUAT	ACCUM BLOCKING VALVE & NWS ISOLATION VALVE
GND	GND	OPEN
GND	AIR	OPEN
AIR	GND	OPEN
AIR	AIR	CLOSED

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Figure 2-30

The nose wheel steering hydraulic pressure is controlled by the normally open nose wheel steering shutoff valve. When the nose landing gear squat switch signals that the airplane is airborne, the nosewheel steering shutoff valve is powered closed. The nose wheel steering shutoff valve can also be powered closed by momentarily pressing the A/P/TRIM/NWS DISC switch on either control wheel. The switch must be held depressed for as long as the nose wheel steering is not desired. Steering will resume when the switch is released. With the nose wheel steering hydraulic power cut off, the nose wheel will caster and the shimmy damping will be effective.

Two redundant systems, therefore, keep hydraulic power from the nosewheel steering system when it is not desired; the hydraulic blocking (sequence) valve which blocks pressure when the gear is not fully extended, and the nosewheel steering (solenoid) shutoff valve, which is powered closed when the nose gear squat switch is signaling that the airplane is airborne.

The hydraulic blocking valve is located in the circuit between the accumulator and the nose wheel steering unit. It is powered open when either main landing gear squat switch signals a landing. The function of the blocking valve is to assure a fully charged nose wheel steering accumulator upon touchdown.

SPEED BRAKES

The speed brakes are comprised of spoiler panels numbered 3 through 8; three of them on the trailing edge of each wing. The panels are mechanically controlled and hydraulically actuated, each panel having its own actuator. They are connected to the control lever, located on the throttle quadrant, by cable, pushrods, and bellcranks to the hydraulic actuators which power them. Speed brake actuation can be modulated from 0 to 40 degrees of deployment. The hydraulic actuators for the speed brakes are essentially the same as the spoiler actuators which operate with the ailerons, except that the speed brakes are controlled only by the speed brake lever and the spoiler panels respond only to control wheel input.

In case of complete hydraulic system failure, or the failure of an actuator, the speed brake panels can retract but will not extend, so loss of range due to floating of speed brakes and spoilers does not present a problem.

The center speed brake panel of the left wing and the outboard panel of the right wing are monitored for position. The speed brake monitoring system puts out signals to the engine indicating and crew alerting system (EICAS) and to the angle-of-attack system. If the monitored speed brake panels are extended over 5 percent, white filled bars will be displayed on the synoptic wing in the EICAS display. If speed brake data is invalid or out of range or if there is a five percent split in the extension of the two monitored panels, the synoptic wing indication of all six panels will change to amber. When the speed brakes are stowed no symbology is present.

SPEEDBRAKES/SPOILERS

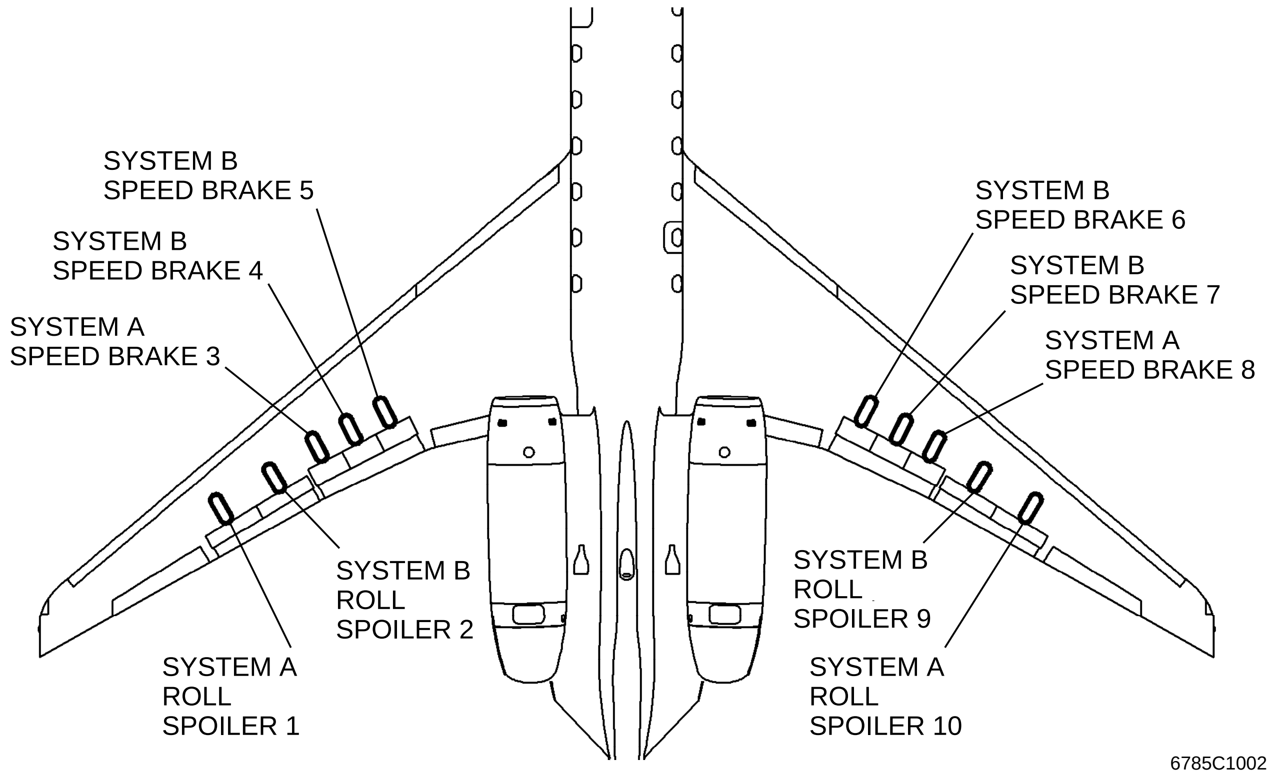


Figure 2-31

FLAPS

The trailing edge flaps are mechanically controlled and driven by a direct current (DC) electric power drive unit through ballscrew actuators and flex-drive shafts. The flaps are in three segments on each wing. They use the Fowler flap motion in that the flaps extend as they are lowered, thereby effectively increasing the wing area when the flaps are extended. Extension time for both full up to full down, and full down to full up, is approximately 27 seconds. The major control and monitoring function of the flaps is accomplished by the flap controller, which can sense several types of malfunctions and shut down the flap system, if required. The controller runs a self test during each preflight to verify the proper functioning of all fault detection circuitry. Each fault that the controller senses has a built in test equipment (BITE) code which it will set, and which can be read after flight, through a window in the controller case. A FLAP RESET button is located immediately forward of the flap control handle; if a condition which has immobilized the flaps has cleared, the flaps will regain operation upon the pressing of the FLAP RESET button. If the condition has not cleared the flaps will remain inoperative.

If the controller senses a fault and disables the flaps, an amber FLAPS FAIL message will appear in the engine instrument and crew alerting system (EICAS) display.

Flap positions of 0, 5, 15, and 35 degrees are selectable in detents.

FLAP SYSTEM BLOCK DIAGRAM

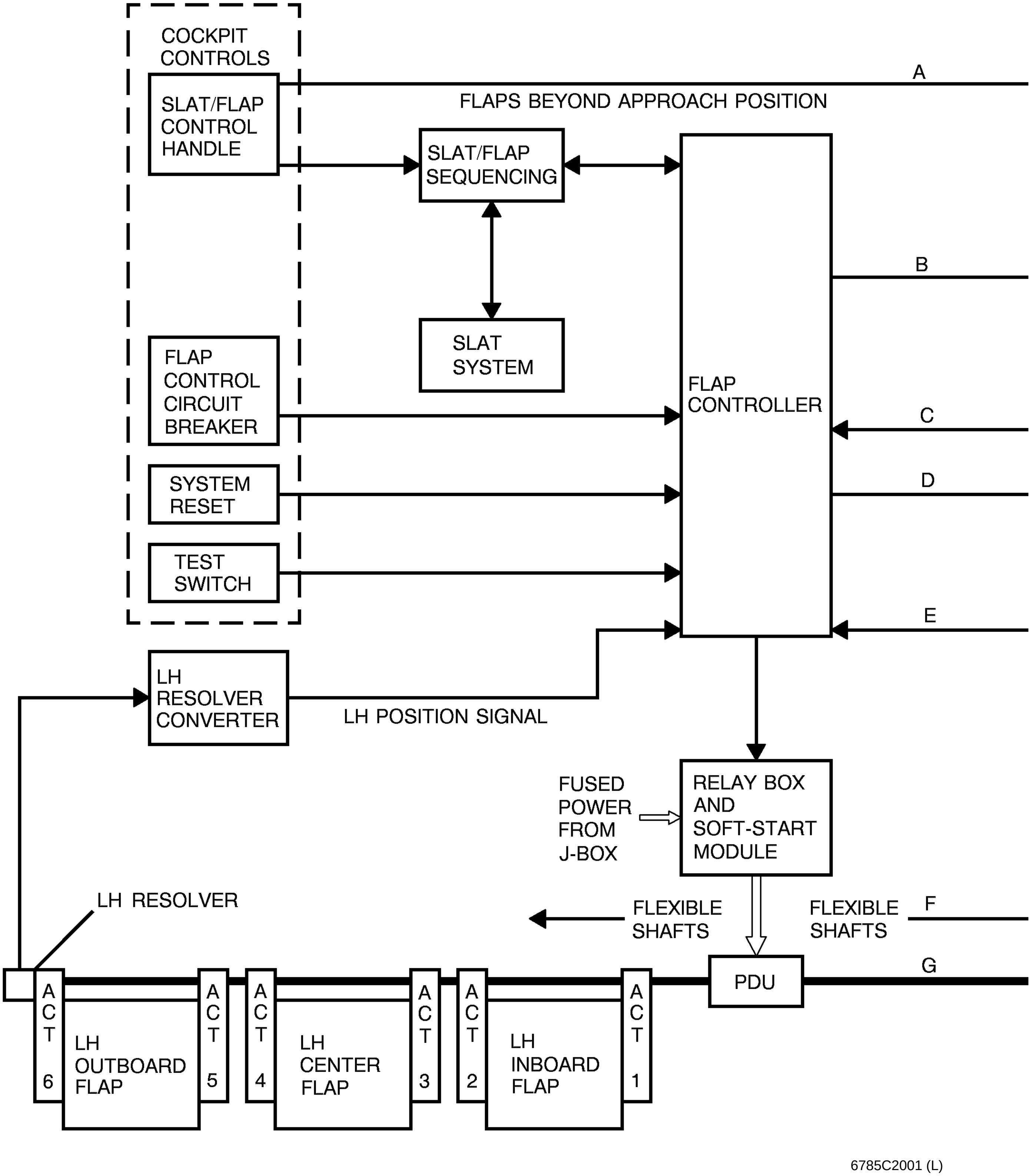


Figure 2-32 (Sheet 1 of 2)

FLAP SYSTEM BLOCK DIAGRAM

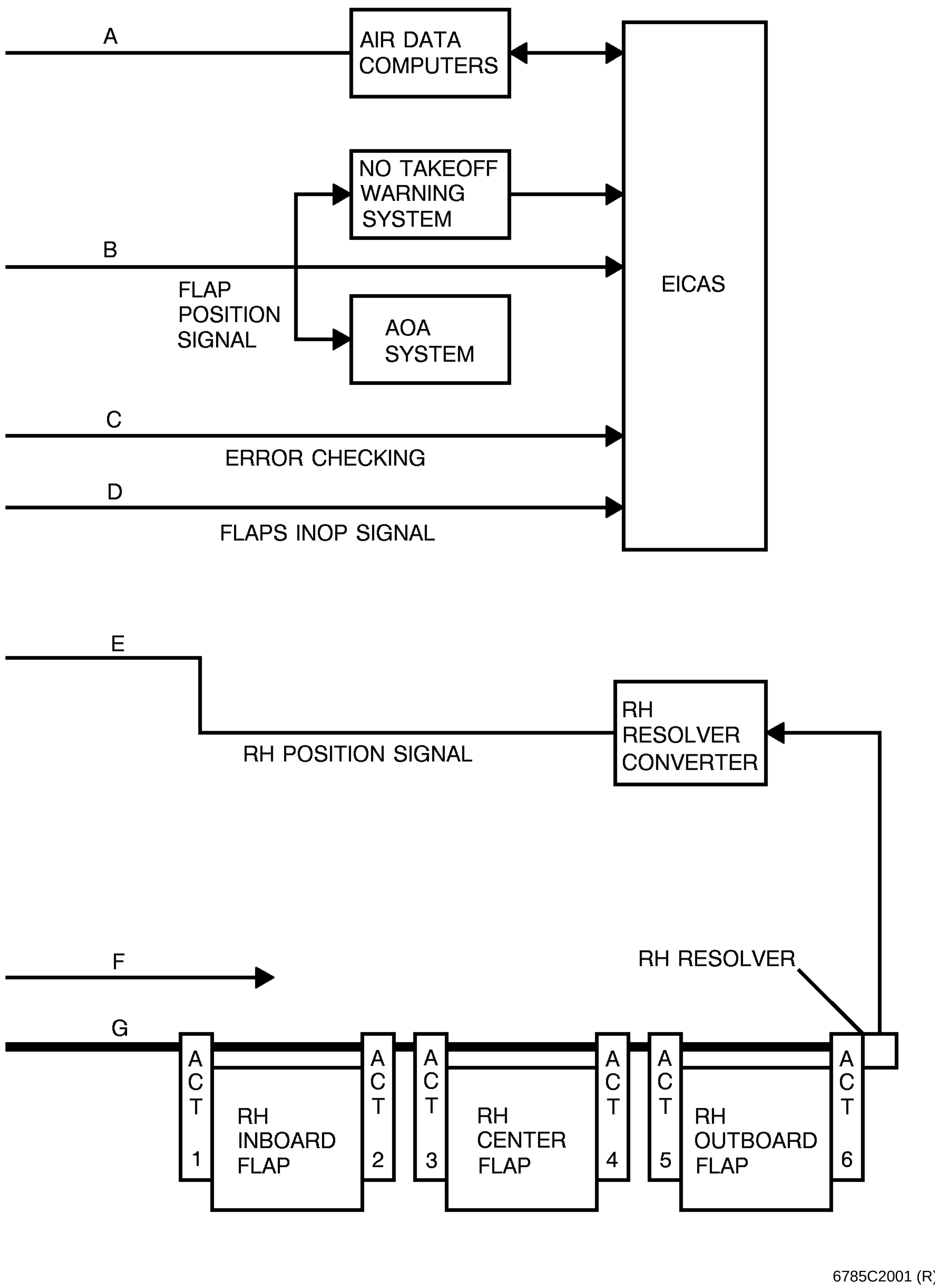


Figure 2-32 (Sheet 2 of 2)

SLATS

Leading edge slats are provided on each wing for added low speed lift, and controllability enhancement. Deployment occurs when the flaps are lowered and the flap handle passes the SLAT detent on the flap handle. The slats only may also be extended by selecting the SLAT ONLY position on the flap quadrant. The slats are retracted when UP is selected on the flap handle and the flaps are retracted to less than 1.5°. The slats are controlled by the slat control valve, which contains four solenoid operated pilot valves and an interlocked spool, to route hydraulic pressure from hydraulic systems A and B into the appropriate stow and deploy lines. Four hydraulic actuators are used on each wing, for a total of eight; every other actuator on each wing is operated by the opposite hydraulic system. Hydraulic system A provides hydraulic pressure for slat actuators number 2, 4, 5, and 7. Hydraulic system B provides the power for slat actuators number 1, 3, 6, and 8. Flap/slat sequencer logic modules are incorporated to process electrical signals pertinent to the flap/slat systems.

The slats react to one extend signal which is not related to handle position. Angle-of-attack (AOA) data from the AOA sensor is provided to the flap/slat sequencer modules. If a very high angle-of-attack condition is sensed, the slats will be extended as an automatic corrective action to the situation. If this automatic extension function should fail, a red AUTO SLATS FAIL message will appear in the crew alerting system (CAS) display and a double chime will sound. In this case there will be no analog display.

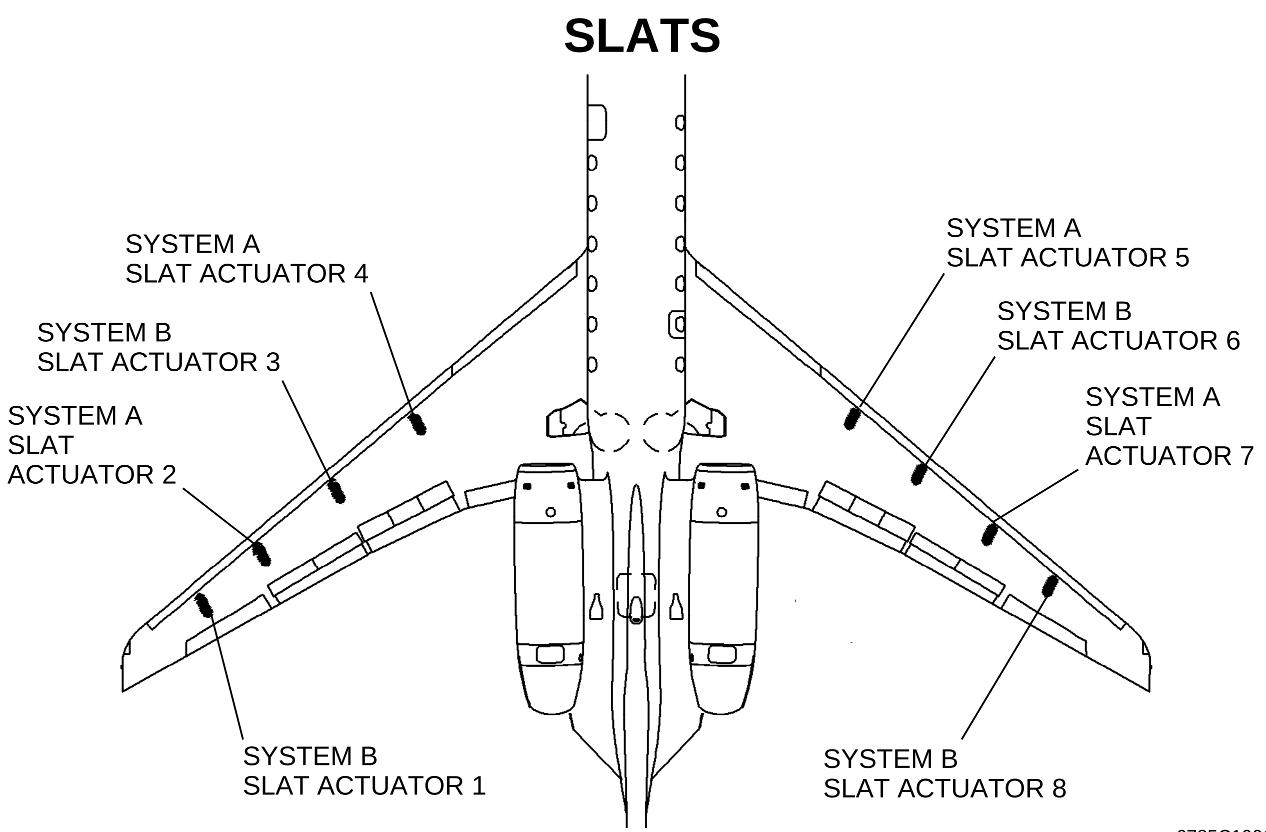


Figure 2-33

Slat position sensing is provided by four proximity switches located in the leading edge of the wing. Position signals are sent through the flap/slat sequencer to the data acquisition units (DAU) and are then displayed on the lower right corner of the engine indicating and crew alerting (EICAS) system display, on the synoptic wing. Slat positions are represented by two bars ahead of the displayed synoptic wing. They are shaded white for normal extension, are absent for retraction, and are amber for an asymmetrical condition. The amber display only indicates that there is an asymmetrical condition; it does not indicate the extent of it, or any detail. An amber digital crew alerting system (CAS) display SLATS ASYMMETRY will also appear at the same time.

If the slats fail to extend or fail to retract when commanded, an amber CAS message SLATS FAIL will be annunciated.

CONTROL LOCK

The control (gust) lock system is mechanically operated and, when engaged, locks the elevators and rudders in the neutral position. The ailerons are held against gusts by their control actuators and do not require locking. The locking system is controlled by a T-handle located below the pilot's instrument panel and is comprised of cables, lever assemblies, bellcranks, torque tubes, springs, force limiters, push rods, latches, and a striker plate. The T-handle is pulled aft against spring tension to engage the control lock. Turning the handle locks the system and holds it against the spring tension. The flight controls should be near neutral position before engaging the control lock; they will lock only in the neutral position. If the lock is pulled out and stowed they will lock due to the spring tension in the system when they arrive, due to gusts, at the neutral position. Centering the controls after locking the handle will also cause them to lock. A proximity switch in the rudder locking system and a pushbutton switch in the elevator system provide a signal to the crew alerting (CAS) system that the controls are locked (cyan message GUST LOCK ON). The control lock is released by turning the T-handle and letting it go forward due to its spring tension. The system is fail safe in that spring tension holds it towards the unlocked position unless the lock handle is purposely pulled and turned.

With the weight-on-wheels (squat) switches compressed and the flight controls locked, a cyan NO TAKEOFF advisory will be annunciated on the engine indicating and crew advisory (EICAS) system, which will change to a red NO TAKEOFF warning if a throttle is moved to a position greater than 60 degrees throttle lever angle (TLA).

STALL WARNING - STICK SHAKER

The stall warning system receives its information from the angle-of-attack (AOA) system. The angle-of-attack system is completely redundant in that it is comprised of two separate systems, a left and a right. Slotted probes, which act as position transducers, are mounted on each side of the forward fuselage. The probe/transducers transmit AOA data to the angle-of-attack computers, mounted in the pilot's and copilot's side consoles, which use the probe/transducer information and airplane configuration (flap, slats, and speedbrakes) to compute a “normalized” angle-of-attack. The resulting information from the left system is displayed on the pilot's optional AOA indicator on the left switch panel, and on the left side of the pilot's electronic attitude director indicator (EADI) display on the electronic flight instrument system (EFIS), and on the optional indexer. Information from the right system is presented on the left side of the copilot's EADI display. The EFIS displays are presented in a low speed awareness format. The stick shakers, which are mounted about nine inches down from the control wheel on the forward side of each pilot's control column, are energized by inputs from the angle-of-attack computers when they sense an impending stall. An electric motor with rotating weights induces a vibration feel to the control column, alerting the pilots to the approaching stall.

If the engine indicating and crew alerting system (EICAS) senses a fault in the AOA system it will present an amber STALL WARN L-R message to warn the crew that the stall warning system (either left or right, as indicated) is not reliable. A left system warning means that the left stick shaker will not operate, the AOA indicator will show off, the optional indexer will be inoperative, and the pilot's low speed awareness display will be inoperative. A right system warning means that the copilot's fast/slow indicator and the stick shaker will be inoperative.

A message of AOA PROBE FAIL L-R on the EICAS indicates that there is a fault in the respective probe transmitter. That particular angle-of-attack system should not be used; the indications driven by the applicable (left or right) system, as listed above, should be disregarded.

An EICAS message AOA HEAT FAIL L-R indicates failure of the applicable AOA probe heater. In icing conditions, information from that system should be disregarded or used with caution.

When the airplane is powered up, the optional analog (pointer) type angle-of-attack indicator will go through a self test including the following:

1. The OFF flag pulls out of view.
2. The pointer is within the display range of the indicator

The rotary TEST switch on the center pedestal provides a means of checking the stick shakers and other features of the angle-of-attack system on preflight. To test the system select AOA on the test switch and observe the following:

1. If the optional indexer is installed, the three lights in the AOA indexer shall illuminate one at a time during the test sequence.
2. The AOA indicator shall slew to the zero end of the scale.
3. The AOA indicator OFF flag shall be displayed as well as the following CAS messages:
    a. STALL WARN L-R
    b. AOA PROBE FAIL L
4. After a few seconds, the AOA OFF flag shall be removed and the indicator will move up scale.
5. As the pointer approaches .60, the INDEXER lights (if installed), shall cycle from yellow to green to red.
6. At approximately .80 normalized angle-of-attack (AOAN), the stick shaker should actuate. Vibration from left stick shaker should be felt through both control columns.
7. System should return to normal operation after a few seconds.

Digital crew alerting system (CAS) messages of an amber AOA PROBE FAIL L-R, and a red AUTO SLATS FAIL will appear in the engine indicating and crew alerting system (EICAS). If hydraulic pressure is available, the slats will deploy during this test. The AUTOSLATS FAIL message should extinguish when the rotary test switch is rotated out of the AOA position.

ELECTRICAL

DESCRIPTION

The electrical power system consists of dual twenty cell 44 ampere-hour nickel cadmium batteries or optional lead-acid batteries, two engine driven brushless generators rated at 400 amperes up to 41,000 feet and 300 amperes above 41,000 feet, two three-phase 115/200 volt, three kilovolt-ampere (KVA) engine driven alternators (AC generators having a variable frequency of 200 to 400 cycles, depending on engine speed), two generator control units, two alternator control units, two battery ON-OFF switches, a load shed override/emergency switch (LOAD SHED O'RIDE/NORM/EMER), an avionics power switch, an engine instrument and crew alerting system (EICAS) power switch, two generator control switches, a direct current (DC) ammeter for the auxiliary power unit (APU), an external power control switch, and a receptacle located below the right pylon for connection of an external power unit. A 400 ampere on-board auxiliary power unit is installed for use during in-flight or ground operations; it can be started and used up to an altitude of 31,000 feet.

The only function of the AC generating system is to provide power for the windshield anti-ice system.

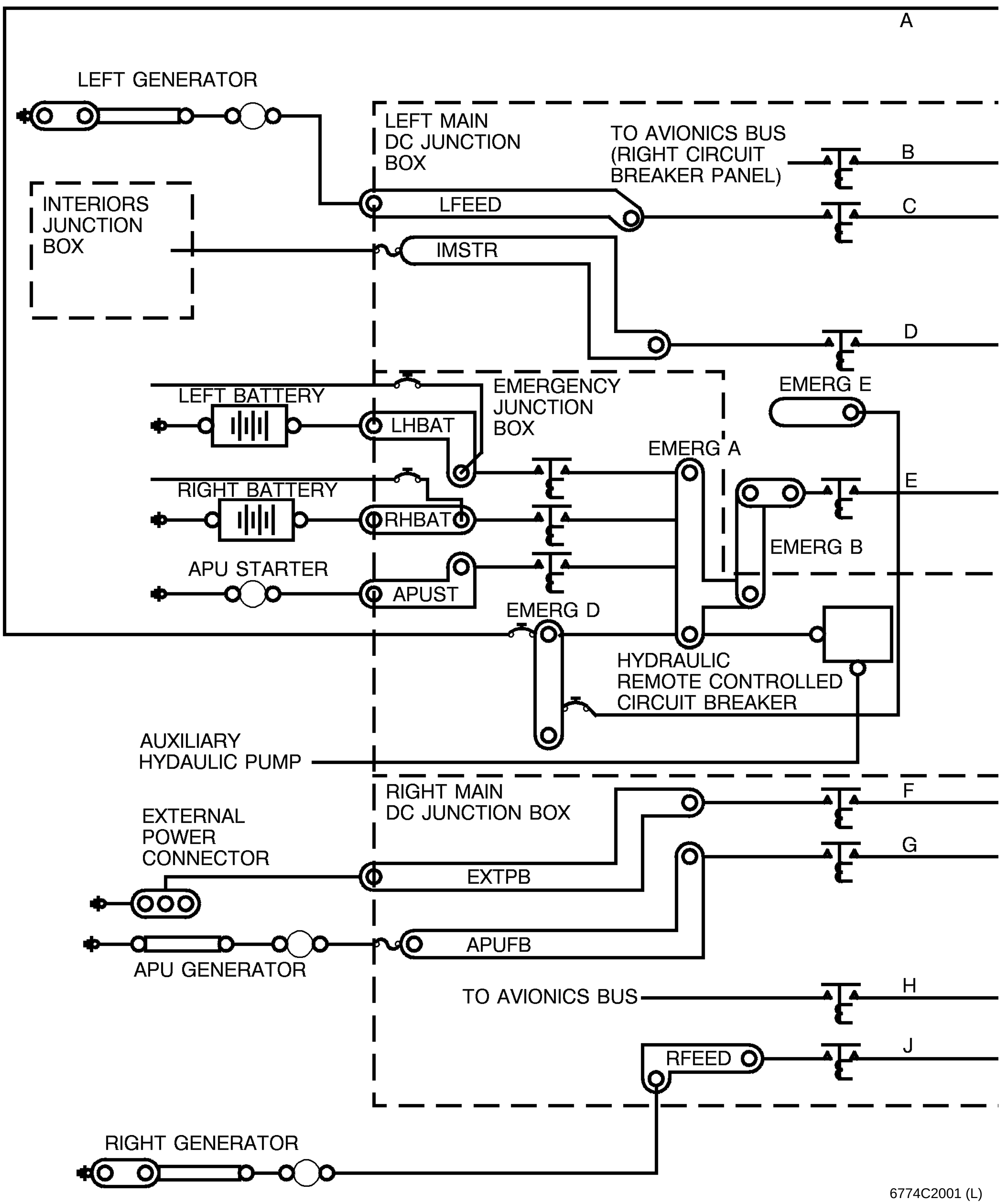
DIRECT CURRENT (DC) POWER

DC power required to operate the airplane and all DC operated equipment is provided by the engine driven generators, the dual battery installation, and the on board auxiliary power unit (APU). Normally, the left generator powers the left main DC bus and right main DC bus is powered by the right generator. Both operate in parallel, but in the event either generator is off the line, a crossfeed bus acts as a cross tie so that the remaining generator will power both main DC buses. These buses supply power for all DC functions. An emergency DC bus is provided so that, in an emergency situation, the main busses may be deenergized to prevent excess current drain. The emergency DC bus powers equipment that is essential to flight; the airplane batteries will support equipment powered by it for a minimum of thirty minutes.

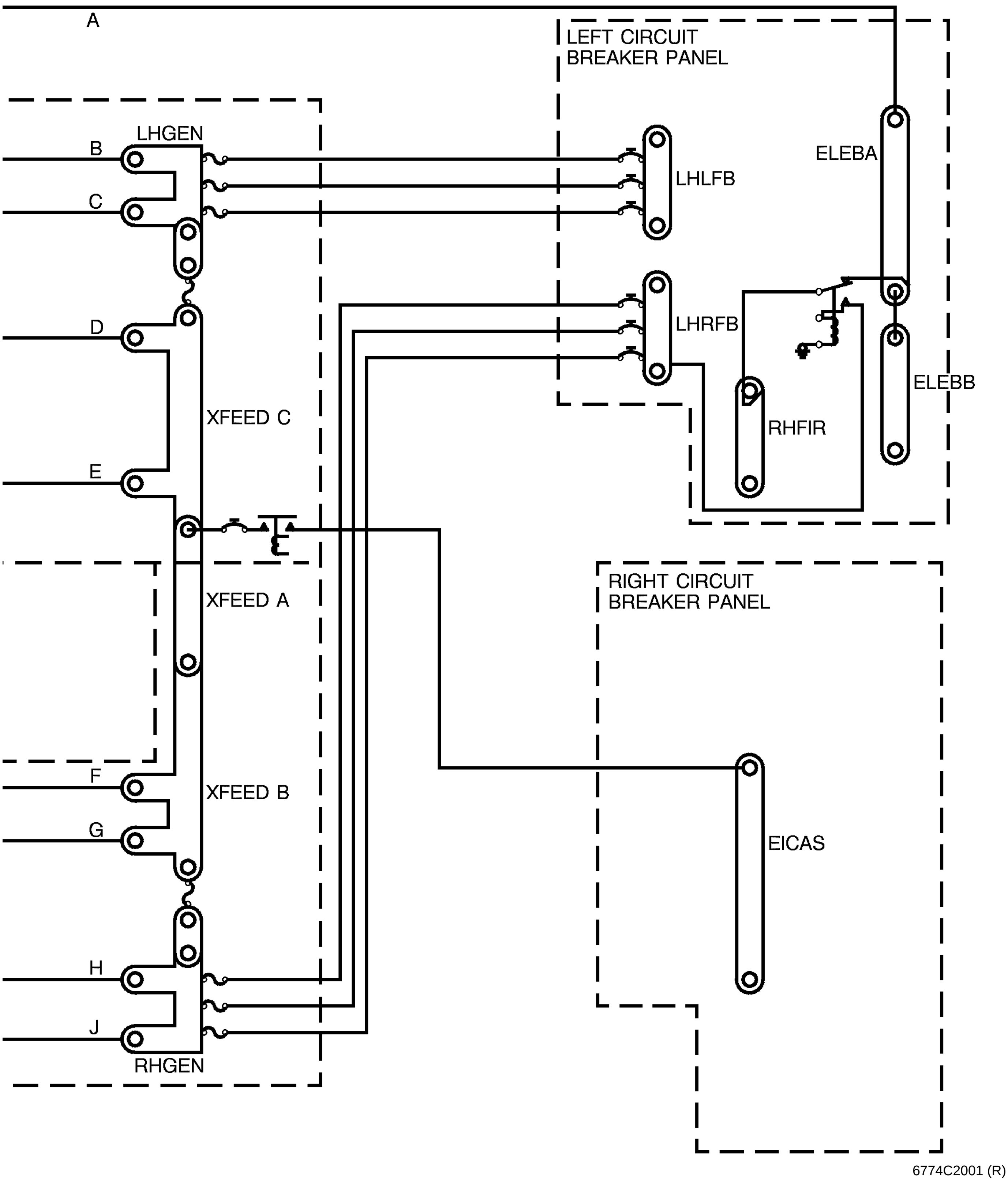
DIRECT CURRENT (DC) POWER INDICATORS

The voltage and amperage of the engine driven DC generators can be read on the crew alerting system (CAS) section of the EICAS display unit. In order to read the information, the ELEC bezel button must be depressed; the voltage and amperage of both generators and the temperature of both batteries may be then read simultaneously. Eight different digital EICAS messages may be annunciated to apprise the crew of abnormal electrical system operation; the ELEC bezel button can then be pressed to read the specific system condition. The APU has its own ammeter which is located on the copilot's meter panel.

Unless the ELEC bezel button is depressed, routine monitoring of the electrical system is not available, however, any abnormal condition will be presented on the EICAS display as a red, amber, or cyan digital message. When a red message appears, the message will also appear on the cross-side multifunction display (MFD) and the master warning and the message will flash until the message is acknowledged. An amber message will cause the master caution light to illuminate steadily, and the message will flash until it is acknowledged. Cyan advisory messages will appear and flash for five seconds and then annunciate steadily. The messages which can be presented are: BATT 1-2 O'TEMP (red), GEN OFF L-R (red or amber, depending on whether 1 or 2 generators have failed), BUS CTRL 1-2 FAIL (amber), BUS ISO OPEN L-R (amber), LOAD SHED (amber), LOAD SHED OVERRIDE (cyan),



Power Distribution Schematic
Figure 2-34 (Sheet 1 of 2)



Power Distribution Schematic
Figure 2-34 (Sheet 2 of 2)

REMOTE CB TRIPPED (cyan), and DC BEARING L-R-APU (cyan). Specific causes for the appearance of the above messages are covered under Engine Indicating and Crew Alerting System (EICAS) in this section. The ammeters function as loadmeters, indicating the load being carried by each generator or by the onboard auxiliary power unit. When the auxiliary power unit is in operation output current can be monitored at all times on the APU ammeter (DC AMPS APU) which is mounted on the copilot's meter panel.

AUXILIARY POWER UNIT AMMETER

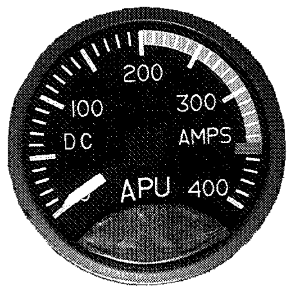


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Figure 2-35

Should either generator fail, the associated power relay will open, removing the generator from the system and the respective EICAS amber digital GEN OFF L-R annunciation will be presented in the CAS message area of the EICAS display unit, in the flashing mode, and the MASTER CAUTION will illuminate. Should both generators fail, the master warning light will illuminate in the flashing mode and the message, concerning both generators, will be displayed in red in the flashing mode. Acknowledging the CAUTION or WARNING annunciations will turn off the respective CAUTION or WARNING and stop the flashing of the message.

GENERATORS

Each engine is equipped with a generator rated at 400 amperes (300 amperes above 41,000 feet) that is self cooled on the ground and is cooled by ram air when in flight. The generator serves two functions: (1) to generate direct current (DC) power to the airplane systems and, (2) to charge the airplane batteries and the standby battery.

The generators normally provide 28.5 volts direct current (DC) to their own busses; generator number one to bus number one (left main bus) and generator number two to bus number two (right main bus). An overvoltage of approximately 32 volts will result in a generator being tripped off the line. The generators have an overcapacity of 150% for 5 minutes and 200% for 20 seconds, which will normally give the crew time to consider the required load shedding in case of loss of one generator. An automatic load shedding device is installed, however, if automatic load shedding is desired. Refer to Loadshed System in this section.

The engines are normally started with the generator switches (DC POWER LH GEN/OFF/RESET and RH GEN/OFF/RESET) in the GEN position, however, if external power is used during the start, the GEN switch may be positioned to OFF, if desired. If the engines are started with the generator switches in the GEN position, the generator control units (GCU) will bring their respective generators on line automatically when they reach a minimum RPM. When an airplane engine driven generator or the APU generator comes on line, the ground power unit (GPU) is automatically disconnected.

The RESET position of the generator control switches is a momentary position, and is used to reset the generators before placing them into operation when there has been a system trip.

Each generator is wired directly to the aft power junction box, and each has electrical terminal filtering to suppress radio noise output. A single generator is capable of supporting the entire electrical system requirements. Generator limitations are the same whether one or both generators are in operation.

Operation of the generators is controlled by two generator control units (GCU) that are installed on the tailcone electrical equipment rack in the lower forward tailcone compartment. The on-board auxiliary power unit (APU) also has a GCU which is mounted in the same area. The GCU units provide the following features: (1) voltage regulation at 28.5 volts throughout the rated load and temperature range, (2) load sharing to a tolerance of within ten percent (amperage) of the indicated load in parallel operation, (3) overvoltage protection, (4) reverse current control, (5) ground fault protection and (6) overspeed sensing and consequent protection from damage that might result from a sheared generator shaft. The generators are also protected from overload/overspeed by a shear shaft in the generator drive.

ELECTRICAL POWER/ENGINE CONTROL PANEL

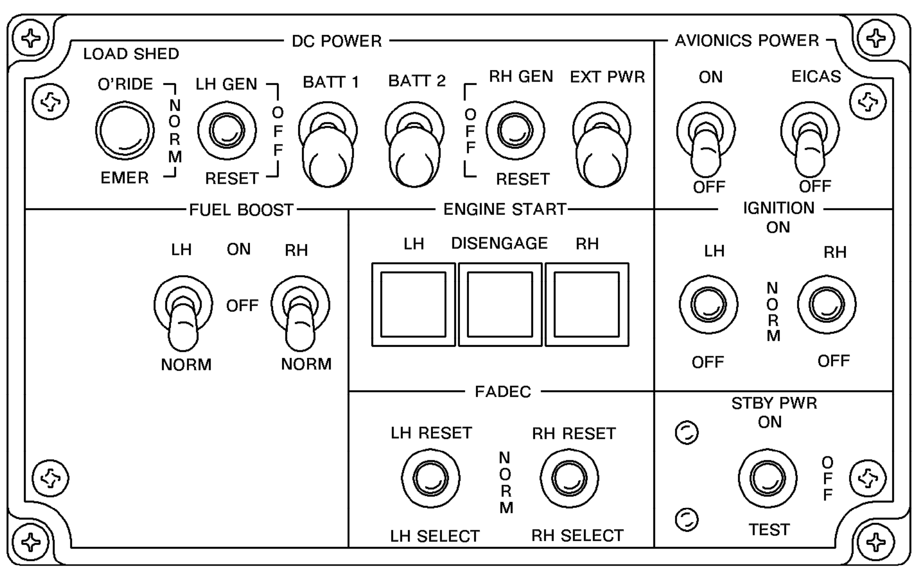


Figure 2-36

An overvoltage protection system is provided during use of an external power unit. The control unit monitors the external power unit voltage and will de-energize the external power relay, removing power, if the voltage exceeds 32 volts. External power cannot be reapplied to the airplane until the voltage is reduced below 32 volts.

GENERATOR CONTROLS AND SWITCHES

A three position generator switch, located on the tilted panel (DC Power Panel), immediately to the left of the pedestal, is provided for each generator. The switch is labeled LH (RH) GEN, OFF and RESET. Selecting the GEN (ON) position with the engine running will extinguish the amber GEN OFF L-R EICAS annunciation and will supply a signal to the generator control unit which monitors the battery bus voltage, and will connect the generator to the bus, unless voltage or amperage is such that the generator control unit (GCU) will not parallel the generator with other(s) which may be on the line, or voltage is otherwise out of tolerance. Placing the switch to the OFF position will disable the signal to the generator control unit, the generator will be dropped off the line, and the amber GEN OFF L-R annunciation will appear. The RESET position is a momentary position that will momentarily connect the armature directly to the field creating a rapid buildup to 28.5 volts. The switch is spring loaded from the RESET back to the OFF position; therefore, it must be manually positioned to GEN when the RESET feature is utilized, and the generator will then come back on line. The RESET position will reset a generator that has been tripped as a result of an overvoltage, feeder fault, or if the fuel and hydraulic firewall shutoff valves have been activated. Generator operation will again be disabled during reset attempts if the fault still exists or until firewall shutoff valves have been deactivated. The MASTER WARNING indicator will flash at any time both generators have faulted or have been tripped off the line for any reason, and a red EICAS message GEN OFF L-R will appear in the flashing mode. An attention tone will also be heard, and if the voice warning system is installed a voice synthesis will be heard until the annunciation is acknowledged.

DIRECT CURRENT (DC) POWER GENERATION AND DISTRIBUTION

DC power originating from the batteries, airplane generators, on board auxiliary power unit or ground external power sources, is initially controlled with different main DC power buses being activated by current switching relays located in the aft power junction box. The junction box is constructed in three sections and is located at the forward end of the baggage compartment on the aft side of a pressure bulkhead. A small isolated section of the main electrical power junction box contains components of the electrical emergency system. Three separate cables from each section of the junction box route DC power to the right and left circuit breaker panels in the cockpit. “Crossover” busses are used to permit convenient grouping of related equipment. The entire system is protected by current limiters and circuit breakers. Current limiters of 275 amperes capacity protect each connection between the crossfeed bus, and the left and right main generator busses. An isolation relay separates the DC emergency bus from the crossfeed bus so that, if required, the emergency bus may be separated from the other busses and their loads.

The interior master bus is separated from the crossfeed bus by the interior master relay. In an emergency the interior master switch may be turned off, deactivating the relay and removing power from the interior bus and the interior junction box. Operation of the interior master switch can reduce the entire airplane electrical demand to below the capacity of a single engine driven generator.

Safety and Protective Features of the System Are:

- When any generator is connected to the distribution bus, application of external power will be prevented.
- Ground external power overvoltage protection is provided.
- Two separate and distinct distribution systems, and related subsystems, supply power.
- No malfunctioning power source can prevent the remaining power sources from furnishing power to essential loads.
- Individual, or collective disconnection of the electrical power sources, including batteries, is available in flight to the flight crew.
- When fuel and hydraulic firewall shutoffs are activated, the respective generators are deactivated, and cannot be reactivated until the fuel and firewall shutoffs are reopened.
- A single generator is capable of supporting the entire electrical system requirements within the altitude limitations defined in the FAA Approved Airplane Flight Manual.
- Generator overvoltage protection at 32.5, +0.5, -0.5 volts is provided.
- All circuit breakers are “trip free” and cannot be reset if a fault is present in the circuit.
- Each battery is provided with a separate switch to provide for individual battery disconnection.
- Electric engine starting, which can result in high battery temperature, is used only on the small APU engine. The airplane engines are started pneumatically.
- Generators are monitored for impending primary bearing failures by the EICAS system. If the system senses that a bearing will fail within ten operating hours a cyan EICAS message DC BEARING L-R-APU will be annunciated.
- The generators are equipped with secondary bearings which will maintain operation for up to twenty hours.
- Automatic load shed of nonessential electrical equipment is provided.
- Failure of bus tie fuse limiters will trigger an EICAS message.
- The airplane is equipped with an APU which is capable of airborne operation and which can be paralleled with the airplane generators.

ELECTRICAL COMPONENTS LOCATION

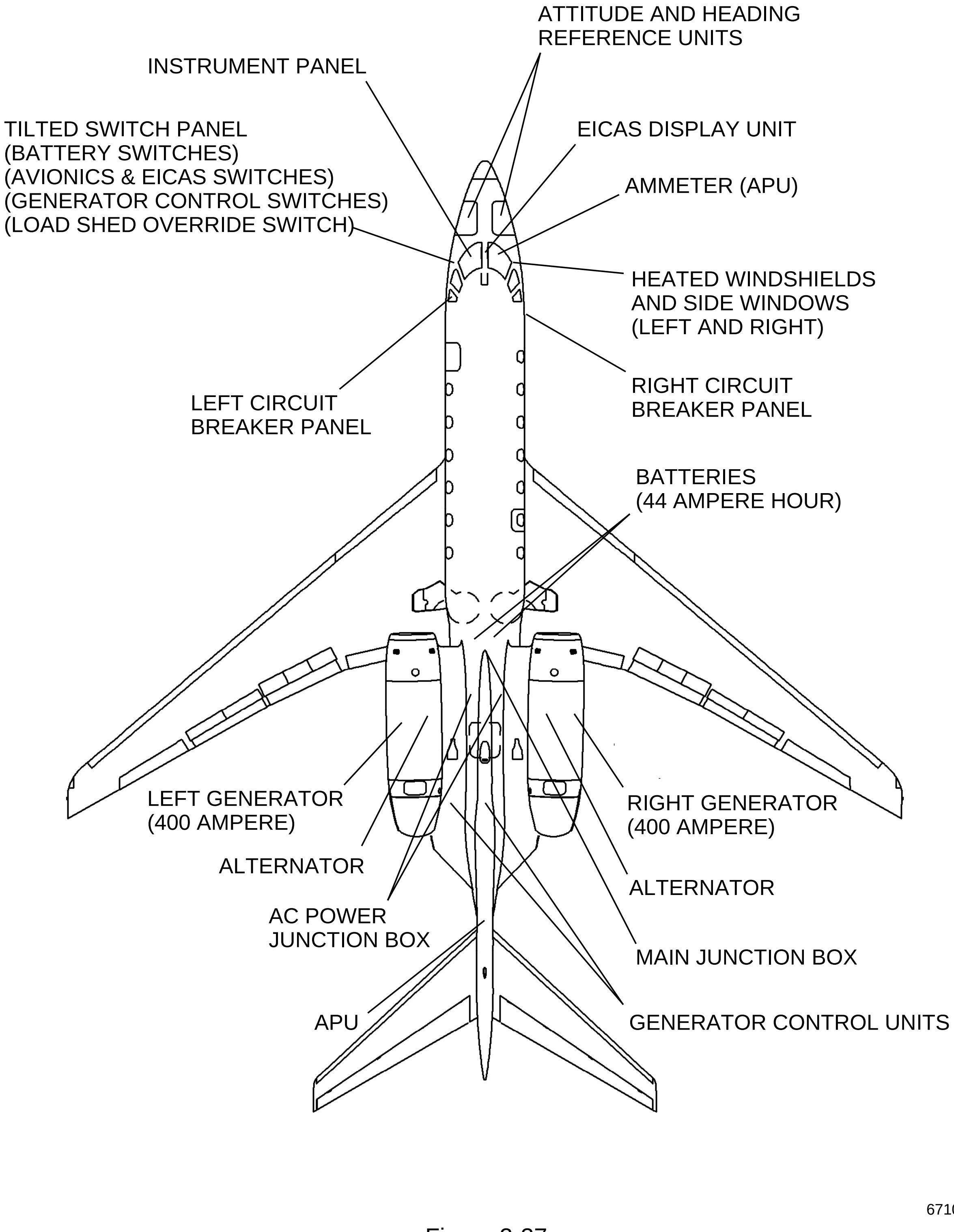


Figure 2-37

BATTERIES

Two 44 ampere hour batteries are connected directly to their respective left and right battery busses, which are connected, through power relays, to the emergency battery bus. Nickel cadmium or lead acid batteries are approved.

Each battery is controlled by its own BATT switch (BATT 1/OFF, BATT 2/OFF) located on the tilted panel immediately to the left of the center pedestal. This allows one battery to be isolated from the system, if necessary, by turning off its respective switch, and normal system operation can be continued. The batteries are a secondary source of direct current (DC) power that is used to provide power during the engine starting sequence and to provide power to the emergency battery bus in the event of a dual generator failure.

The batteries are located inside the aft fairing on either side of the airplane centerline just aft of the wing trailing edge. They are vented overboard through tubes located on the belly beneath the batteries. The 24 volt batteries are wired in parallel, through the left and right battery relays to increase the available amperage to the emergency bus, and through it, to the electrical system.

External power is applied to the external power bus when the ground power unit (GPU) is connected to the airplane and the GPU is started. When the external power relay is closed by placing the EXT PWR switch to EXT PWR (ON) the external power is applied to the crossfeed bus, and is available to the complete airplane electrical system. Ground external power will automatically be disconnected by the external power relay when a generator switch is placed to the GEN position after an engine has been started.

Both airplane batteries will charge from the ground power unit. With either battery switch in BATT and the ground power unit connected and in operation, external power will be applied to the airplane busses and the respective battery will be charged. The ground power unit should have the voltage adjusted to maintain 28.5 volts, +0.5 or -0.5 volts.

Nickel cadmium Battery temperature should remain below 60°C (140°F). A thermal monitoring system is installed as an integral part of each battery. The system provides continual monitoring of the internal thermal condition of the batteries and will warn the pilot that if battery overheat condition exists. If a temperature of 62.8°C or greater is sensed, it will illuminate a flashing red BATT 1-2 O'TEMP annunciation in the crew alerting system (CAS) area of the EICAS display unit. The master warning will also flash, and a double chime will sound. If the battery temperature continues to climb to 71°C, or if the second battery were to also exceed 62.8°C, the system will reactivate and will annunciate again. Refer to the Emergency Procedures section of the FAA Approved Airplane Flight Manual, or to Section Three of this manual for specific action to be taken when a battery overheat condition exists. Lead acid batteries do not have temperature monitoring; therefore, these procedures do not apply.

If the ELEC bezel button on the EICAS display unit (DU) is pressed, the electrical system can be continuously monitored on the one section (page) of the DU that is selectable by the pilots. The battery temperature can be monitored digitally as well as the generator voltage, battery voltage, and DC amperage. A battery temperature of greater than 20°C to 62.7°C will be digitally annunciated in green. A temperature of less than 20°C will be annunciated in amber. A temperature of 62.8°C will be annunciated in red; if the temperature rises above 71°C the same message will be triggered again.

The batteries must be serviced per the maintenance manual when the battery temperature exceeds 60°C (140°F).

The OFF position of the BATT switches disconnects battery power from all the electrical buses except the hot battery bus. Selection of BATT 1 or BATT 2 supplies power to the emergency bus, and through the emergency isolation relay, to the rest of the airplane busses.

When the battery switch is in the OFF position, certain electrical equipment will still operate, such as BATT 1 and BATT 2 sensing, certain forward and aft compartment lights, EICAS emergency power, and emergency exit lights, since power is taken directly from the hot battery bus.

INTERIOR MASTER SWITCH

A covered interior master switch, located just aft of the right circuit breaker panel, can be used to electrically isolate the cabin area, shutting off all power to it except emergency and exit lighting. Its primary purpose is to shut off power to the cabin in case of a cabin electrical fire, or of a generator failure. This amount of reduction will lower the electrical load to the point that a single generator will carry it, although a single generator will normally carry the regular electrical load of the airplane.

STANDBY POWER SWITCH

A standby power switch (STBY PWR ON/OFF/TEST) is located on the AVIONICS POWER panel, which is located next to the DC POWER PANEL on the pilot's tilted panel. This switch controls power distribution from the standby battery (standby equipment bus), located in the left side of the nose avionics compartment. This switch controls power to certain items of standby equipment whether they are receiving power from the usual airplane sources or from the standby battery. If the switch is ON and normal aircraft power sources are available, it will cause those items to which it controls power, to receive power from the normal aircraft circuits. After loss of normal battery and generator power (and external power on the ground), with the switch ON, power will be supplied from the standby battery pack. Illumination of the amber light next to the switch indicates that the battery pack is supplying the power to the standby altimeter/airspeed indicator vibrator, the standby attitude indicator, and the standby engine indicators. Following loss of regular power, these standby items will be powered by the standby battery for a minimum of thirty minutes. In the OFF position, the standby equipment bus is not powered, regardless of other airplane electrical configuration. When the switch is held to the spring-loaded TEST position, a self-test of the battery and circuits is accomplished. The green light next to the switch will illuminate if the test is satisfactory and the battery is sufficiently charged. The standby battery is a lead-acid type which is kept charged by the airplane electrical system.

LOAD SHED OVERRIDE SWITCH

An automatic load shed switch (LOAD SHED O'RIDE/NORM/EMER) is located on the upper left corner of the DC POWER panel on the pilots' tilt panel. Its function is to control the isolation relay which connects the crossfeed and emergency busses. In the NORM position, the isolation relay will be closed at any time the airplane is on the ground, or in flight with one generator (including the APU) on the line.

CAUTION

WITH LOAD SHED OVERRIDE SELECTED AND THE GENERATORS OFF LINE, BATTERY ENDURANCE WILL BE LESS THAN 30 MINUTES, IN NON-ICING CONDITIONS. TURN OFF ALL UNNECESSARY EQUIPMENT.

In flight with all three generators off the line and the load shed switch in NORM, the bus isolation relay will automatically open approximately 70 seconds after the last generator goes off the line. All power will then be removed from the crossfeed bus, and the emergency busses, including the emergency extension bus, the avionics emergency bus, the APU bus, and the APU starter will be supplied with power from both airplane batteries. If the EMER position of the load shed override switch is selected while any generator is on the line, no bus will lose power. With no generator on the line, with the battery switches ON, if EMER position is selected, the isolation relay will be opened and power will be supplied from the batteries to the emergency busses only. If the O'RIDE position is selected with no generators on the line, the automatic load shedding function of the system is overridden and no busses will be dropped off the line; the bus isolation relay will be closed and all busses will be powered by the batteries. If the APU generator is in operation, the load shed function is inhibited.

NOTE

- With load shed override and generators off line, battery endurance will be less than 30 minutes. Turn off all unnecessary equipment.

- With LOAD SHED switch in EMER (or NORM, following automatic load shed), electrical power will be supplied to the following equipment for approximately 30 minutes:

Both Rudders Limiters
Pilot and Copilot Audio Panels
Audio Warnings *******
VHF Comm 1
VHF Nav 1
RMU 1
Standby Nav/Comm
(Honeywell radios only)
Standby HSI
Standby Attitude *****
Standby Pitot/Static Heat
Auxiliary Panel Lights
AHRS 1 or IRS 1
Emergency Lighting ******
MADC 1
LH Windshield Heat

"A" AUX Hydraulic Pump
Upper Rudder Actuator
Pitch Feel
Rudder Trim
Aileron Trim
Secondary Stabilizer Trim
APU

Engine Start Logic
Both Engine A and B FADECs
Engine Fire Detect and Extinguishers
Firewall Shutoff - Fuel and Hydraulic
Standby Engine Instruments *****
Landing Gear Control and Indicator
Lights (except retract)
HF Radio 1 (750-0023 and on, if installed)

***** Powered by standby battery ****** Also powered by emergency light battery pack
******* Secondary pitch trim clacker and pilot's overspeed warning only

EMERGENCY LIGHTING BATTERIES

Two 1 ampere-hour 18-cell nickel cadmium battery packs are installed in the airplane; one in the pilot's console and one in the left side of the raised aisle at the aft end of the cabin. The battery packs are connected to the airplane charging system and are being charged any time the main airplane power is on. An emergency lighting switch (EMERG LT ARM/ON/OFF), located at the left end of the pilot's tilt panel, is used to control the emergency lighting system and the emergency battery packs. The ON position directs power to the emergency lighting system from the main batteries/generators. The ARM position will provide power to the emergency lighting system from the emergency battery packs in the event the airplane should experience a 5G longitudinal deceleration, or if there is a loss of normal airplane power. The OFF position disables the emergency lighting system and the

EMERGENCY BUS SCHEMATIC

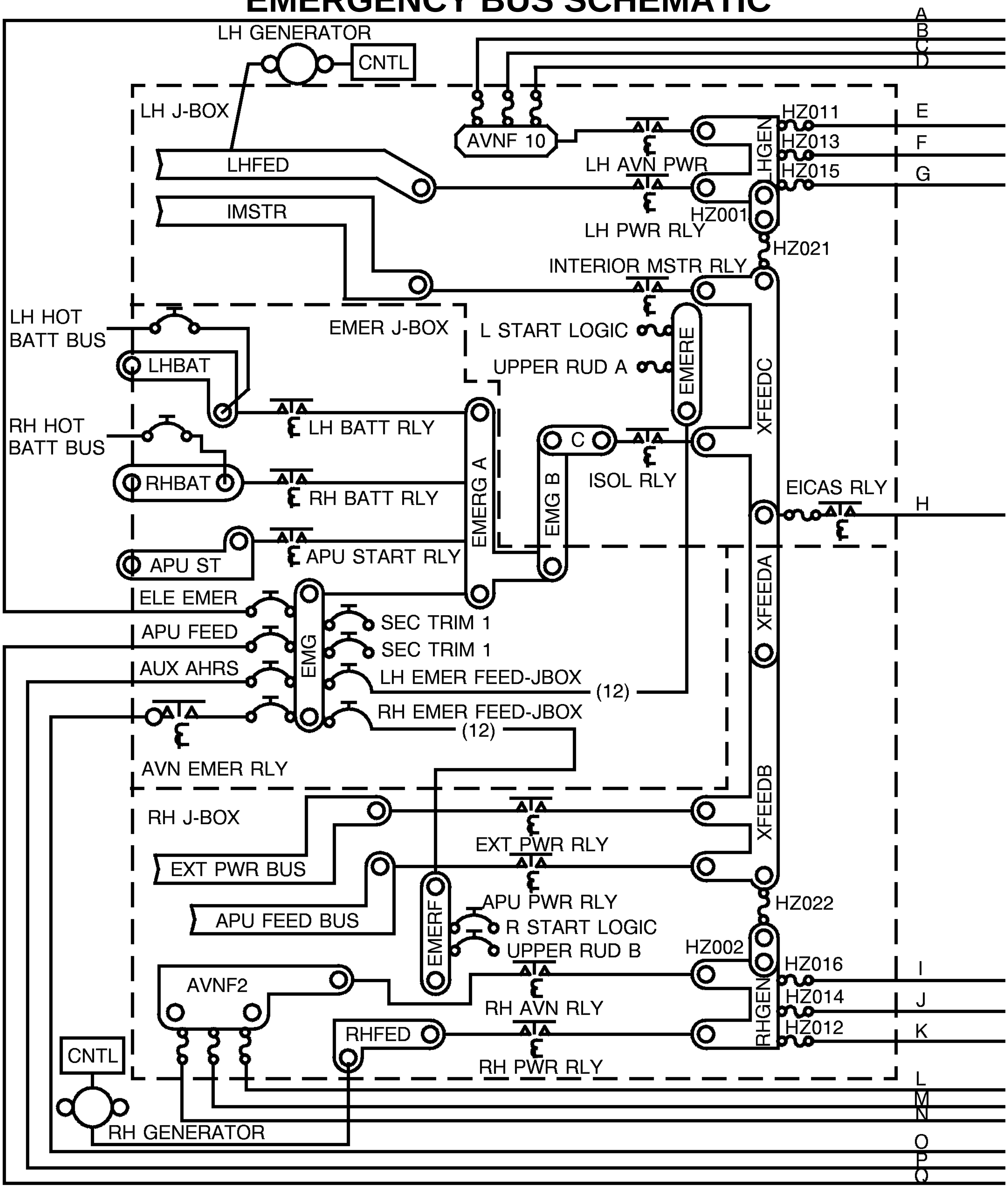


Figure 2-38 (Sheet 1 of 2)

6774C2001 (L)

EMERGENCY BUS SCHEMATIC

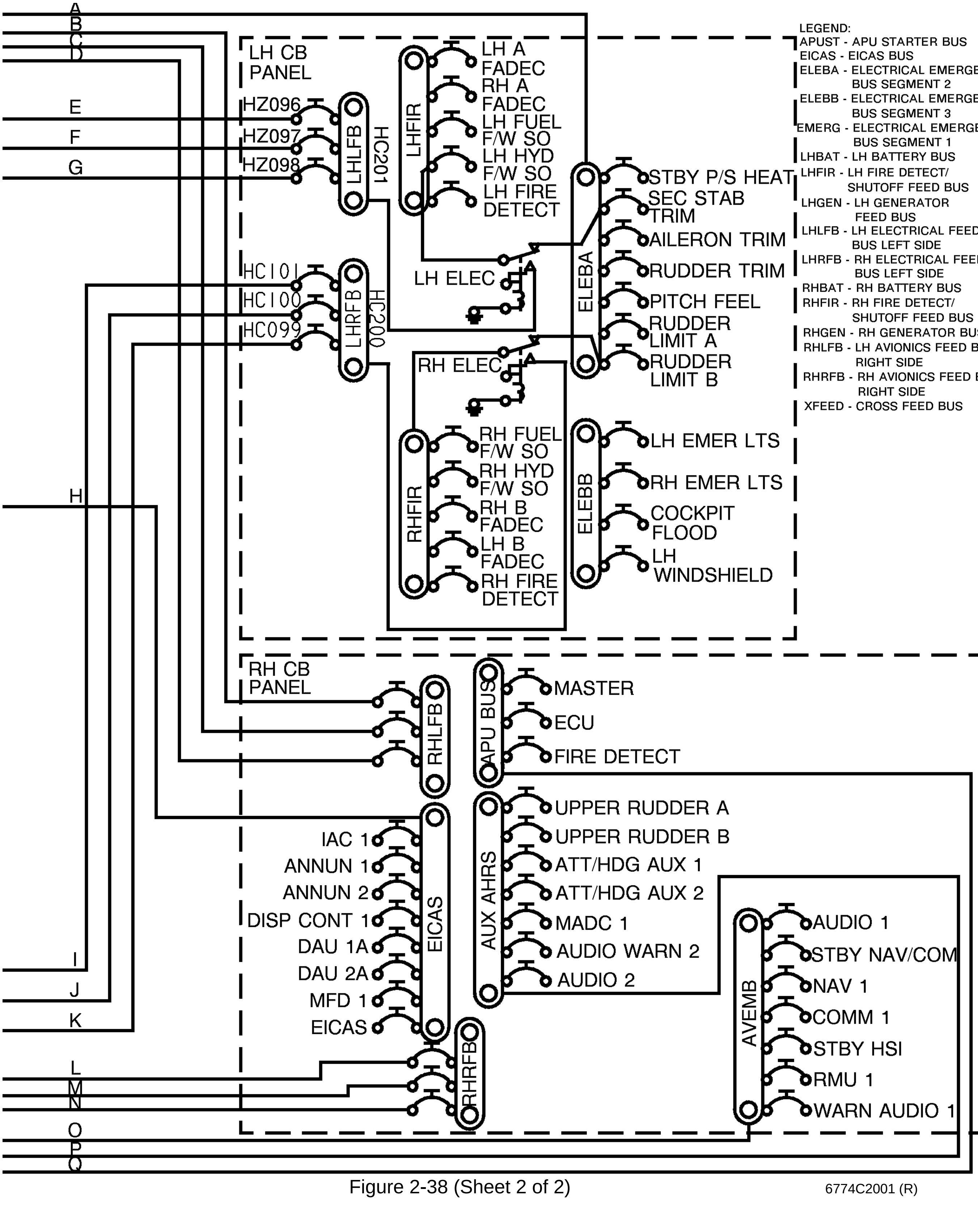


Figure 2-38 (Sheet 2 of 2)

6774C2001 (R)

emergency battery packs. An amber warning light, located adjacent to the EMER LT switch, will illuminate when power is on the airplane, signifying the emergency lighting is off and that the EMER LT switch should be placed to the ARM position.

The battery packs provide the power for the cabin emergency lights, selected reading lights, and the cabin exit signs, and escape path lighting. One pack is dedicated to the cockpit and forward cabin while the second pack powers the mid and aft cabin emergency lighting. The batteries also provide power for the SEAT BELT and NO SMOKING illuminated signs.

AUXILIARY POWER UNIT

An auxiliary power unit (APU) is mounted in the stinger of the airplane. The APU turbine powers a DC generator which has a rated capacity of 200 amperes in flight and 300 amperes on the ground. It may be started and used up to an altitude of 31,000 feet. It may also be used to provide engine starting air and auxiliary bleed air for the air conditioning system and for door seal inflation, and therefore makes the airplane largely self sustaining on the ground.

Engine power for the APU is provided by a simple turbine using a single-stage centrifugal compressor and a single stage radial inflow turbine. Turbine maximum rated speed is 58,737 RPM with a maximum continuous exhaust gas temperature of 665°C; a temperature of 718°C constitutes an overtemperature condition. Maximum start temperature is 973°C.

APU electrical power is controlled by a generator control unit (GCU) which is mounted in the tailcone aft of the cabin pressure bulkhead, with the engine generator GCUs. Fuel for the APU operation is provided from the left wing fuel hopper by the left fuel boost pump. The fuel boost pump is started, if not already running, any time the APU is put into operation. The APU is so designed that shaft loads (electricity generation) will have priority over an air bleed load. If the APU load is excessive, with air bleed and generator output being used, the amount of air output will be reduced by the load control valve (LCV) in order to maintain the APU load within its capacity.

The APU control panel is mounted in the cockpit forward of the right circuit breaker panel. APU RELAY ENGAGED and APU FAIL annunciator lights are mounted on the right meter panel. A logic control module, which provides an interface for the aircraft mounted controls and the APU digital engine sequencing unit (ESU), is located in the right main power junction box. The ESU is essentially a microprocessor that has been programmed to control and initiate a series of events necessary for satisfactory operation of the auxiliary power unit. Functions which are controlled by this logic are auxiliary power unit start and sequence to operation, malfunction indication and automatic shutdown during start, and malfunction indication and shutdown during auxiliary power unit operation. The logic also sequences itself to restart condition on reapplication of power to the system after a shutdown.

The APU MASTER ON/OFF switch controls electrical power to the APU. The TEST/PUSH switch causes the APU to repeat its internal tests. The APU/START/NORM/STOP switch is spring loaded to NORM and is used to start or shut down the APU. The APU STARTER DISENGAGE/NORMAL switch is spring loaded to NORMAL and is used to disengage the APU starter if it does not disengage normally. A READY TO LOAD annunciator will illuminate when the APU has started and is ready for the generator to be put on the line. The BLEED AIR MAX COOL/ON/OFF Switch controls the APU bleed air. The ON position is used for normal environmental bleed air extraction and for cooling. The maximum flow valve bypasses the bi-level flow control valves and, therefore, will not shut off environmental air during engine start. The APU MAX COOL bleed air is not approved for engine start; the start pressure could be low, which would result in a hung start.

On starting, when the engine speed reaches approximately ten percent, the APU electronic control box (ECB) completes a circuit to the fuel shutoff valve, ignition unit, and surge control valve. The fuel shutoff valve is then energized open to permit fuel flow to the fuel nozzle assemblies, and the ignition fires the fuel-air charge in the combustion chamber. The surge control valve is energized open to permit reaction to compressor discharge pressure. When engine speed reaches 50 percent, the controller provides a signal for starter disengagement. At approximately 60 percent RPM compressor discharge pressure opens the surge control valve and dumps a small percentage of compressor discharge air overboard, preventing engine surge. At 99 percent the controller opens the circuits to the ignition unit, and acceleration continues to the no-load govern speed point. At governed engine speed the turbine discharge temperature is automatically regulated to within established limits by the load control valve.

NOTE

Refer to the FAA Approved Airplane Flight Manual for auxiliary power unit operating limitations and procedures.

Fire protection is provided by a fire detector system and a fire extinguisher system. An associated warning light/switch (APU FIRE) located on the copilot's instrument panel will illuminate in case of an APU fire. An aural tone will also sound. The fire detector sensor is of the continuous loop gas filled type, which is routed around the APU at strategic points, and which is connected to an alarm responder and to an integrity responder. A dedicated fire bottle is installed below the APU. The fire bottle is fired by lifting the cover on the illuminated APU FIRE switch/light and pressing the switch; it does not discharge automatically.

The APU is designed to handle full cabin loads prior to main engine starts. The APU is started electrically and can be started and operated up to a maximum altitude of 31,000 feet. It can be paralleled with the engine driven generators. Parallel operation is considered to be a variance of 10% of the amount of the maximum rated amperage; therefore, a load variation of 40 amperes is acceptable. The APU ESU stores APU system fault data in a non-volatile memory and retains it from the last five APU cycles. If the APU is on the line or operating in parallel with the engine generators, the automatic load shedding function of the electrical system is inhibited. The APU directly feeds the crossfeed/emergency bus. At least one battery switch must be on to operate the APU.

An APU shutdown switch is located inside the tailcone access door on the right aft side of the door frame, to permit APU shutdown without requiring cockpit access.

AVIONICS POWER

Power to the avionics is controlled by an AVIONICS POWER ON/OFF switch located on the AVIONICS POWER control panel, which is immediately to the right of the DC POWER control panel. When in the ON position all avionics equipment receives power. An EICAS/OFF switch, just to the right of the ON/OFF switch, supplies power only to the engine instrument and crew alerting system (EICAS) bus (partial power). Only the left multifunction display (MFD) and EICAS system will then be powered. This switch allows the essential EICAS equipment to be powered for maintenance, and for other functions which require only engine information or EICAS readings, thereby saving power-up cycles and operating time on the complete EICAS system and the electronic flight instrument system (EFIS). The EICAS, EFIS, and other avionics systems of the Model 750 are direct current (DC), and therefore system inverters are not required.

EXTERNAL POWER SWITCH

An external power switch (EXT PWR/OFF) is mounted on the DC power control panel. Its function is to control the power from a ground power unit (GPU). In the EXT PWR position, external power is applied to the airplane busses, and overvoltage and undervoltage protection is provided, but the batteries will not charge unless the battery switch(es) is/are turned on.

WINDSHIELD ALTERNATING CURRENT (AC) ELECTRICAL ANTI-ICE SYSTEM

Windshield and forward cockpit side window anti-icing is provided by two 3.0 kilovolt-ampere alternators, one of which is mounted on the accessory drive case of each engine. They deliver three-phase alternating current (AC) power. The speed of the alternators is not governed, so their speed varies with engine speed, which causes the current cycle rate to vary. The cycle variations have no effect on the windshield heaters.

The windshields are divided into three heating sections; power from the left alternator is applied to the left outboard and center sections of the left windshield, to the right windshield inboard section, and to the right side window.

Power from the right alternator is applied to the right outboard and center sections of the right windshield, to the inboard section of the left windshield, and to the left side window.

Control switches for the system are located on the ANTI-ICE control panel which is located to the right of the center pedestal on the tilt panel (WINDSHIELD ANTI-ICE LH/RH). The three position toggle switches are labeled OFF/HT ON/O'RIDE. Placing the switches to HT ON (center position) will initiate a ramp heating function which will gradually warm the windshield to operating temperature. If anti-icing is needed immediately, such as when unexpected icing is encountered, the switches may be placed immediately to O'RIDE position and the ramp heating function will be bypassed. The switches are spring loaded out of the O'RIDE position and will automatically be positioned back to ON. The HT ON position should be used for normal operation.

Three integral temperature sensors are incorporated in each windshield assembly. One sensor is used as a primary sensor, and one as a secondary, or backup, sensor; the third is a spare. There is a control unit for each windshield side, mounted in the respective pilot or copilot side console. The control units monitor the windshield temperature through the primary sensor. If the primary sensor should develop a fault, the system will revert automatically to the secondary sensor, and temperature monitoring will not be interrupted. The left and right main windshields are regulated to a temperature of 110°F.

The engine and crew alerting system (EICAS) constantly monitors the windshield heat and will alert the crew of a fault or overtemperature condition. An amber EICAS message, WSHLD O'TEMP L-R will illuminate, and electric power to the windshield will automatically be cut off if windshield surface temperature exceeds 140°F. Power will be restored and an amber message will extinguish when the windshield surface temperature drops below 115°F. Another amber EICAS message, WSHLD HEAT INOP L-R, will illuminate if the electrical windshield controller is unable to supply current to the heater elements. When any of the above messages appear, a chime will sound.

The windshield anti-ice must be turned ON any time icing is detected. It may be operated full time from engine start to shutdown and will improve cockpit comfort at high altitude, particularly at night. Windshield anti-ice is also required for defogging the windshield.

ELECTRICAL

DESCRIPTION

The electrical power system consists of dual twenty cell 44 ampere-hour nickel cadmium batteries or optional lead-acid batteries, two engine driven brushless generators rated at 400 amperes up to 41,000 feet and 300 amperes above 41,000 feet, two three-phase 115/200 volt, three kilovolt-ampere (KVA) engine driven alternators (AC generators having a variable frequency of 200 to 400 cycles, depending on engine speed), two generator control units, two alternator control units, two battery ON-OFF switches, an emergency switch (NORM/EMER) an avionics power switch, an engine instrument and crew alerting system (EICAS) power switch, two generator control switches, a direct current (DC) ammeter for the auxiliary power unit (APU), an external power control switch, and a receptacle located below the left pylon for connection of an external power unit. A 400 ampere on-board auxiliary power unit is installed for use during in-flight or ground operations; it can be started and used up to an altitude of 31,000 feet.

The only function of the AC generating system is to provide power for the windshield anti-ice system.

DIRECT CURRENT (DC) POWER

DC power required to operate the airplane and all DC operated equipment is provided by the engine driven generators, the dual battery installation, and the on board auxiliary power unit (APU). Generator power is selected by the LH and RH GEN switches and the APU GENERATOR switch. In the LH GEN, RH GEN or APU ON position, the GCUs will place the respective generator on line, when the engines or APU are running. The left and right engine generators operate independently. There is no load parelleling. The APU generator will not come on line or will drop off line if the right engine generator is on line. The reset switch position is momentary and resets the GCU after a system trip has occurred. The left and right generators supply 28.5 VDC power to the RH feed bus and through the RH isolation relay, to the RH battery bus and through the crosstie relay and the LH isolation relay, to the LH battery bus.

DIRECT CURRENT (DC) POWER INDICATORS

The voltage and amperage of the engine driven DC generators can be read on the crew alerting system (CAS) section of the EICAS display unit. In order to read the information, the ELEC bezel button must be depressed; the voltage and amperage of both generators and the temperature of both batteries may be then read simultaneously. Eight different digital EICAS messages may be annunciated to apprise the crew of abnormal electrical system operation; the ELEC bezel button can then be pressed to read the specific system condition. The APU has its own ammeter which is located on the copilot's meter panel.

Unless the ELEC bezel button is depressed, routine monitoring of the electrical system is not available, however, any abnormal condition will be presented on the EICAS display as a red, amber, or cyan digital message. When a red message appears, the message will also appear on the cross-side multifunction display (MFD) and the master warning and the message will flash until the message is acknowledged. An amber message will cause the master caution light to illuminate steadily, and the message will flash until it is acknowledged. Cyan advisory messages will appear and flash for five seconds and then annunciate steadily. The messages which can be presented are: BATT 1-2 O'TEMP (red), GEN OFF L-R (red or amber, depending on whether 1 or 2 generators have failed), BUS CTRL 1-2 FAIL (amber), BUS ISO OPEN L-R (amber), REMOTE CB TRIPPED (cyan), and DC BEARING L-R-APU (cyan). Specific causes for the appearance of the above messages are covered under

ELECTRICAL SYSTEM BLOCK DIAGRAM

LEFT EXTENSION BUS

RIGHT EXTENSION BUS

LEFT
ELECTRICAL EXT
BUS (ON LEFT
C/B PANEL)

LEFT
AVIONICS EXT
BUS (ON RIGHT
C/B PANEL)

RIGHT
ELECTRICAL EXT
BUS (ON LEFT
C/B PANEL)

RIGHT
AVIONICS EXT
BUS (ON RIGHT
C/B PANEL)

L
MAIN
BUS

XTE

R
MAIN
BUS

L EMER

R EMER

APU

DC
BUS 1

GEN

DC
BUS 2

EICAS

BATT 1
BUS

BATT 2
BUS

FLAPS

GEN

BATT 1

BATT 2

INTERIOR
MASTER

(LEFT
ENGINE)

(RIGHT
ENGINE)

GEN

(APU)

6784T1006

Figure 2-34 Electrical Block Diagram and Power Distribution (Sheet 1 of 3)

ELECTRICAL SYSTEM (Continued)

POWER SOURCE/DISTRIBUTION STATUS						BUS STATUS/POWER SOURCE										
L GEN	R GEN	APU	BUS 2	BUS 1	XTIE	L MAIN	EICAS	L EXT	L BAT	L EMER	R MAIN	R EXT	R BAT	R EMER	APU	NOTES
INOP	GEN	- -	NORM	NORM	CLSD	R GEN	R GEN	R GEN	R GEN	R GEN	R GEN	R GEN	R GEN	R GEN	R GEN	
GEN	INOP	- -	NORM	NORM	CLSD	L GEN	L GEN	L GEN	L GEN	L GEN	L GEN	L GEN	L GEN	L GEN	L GEN	
INOP	INOP	GEN	NORM	NORM	CLSD	APU	APU	APU	APU	APU	APU	APU	APU	APU	APU	
INOP	INOP	INOP	EMER	EMER	- -	INOP	INOP	INOP	L BAT	L BAT	INOP	INOP	R BAT	R BAT	RBAT	1
GEN	GEN	- -	NORM	EMER	OPEN	L GEN	L GEN	L GEN	L BAT	L BAT	R GEN	R GEN	R GEN	R GEN	R GEN	1
GEN	GEN	- -	EMER	NORM	OPEN	L GEN	L GEN	L GEN	L GEN	L GEN	R GEN	R GEN	R BAT	R BAT	R BAT	1
INOP	GEN	- -	NORM	EMER	OPEN	INOP	INOP	INOP	L BAT	L BAT	R GEN	R GEN	R GEN	R GEN	R GEN	1, 2
GEN	INOP	INOP	EMER	NORM	OPEN	L GEN	L GEN	L GEN	L GEN	L GEN	INOP	INOP	R BAT	R BAT	R BAT	1, 2
GEN	INOP	INOP	NORM	NORM	OPEN	L GEN	L GEN	L GEN	L GEN	L GEN	R BAT	R BAT	R BAT	R BAT	R BAT	3
INOP	GEN	- -	NORM	NORM	OPEN	L BAT	L BAT	L BAT	L BAT	L BAT	R GEN	R GEN	R GEN	R GEN	R GEN	3

NOTES

1.) Battery endurance approximately 60 minutes.
2.) Failure probably due to affected side overcurrent fault. Isolation crosstie, relays and generator not resetable.
3.) Battery endurance approximately 14 minutes.

EXAMPLE: From the Power Source/Distribution Status side of the table, find the status of power distribution systems. For this example, we have selected L GEN, R GEN and APU as INOP, with DC Power BUS 1 and BUS 2 switches in EMER. Reading from left to right into the Bus Status/Power portion of the table, we can determine which buses are operating on what power source. The status of specific components can then be further cross-checked against sheet 3 of this Figure to determine if they are powered or inoperative give the power source/distribution status configuration.

Figure 2-34 Electrical Block Diagram and Power Distribution (Sheet 2 of 3)

ELECTRICAL SYSTEM (Continued)

LEFT HAND DISTRIBUTION BUSES

LEFT MAIN

L LANDING LIGHT
COCKPIT ECU
GRD RECOG LIGHTS
AHRS 1 (primary)
L FAIRING HT
FLAPS

EICAS

IAC 1
MFD 1
EICAS DISP
DAU 1 / 2 A
DISP CONT 1

LEFT BATT

ENTRY LIGHTS
BATT SENSE 1

LEFT EMER

L START LOGIC
AUX PANEL LTS
L W/S A/I CONT
L BLD PRECOOLER
SEC STAB TRIM
AILERON TRIM
PITCH FEEL
UPPER RUD/YAW DAMP A
RUD LIMIT A
BAT 1 AMMETER
WARN AUDIO 1
COM / NAV / RMU 1
TRANSPONDER 1 (opt)

STANDBY HSI
AHRS 1 AUX PWR
L FIRE DET / EXT
L F/W SHUTOFF
L & R FADEC A
L EMER LTS
AUDIO AMP 1
MADC 1
L. FUEL PUMP

LEFT EXTENSION

GPWS
ANTI-COL STROBE LTS
L WING INSP LT
L PANEL LT
CKPT FLOOD LT
L RAT, P/S, AOA HT
L A/I (fail valves open)
L FUEL TRANSFER
(fails current position)
L START VALVE
L/CTR FUEL QTY
L TLA DISCRETES
L STALL WARN/AOA
PAX OXY AUTO DROP
ANTI SKID
LH TR
(deploy & stow)
HYD CONT A (fails on)
FLAPS
SLAT CONT A
RADAR / LTG DET
L ENG BLEED
(valves fail open)
CKPT TEMP CONT
CABIN DOOR MONITOR
ADF 1
DME 1
RADALT 1
FLT PH / CAB INTCOM
GPS 1 / FMS 1
AP / FGC 1
DAU 1 B
FDR
TCAS
NORMAL
PRESSURIZATION

RIGHT HAND DISTRIBUTION

RIGHT MAIN

R. LANDING LT
TAXI LTS
CAB ECU (PAC)
BAG FAN
R. FAIRING HT
STBY INST (primary)
STBY BAT (charge)

RIGHT BATT

BATT SENSE 2

APU

APU PWR / SENSE
APU ECU
APU FIRE

RIGHT EMER

R START LOGIC
UPPER RUD/YAW
DAMP B
R BLD PRECOOLER
HF 1
AUDIO AMP 2
AUDIO WARN 2
AHRS 2 AUX PWR
MADC 2
R EMER LTS
STBY P/S HT
RUD TRIM
LDG GEAR
RUD LIM B
A AUX HYD PUMP
R FIRE DET / EXT
R FIREWALL SHUTOFF
L & R FADEC B
BAT 2 AMMETER

RIGHT EXTENSION

MAP LTS
R W/S A/I CONT
R RAT, P/S, AOA HT
R A/I (valves fail open)
PRI STAB TRIM
R FUEL BOOST
F FUEL TRANSFER
(fails current position)
R START VALVE
R FUEL QTY
R TLA DISCRETES
R STALL WARN / AOA
NOSE STEERING
R TR (deploy & stow)
HYD CONT B (Fails on)
PCU MONISOT
RUD STBY HYD
COM / NAV / RMI 2
TRANSPONDER 2
ADF 2
DME 2
HF 2
GPS / FMS 2
AP / FGC B
PFD / MFD 2
DISP CONT 2
DAU 2 B
NAV LTS
R & CTR PANEL LTS

STANDBY BUS

STBY ALT/AS VIB
STBY ATT INDICATOR
STBY ENG INST
STBY INST/LIGHTING

Figure 2-34 Electrical Block Diagram and Power Distribution (Sheet 3 of 3)

ELECTRICAL SYSTEM (Continued)

POWER SOURCE/DISTRIBUTION STATUS						BUS STATUS/POWER SOURCE										
L GEN	R GEN	APU	BUS 2	BUS 1	XTIE	L MAIN	EICAS	L EXT	L BAT	L EMER	R MAIN	R EXT	R BAT	R EMER	APU	NOTES
INOP	GEN	- -	NORM	NORM	CLSD	R GEN	R GEN	R GEN	R GEN	R GEN	R GEN	R GEN	R GEN	R GEN	R GEN	
GEN	INOP	- -	NORM	NORM	CLSD	L GEN	L GEN	L GEN	L GEN	L GEN	L GEN	L GEN	L GEN	L GEN	L GEN	
INOP	INOP	GEN	NORM	NORM	CLSD	APU	APU	APU	APU	APU	APU	APU	APU	APU	APU	
INOP	INOP	INOP	EMER	EMER	- -	INOP	INOP	INOP	L BAT	L BAT	INOP	INOP	R BAT	R BAT	RBAT	1
GEN	GEN	- -	NORM	EMER	OPEN	L GEN	L GEN	L GEN	L BAT	L BAT	R GEN	R GEN	R GEN	R GEN	R GEN	1
GEN	GEN	- -	EMER	NORM	OPEN	L GEN	L GEN	L GEN	L GEN	L GEN	R GEN	R GEN	R BAT	R BAT	R BAT	1
INOP	GEN	- -	NORM	EMER	OPEN	INOP	INOP	INOP	L BAT	L BAT	R GEN	R GEN	R GEN	R GEN	R GEN	1, 2
GEN	INOP	INOP	EMER	NORM	OPEN	L GEN	L GEN	L GEN	L GEN	L GEN	INOP	INOP	R BAT	R BAT	R BAT	1, 2
GEN	INOP	INOP	NORM	NORM	OPEN	L GEN	L GEN	L GEN	L GEN	L GEN	R BAT	R BAT	R BAT	R BAT	R BAT	3
INOP	GEN	- -	NORM	NORM	OPEN	L BAT	L BAT	L BAT	L BAT	L BAT	R GEN	R GEN	R GEN	R GEN	R GEN	3

NOTES

1.) Battery endurance approximately 60 minutes.
2.) Failure probably due to affected side overcurrent fault. Isolation crosstie, relays and generator not resetable.
3.) Battery endurance approximately 14 minutes.

EXAMPLE: From the Power Source/Distribution Status side of the table, find the status of power distribution systems. For this example, we have selected L GEN, R GEN and APU as INOP, with DC Power BUS 1 and BUS 2 switches in EMER. Reading from left to right into the Bus Status/Power portion of the table, we can determine which buses are operating on what power source. The status of specific components can then be further cross-checked against sheet 3 of this Figure to determine if they are powered or inoperative give the power source/distribution status configuration.

Figure 2-34 Electrical Block Diagram and Power Distribution (Sheet 2 of 3)

ELECTRICAL SYSTEM (Continued)

LEFT HAND DISTRIBUTION BUSES

LEFT MAIN

L LANDING LIGHT
COCKPIT ECU
GRD RECOG LIGHTS
AHRS 1 (primary)
L FAIRING HT
FLAPS

EICAS

IAC 1
MFD 1
EICAS DISP
DAU 1 / 2 A
DISP CONT 1

LEFT BATT

ENTRY LIGHTS
BATT SENSE 1

LEFT EMER

L START LOGIC
AUX PANEL LTS
L W/S A/I CONT
L BLD PRECOOLER
SEC STAB TRIM
AILERON TRIM
PITCH FEEL
UPPER RUD/YAW DAMP A
RUD LIMIT A
BAT 1 AMMETER
WARN AUDIO 1
COM / NAV / RMU 1
TRANSPONDER 1 (opt)
STANDBY NAV/COM
STANDBY HSI
AHRS 1 AUX PWR
L FIRE DET / EXT
L F/W SHUTOFF
L & R FADEC A
L EMER LTS
AUDIO AMP 1
MADC 1
L. FUEL PUMP

LEFT EXTENSION

GPWS
ANTI-COL STROBE LTS
L WING INSP LT
L PANEL LT
CKPT FLOOD LT
L RAT, P/S, AOA HT
L A/I (fail valves open)
L FUEL TRANSFER
(fails current position)
L START VALVE
L/CTR FUEL QTY
L TLA DISCRETES
L STALL WARN/AOA
PAX OXY AUTO DROP
ANTI SKID
LH TR
(deploy & stow)
HYD CONT A (fails on)
FLAPS
SLAT CONT A
RADAR / LTG DET
L ENG BLEED
(valves fail open)
CKPT TEMP CONT
CABIN DOOR MONITOR
ADF 1
DME 1
RADALT 1
FLT PH / CAB INTCOM
GPS 1 / FMS 1
AP / FGC 1
DAU 1 B
FDR
TCAS
NORMAL
PRESSURIZATION

RIGHT HAND DISTRIBUTION

RIGHT MAIN

R. LANDING LT
TAXI LTS
CAB ECU (PAC)
BAG FAN
R. FAIRING HT
STBY INST (primary)
STBY BAT (charge)

RIGHT BATT

BATT SENSE 2

APU

APU PWR / SENSE
APU ECU
APU FIRE

RIGHT EMER

R START LOGIC
UPPER RUD/YAW
DAMP B
R BLD PRECOOLER
HF 1
AUDIO AMP 2
AUDIO WARN 2
AHRS 2 AUX PWR
MADC 2
R EMER LTS
STBY P/S HT
RUD TRIM
LDG GEAR
RUD LIM B
A AUX HYD PUMP
R FIRE DET / EXT
R FIREWALL SHUTOFF
L & R FADEC B
BAT 2 AMMETER

RIGHT EXTENSION

MAP LTS
R W/S A/I CONT
R RAT, P/S, AOA HT
R A/I (valves fail open)
PRI STAB TRIM
R FUEL BOOST
F FUEL TRANSFER
(fails current position)
R START VALVE
R FUEL QTY
R TLA DISCRETES
R STALL WARN / AOA
NOSE STEERING
R TR (deploy & stow)
HYD CONT B (Fails on)
PCU MONISOT
RUD STBY HYD
COM / NAV / RMI 2
TRANSPONDER 2
ADF 2
DME 2
HF 2
GPS / FMS 2
AP / FGC B
PFD / MFD 2
DISP CONT 2
DAU 2 B
NAV LTS
R & CTR PANEL LTS

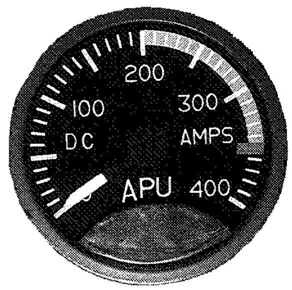
STANDBY BUS

STBY ALT/AS VIB
STBY ATT INDICATOR
STBY ENG INST
STBY INST/LIGHTING

Figure 2-34 Electrical Block Diagram and Power Distribution (Sheet 3 of 3)

Engine Indicating and Crew Alerting System (EICAS) in this section. The ammeters function as loadmeters, indicating the load being carried by each generator or by the onboard auxiliary power unit. When the auxiliary power unit is in operation output current can be monitored at all times on the APU ammeter (DC AMPS APU) which is mounted on the copilot's meter panel.

AUXILIARY POWER UNIT AMMETER



6785P1005

Figure 2-35

GENERATORS

Each engine is equipped with a generator rated at 400 amperes (300 amperes above 41,000 feet) that is self cooled on the ground and is cooled by ram air when in flight. The generator serves two functions: (1) to generate direct current (DC) power to the airplane systems and, (2) to charge the airplane batteries and the standby battery.

The generators normally provide 28.5 volts direct current (DC) to their own busses; generator number one to bus number one (left main bus) and generator number two to bus number two (right main bus). An overvoltage of approximately 32 volts will result in a generator being tripped off the line. The generators have an overcapacity of 150% for 5 minutes and 200% for 20 seconds, which will normally give the crew time to consider the required load shedding in case of loss of one generator.

The engines are normally started with the generator switches (DC POWER LH GEN/OFF/RESET and RH GEN/OFF/RESET) in the GEN position, however, if external power is used during the start, the GEN switch may be positioned to OFF, if desired. If the engines are started with the generator switches in the GEN position, the generator control units (GCU) will bring their respective generators on line automatically when they reach a minimum RPM. When an airplane engine driven generator or the APU generator comes on line, the ground power unit (GPU) is automatically disconnected.

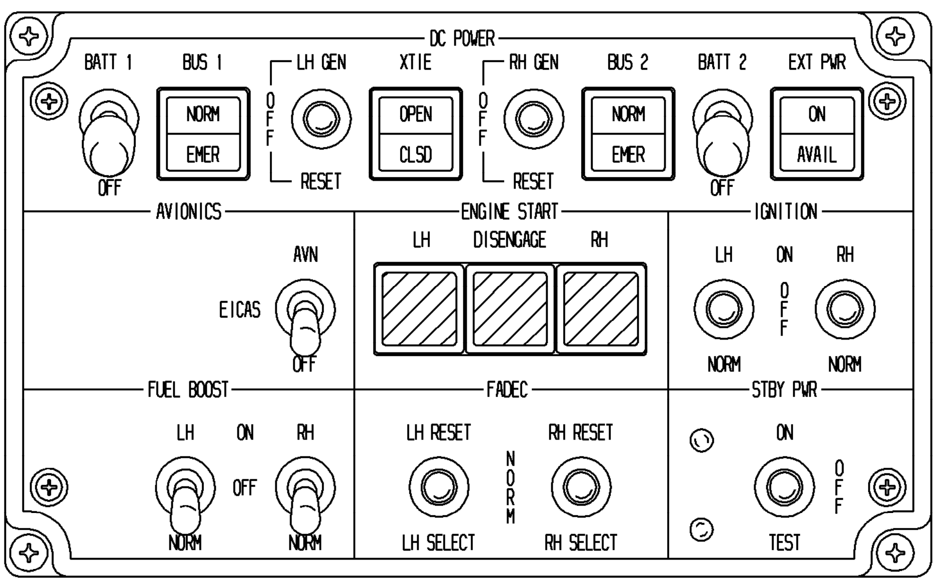
The RESET position of the generator control switches is a momentary position, and is used to reset the generators before placing them into operation when there has been a system trip.

Each generator is wired directly to a separate power junction box, and each has electrical terminal filtering to suppress radio noise output. A single generator is capable of supporting the entire electrical system requirements. Generator limitations are the same whether one or both generators are in operation.

Operation of the generators is controlled by two generator control units (GCU) that are installed on the tailcone electrical equipment rack in the lower forward tailcone compartment. The on-board auxiliary power unit (APU) also has a GCU which is mounted in the same area. The GCU units provide the following features: (1) voltage regulation at 28.5 volts throughout the rated load and temperature range, (2) load sharing to a tolerance of within ten percent (amperage) of the indicated load in parallel operation, (3) overvoltage protection, (4) reverse current control, (5) ground fault protection and (6) overspeed sensing and consequent protection from damage that might result from a sheared generator shaft. The generators are also protected from overload/overspeed by a shear shaft in the generator drive.

An overvoltage protection system is provided during use of an external power unit. The control unit monitors the external power unit voltage and will de-energize the external power relay, removing power, if the voltage exceeds 32 volts. External power cannot be reapplied to the airplane until the voltage is reduced below 32 volts.

ELECTRICAL POWER/ENGINE CONTROL PANEL



9914563-4

Figure 2-36

An overvoltage protection system is provided during use of an external power unit. The control unit monitors the external power unit voltage and will de-energize the external power relay, removing power, if the voltage exceeds 32 volts. External power cannot be reapplied to the airplane until the voltage is reduced below 32 volts.

GENERATOR CONTROLS AND SWITCHES

A three position generator switch, located on the tilted panel (DC Power Panel), immediately to the left of the pedestal, is provided for each generator. The switch is labeled LH (RH) GEN, OFF and RESET. Selecting the GEN (ON) position with the engine running will extinguish the amber GEN OFF L-R EICAS annunciation and will supply a signal to the generator control unit which monitors the battery bus voltage, and will connect the generator to the bus, unless voltage or amperage is such that the generator control unit (GCU) will not parallel the generator with other(s) which may be on the line, or voltage is otherwise out of tolerance. Placing the switch to the OFF position will disable the signal to the generator control unit, the generator will be dropped off the line, and the amber GEN OFF L-R annunciation will appear. The RESET position is a momentary position that will momentarily connect the armature directly to the field creating a rapid buildup to 28.5 volts. The switch is spring loaded from the RESET back to the OFF position; therefore, it must be manually positioned to GEN when the RESET feature is utilized, and the generator will then come back on line. The RESET position will reset a generator that has been tripped as a result of an overvoltage, feeder fault, or if the fuel and hydraulic firewall shutoff valves have been activated. Generator operation will again be disabled during reset attempts if the fault still exists or until firewall shutoff valves have been deactivated. The MASTER WARNING indicator will flash at any time both generators have faulted or have been tripped off the line for any reason, and a red EICAS message GEN OFF L-R will appear in the flashing mode. An attention tone will also be heard, and if the voice warning system is installed a voice synthesis will be heard until the annunciation is acknowledged.

DIRECT CURRENT (DC) POWER GENERATION AND DISTRIBUTION

DC power originating from the batteries, airplane generators, on board auxiliary power unit or ground external power sources, is initially controlled with different main DC power buses being activated by current switching relays located in the aft power junction box. The junction box is constructed in three sections and is located at the forward end of the baggage compartment on the aft side of a pressure bulkhead. A small isolated section of the main electrical power junction box contains components of the electrical emergency system. Three separate cables from each section of the junction box route DC power to the right and left circuit breaker panels in the cockpit. “Crossover” busses are used to permit convenient grouping of related equipment. The entire system is protected by current limiters and circuit breakers. Current limiters of 275 amperes capacity protect each connection between the crossfeed bus, and the left and right main generator busses. An isolation relay separates the DC emergency bus from the crossfeed bus so that, if required, the emergency bus may be separated from the other busses and their loads.

The left and right feed busses are connected through a crosstie (XTIE) relay. The crosstie relay is closed on the ground during initial power up and then opens automatically, when the second generator comes on line after engine start on the ground, to allow the left and right electrical systems to operate independently. The crosstie relay can be pilot controlled using a XTIE/OPEN, CLSD switch annunciator in the electrical switch panel. In the event that a generator overcurrent causes a generator to be automatically shut off, the crosstie relay will be latched open and cannot be selected closed.

Safety and Protective Features of the System Are:

- When any generator is connected to the distribution bus, application of external power will be prevented.
- Ground external power overvoltage protection is provided.
- Two separate and distinct distribution systems, and related subsystems, supply power.
- No malfunctioning power source can prevent the remaining power sources from furnishing power to essential loads.
- Individual, or collective disconnection of the electrical power sources, including batteries, is available in flight to the flight crew.
- When fuel and hydraulic firewall shutoffs are activated, the respective generators are deactivated, and cannot be reactivated until the fuel and firewall shutoffs are reopened.
- Generator overvoltage protection at 32.5, +0.5, -0.5 volts is provided.
- All circuit breakers are “trip free” and cannot be reset if a fault is present in the circuit.
- Each battery is provided with a separate switch to provide for individual battery disconnection.
- Electric engine starting, which can result in high battery temperature, is used only on the small APU engine. The airplane engines are started pneumatically.
- Generators are monitored for impending primary bearing failures by the EICAS system. If the system senses that a bearing will fail within ten operating hours a cyan EICAS message DC BEARING L-R-APU will be annunciated.
- The generators are equipped with secondary bearings which will maintain operation for up to twenty hours.
- Failure of bus tie fuse limiters will trigger an EICAS message.

ELECTRICAL COMPONENTS LOCATION

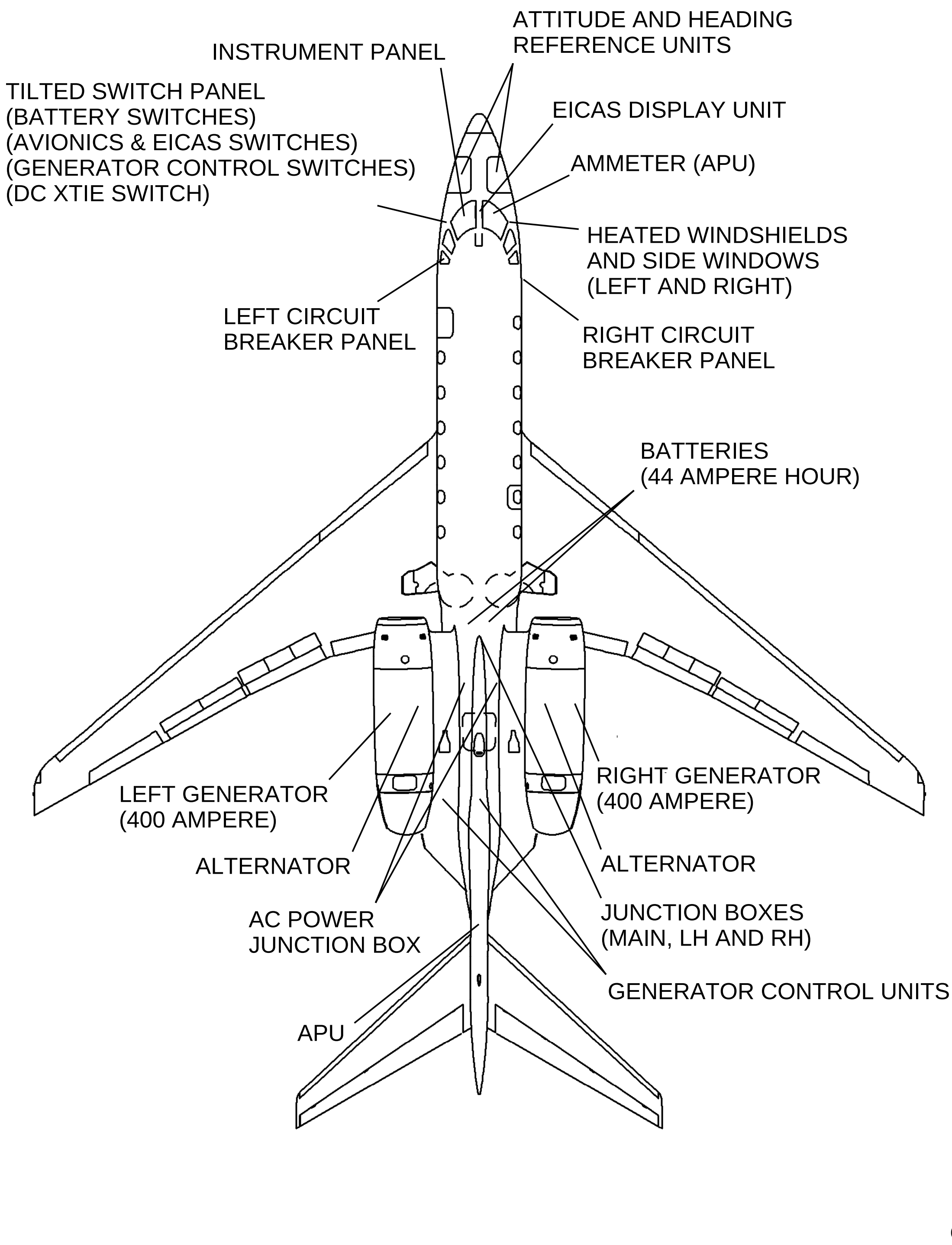


Figure 2-37

GENERATOR CONTROLS AND SWITCHES

A three position generator switch, located on the tilted panel (DC Power Panel), immediately to the left of the pedestal, is provided for each generator. The switch is labeled LH (RH) GEN, OFF and RESET. Selecting the GEN (ON) position with the engine running will extinguish the amber GEN OFF L-R EICAS annunciation and will supply a signal to the generator control unit which monitors the battery bus voltage, and will connect the generator to the bus, unless voltage or amperage is such that the generator control unit (GCU) will not parallel the generator with other(s) which may be on the line, or voltage is otherwise out of tolerance. Placing the switch to the OFF position will disable the signal to the generator control unit, the generator will be dropped off the line, and the amber GEN OFF L-R annunciation will appear. The RESET position is a momentary position that will momentarily connect the armature directly to the field creating a rapid buildup to 28.5 volts. The switch is spring loaded from the RESET back to the OFF position; therefore, it must be manually positioned to GEN when the RESET feature is utilized, and the generator will then come back on line. The RESET position will reset a generator that has been tripped as a result of an overvoltage, feeder fault, or if the fuel and hydraulic firewall shutoff valves have been activated. Generator operation will again be disabled during reset attempts if the fault still exists or until firewall shutoff valves have been deactivated. The MASTER WARNING indicator will flash at any time both generators have faulted or have been tripped off the line for any reason, and a red EICAS message GEN OFF L-R will appear in the flashing mode. An attention tone will also be heard, and if the voice warning system is installed a voice synthesis will be heard until the annunciation is acknowledged.

DIRECT CURRENT (DC) POWER GENERATION AND DISTRIBUTION

DC power originating from the batteries, airplane generators, on board auxiliary power unit or ground external power sources, is initially controlled with different main DC power buses being activated by current switching relays located in the aft power junction box. The junction box is constructed in three sections and is located at the forward end of the baggage compartment on the aft side of a pressure bulkhead. A small isolated section of the main electrical power junction box contains components of the electrical emergency system. Three separate cables from each section of the junction box route DC power to the right and left circuit breaker panels in the cockpit. “Crossover” busses are used to permit convenient grouping of related equipment. The entire system is protected by current limiters and circuit breakers. Current limiters of 275 amperes capacity protect each connection between the crossfeed bus, and the left and right main generator busses. An isolation relay separates the DC emergency bus from the crossfeed bus so that, if required, the emergency bus may be separated from the other busses and their loads.

The left and right feed busses are connected through a crosstie (XTIE) relay. The crosstie relay is closed on the ground during initial power up and then opens automatically, when the second generator comes on line after engine start on the ground, to allow the left and right electrical systems to operate independently. The crosstie relay can be pilot controlled using a XTIE/OPEN, CLSD switch annunciator in the electrical switch panel. In the event that a generator overcurrent causes a generator to be automatically shut off, the crosstie relay will be lathed open and cannot be selected closed.

BATTERIES

Two 44 ampere-hour nickel-cadmium batteries are connected directly to their respective left and right battery busses, which are connected, through isolation relays, to the emergency battery bus.

Battery power is selected by the BATT 1 and BATT 2 switches. Battery 1 is located in the left aft fuselage fairing and Battery 2 is located in the right aft fuselage fairing. They are vented overboard through tubes located on the belly beneath the batteries. Selecting BATT 1 or BATT 2 supplies battery power to the respective LH and RH battery busses and alson allows battery charging. The batteries are a secondary source of direct current (DC) power that is used to provide power during the engine starting sequence and to provide power to the emergency battery bus in the event of a dual generator failure. With no generator on line and the BUS 1 and BUS 2 switches set to NORM, the batteries will provide powert to all aircraft systems, except interior master, for approximately 14 minutes. Selecting both bus switches to EMER within 5 minutes after loss of generator power will allow the battery busses to supply power for approximately 60 minutes to the emergency bus equipment.

The main batteries are supplemented by a 2.5 ampere-hour, 28 VDC lead-acid power pack, located in the airplane nose compartment, which provides emergency electrical power to the standby instruments.

External power is applied to the external power bus when the ground power unit (GPU) is connected to the airplane and the GPU is started. When the external power relay is closed by placing the EXT PWR switch to EXT PWR (ON) the external power is applied to the crossfeed bus, and is available to the complete airplane electrical system. Ground external power will automatically be disconnected by the external power relay when a generator switch is placed to the GEN position after an engine has been started.

Both airplane batteries will charge from the ground power unit. With either battery switch in BATT and the ground power unit connected and in operation, external power will be applied to the airplane busses and the respective battery will be charged. The ground power unit should have the voltage adjusted to maintain 28.5 volts, +0.5 or -0.5 volts.

Nickel cadmium battery temperature should remain below 60°C (140°F). A thermal monitoring system is installed as an integral part of each battery. The system provides continual monitoring of the internal thermal condition of the batteries and will warn the pilot that if battery overheat condition exists. If a temperature of 62.8°C or greater is sensed, it will illuminate a flashing red BATT 1-2 O'TEMP annunciation in the crew alerting system (CAS) area of the EICAS display unit. The master warning will also flash, and a double chime will sound. If the battery temperature continues to climb to 71°C, or if the second battery were to also exceed 62.8°C, the system will reactivate and will annunciate again. Refer to the Emergency Procedures section of the FAA Approved Airplane Flight Manual, or to Section Three of this manual for specific action to be taken when a battery overheat condition exists. Lead acid batteries do not have temperature monitoring; therefore, these procedures do not apply.

If the ELEC bezel button on the EICAS display unit (DU) is pressed, the electrical system can be continuously monitored on the one section (page) of the DU that is selectable by the pilots. The battery temperature can be monitored digitally as well as the generator voltage, battery voltage, and DC amperage. A battery temperature of greater than 20°C to 62.7°C will be digitally annunciated in green. A temperature of less than 20°C will be annunciated in amber. A temperature of 62.8°C will be annunciated in red; if the temperature rises above 71°C the same message will be triggered again.

The batteries must be serviced per the maintenance manual when the battery temperature exceeds 60°C (140°F).

The OFF position of the BATT switches disconnects battery power from all the electrical buses except the hot battery bus. Selection of BATT 1 or BATT 2 supplies power to the emergency bus, and through the emergency isolation relay, to the rest of the airplane busses.

When the battery switch is in the OFF position, certain electrical equipment will still operate, such as BATT 1 and BATT 2 sensing, certain forward and aft compartment lights, EICAS emergency power, and emergency exit lights, since power is taken directly from the hot battery bus.

INTERIOR MASTER SWITCH

A covered interior master switch, located just aft of the right circuit breaker panel, can be used to electrically isolate the cabin area, shutting off all power to it except emergency and exit lighting. Its primary purpose is to shut off power to the cabin in case of a cabin electrical fire, or of a generator failure. This amount of reduction will lower the electrical load to the point that a single generator will carry it, although a single generator will normally carry the regular electrical load of the airplane.

STANDBY POWER SWITCH

The STBY PWR switch controls power distribution from the standby battery, located in the nose compartment, to the standby equipment bus. This switch must be selected to ON for the standby equipment to operate. Electrical power will normally be supplied to the standby equipment bus from the emergency bus it either airplane battery, generator or external power is on line. After loss of battery, generator and/or external power, with the switch ON, power will be drawn from the standby battery pack. This will be indicated by an amber light adjacent to the switch. In the OFF position, the standby equipment bus is not powered, regardless of other airplane electrical configuration. The TEST position permits the crew to test the lead-acid standby battery pack.

NOTE

> Following loss of electrical power, the standby equipment battery pack will continue to supply electrical power to the following equipment for 60 minutes: standby altimeter/airspeed vibrator, standby attitude indicator, standby engine indicators and standby instrument lighting. If the airplane is on the ground, turning the standby power swith to OFF will turn off AHRS or IRS power.

EMERGENCY LIGHTING BATTERIES

Two 1½ ampere-hour 18-cell nickel cadmium battery packs are installed in the airplane; one in the pilot's console and one in the left side of the raised aisle at the aft end of the cabin. The battery packs are connected to the airplane charging system and are being charged any time the main airplane power is on. An emergency lighting switch (EMERG LT ARM/ON/OFF), located at the left end of the pilot's tilt panel, is used to control the emergency lighting system and the emergency battery packs. The ON position directs power to the emergency lighting system from the main batteries/generators. The ARM position will provide power to the emergency lighting system from the emergency battery packs in the event the airplane should experience a 5G longitudinal deceleration, or if there is a loss of normal airplane power. The OFF position disables the emergency lighting system and the emergency battery packs. An amber warning light, located adjacent to the EMER LT switch, will illuminate when power is on the airplane, signifying the emergency lighting is off and that the EMER LT switch should be placed to the ARM position.

The battery packs provide the power for the cabin emergency lights, selected reading lights, and the cabin exit signs, and escape path lighting. One pack is dedicated to the cockpit and forward cabin while the second pack powers the mid and aft cabin emergency lighting. The batteries also provide power for the SEAT BELT and NO SMOKING illuminated signs.

AUXILIARY POWER UNIT

An auxiliary power unit (APU) is mounted in the stinger of the airplane. The APU turbine powers a DC generator which has a rated capacity of 200 amperes in flight and 300 amperes on the ground. It may be started and used up to an altitude of 31,000 feet. It may also be used to provide engine starting air and auxiliary bleed air for the air conditioning system and for door seal inflation, and therefore makes the airplane largely self sustaining on the ground.

Engine power for the APU is provided by a simple turbine using a single-stage centrifugal compressor and a single stage radial inflow turbine. Turbine maximum rated speed is 58,737 RPM with a maximum continuous exhaust gas temperature of 665°C; a temperature of 718°C constitutes an overtemperature condition. Maximum start temperature is 973°C.

APU electrical power is controlled by a generator control unit (GCU) which is mounted in the tailcone aft of the cabin pressure bulkhead, with the engine generator GCUs. Fuel for the APU operation is provided from the left wing fuel hopper by the left fuel boost pump. The fuel boost pump is started, if not already running, any time the APU is put into operation. The APU is so designed that shaft loads (electricity generation) will have priority over an air bleed load. If the APU load is excessive, with air bleed and generator output being used, the amount of air output will be reduced by the load control valve (LCV) in order to maintain the APU load within its capacity.

The APU control panel is mounted in the cockpit forward of the right circuit breaker panel. APU RELAY ENGAGED and APU FAIL annunciator lights are mounted on the right meter panel. A logic control module, which provides an interface for the aircraft mounted controls and the APU digital engine sequencing unit (ESU), is located in the right main power junction box. The ESU is essentially a microprocessor that has been programmed to control and initiate a series of events necessary for satisfactory operation of the auxiliary power unit. Functions which are controlled by this logic are auxiliary power unit start and sequence to operation, malfunction indication and automatic shutdown during start, and malfunction indication and shutdown during auxiliary power unit operation. The logic also sequences itself to restart condition on reapplication of power to the system after a shutdown.

The APU MASTER ON/OFF switch controls electrical power to the APU. The TEST/PUSH switch causes the APU to repeat its internal tests. The APU/START/NORM/STOP switch is spring loaded to NORM and is used to start or shut down the APU. The APU STARTER DISENGAGE/NORMAL switch is spring loaded to NORMAL and is used to disengage the APU starter if it does not disengage normally. A READY TO LOAD annunciator will illuminate when the APU has started and is ready for the generator to be put on the line. The BLEED AIR MAX COOL/ON/OFF Switch controls the APU bleed air. The ON position is used for normal environmental bleed air extraction and for cooling. The maximum flow valve bypasses the bi-level flow control valves and, therefore, will not shut off environmental air during engine start. The APU MAX COOL bleed air is not approved for engine start; the start pressure could be low, which would result in a hung start.

On starting, when the engine speed reaches approximately ten percent, the APU electronic control box (ECB) completes a circuit to the fuel shutoff valve, ignition unit, and surge control valve. The fuel shutoff valve is then energized open to permit fuel flow to the fuel nozzle assemblies, and the ignition fires the fuel-air charge in the combustion chamber. The surge control valve is energized open to permit reaction to compressor discharge pressure. When engine speed reaches 50 percent, the controller provides a signal for starter disengagement. At approximately 60 percent RPM compressor discharge pressure opens the surge control valve and dumps a small percentage of compressor discharge air overboard, preventing engine surge. At 99 percent the controller opens the circuits to the ignition unit, and acceleration continues to the no-load govern speed point. At governed engine speed the turbine discharge temperature is automatically regulated to within established limits by the load control valve.

NOTE

Refer to the FAA Approved Airplane Flight Manual for auxiliary power unit operating limitations and procedures.

Fire protection is provided by a fire detector system and a fire extinguisher system. An associated warning light/switch (APU FIRE) located on the copilot's instrument panel will illuminate in case of an APU fire. An aural tone will also sound. The fire detector sensor is of the continuous loop gas filled type, which is routed around the APU at strategic points, and which is connected to an alarm responder and to an integrity responder. A dedicated fire bottle is installed below the APU. The fire bottle is fired by lifting the cover on the illuminated APU FIRE switch/light and pressing the switch; it does not discharge automatically.

The APU is designed to handle full cabin loads prior to main engine starts. The APU is started electrically and can be started and operated up to a maximum altitude of 31,000 feet. It can be paralleled with the engine driven generators. Parallel operation is considered to be a variance of 10% of the amount of the maximum rated amperage; therefore, a load variation of 40 amperes is acceptable. The APU ESU stores APU system fault data in a non-volatile memory and retains it from the last five APU cycles. If the APU is on the line or operating in parallel with the engine generators, the automatic load shedding function of the electrical system is inhibited. The APU directly feeds the crossfeed/emergency bus. At least one battery switch must be on to operate the APU.

An APU shutdown switch is located inside the tailcone access door on the right aft side of the door frame, to permit APU shutdown without requiring cockpit access.

AVIONICS POWER

Power to the avionics is controlled by an AVIONICS POWER ON/OFF switch located on the AVIONICS POWER control panel, which is immediately to the right of the DC POWER control panel. When in the ON position all avionics equipment receives power. An EICAS/OFF switch, just to the right of the ON/OFF switch, supplies power only to the engine instrument and crew alerting system (EICAS) bus (partial power). Only the left multifunction display (MFD) and EICAS system will then be powered. This switch allows the essential EICAS equipment to be powered for maintenance, and for other functions which require only engine information or EICAS readings, thereby saving power-up cycles and operating time on the complete EICAS system and the electronic flight instrument system (EFIS). The EICAS, EFIS, and other avionics systems of the Model 750 are direct current (DC), and therefore system inverters are not required.

EXTERNAL POWER SWITCH

An external power switch (EXT PWR/OFF) is mounted on the DC power control panel. Its function is to control the power from a ground power unit (GPU). In the EXT PWR position, external power is applied to the airplane busses, and overvoltage and undervoltage protection is provided, but the batteries will not charge unless the battery switch(es) is/are turned on.

WINDSHIELD ALTERNATING CURRENT (AC) ELECTRICAL ANTI-ICE SYSTEM

Windshield and forward cockpit side window anti-icing is provided by two 3.0 kilovolt-ampere alternators, one of which is mounted on the accessory drive case of each engine. They deliver three-phase alternating current (AC) power. The speed of the alternators is not governed, so their speed varies with engine speed, which causes the current cycle rate to vary. The cycle variations have no effect on the windshield heaters.

The windshields are divided into three heating sections; power from the left alternator is applied to the left outboard and center sections of the left windshield, to the right windshield inboard section, and to the right side window.

Power from the right alternator is applied to the right outboard and center sections of the right windshield, to the inboard section of the left windshield, and to the left side window.

Control switches for the system are located on the ANTI-ICE control panel which is located to the right of the center pedestal on the tilt panel (WINDSHIELD ANTI-ICE LH/RH). The three position toggle switches are labeled OFF/HT ON/O'RIDE. Placing the switches to HT ON (center position) will initiate a ramp heating function which will gradually warm the windshield to operating temperature. If anti-icing is needed immediately, such as when unexpected icing is encountered, the switches may be placed immediately to O'RIDE position and the ramp heating function will be bypassed. The switches are spring loaded out of the O'RIDE position and will automatically be positioned back to ON. The HT ON position should be used for normal operation.

Three integral temperature sensors are incorporated in each windshield assembly. One sensor is used as a primary sensor, and one as a secondary, or backup, sensor; the third is a spare. There is a control unit for each windshield side, mounted in the respective pilot or copilot side console. The control units monitor the windshield temperature through the primary sensor. If the primary sensor should develop a fault, the system will revert automatically to the secondary sensor, and temperature monitoring will not be interrupted. The left and right main windshields are regulated to a temperature of 110°F.

The engine and crew alerting system (EICAS) constantly monitors the windshield heat and will alert the crew of a fault or overtemperature condition. An amber EICAS message, WSHLD O'TEMP L-R will illuminate, and electric power to the windshield will automatically be cut off if windshield surface temperature exceeds 140°F. Power will be restored and an amber message will extinguish when the windshield surface temperature drops below 115°F. Another amber EICAS message, WSHLD HEAT INOP L-R, will illuminate if the electrical windshield controller is unable to supply current to the heater elements. When any of the above messages appear, a chime will sound.

The windshield anti-ice must be turned ON any time icing is detected. It may be operated full time from engine start to shutdown and will improve cockpit comfort at high altitude, particularly at night. Windshield anti-ice is also required for defogging the windshield.

CIRCUIT BREAKERS

Push-to-reset, pull-off type circuit breakers with the amperage rating marked on each breaker, are installed in panels located on both sides of the cockpit. The panels are readily accessible to the flight crew during flight. Panel configurations may vary from airplane to airplane due to differences in installed equipment; therefore, the panels shown are typical installations.

Additional circuit breakers, to which flight crew access is not essential, are located in the tailcone junction boxes.

CIRCUIT BREAKER PANEL

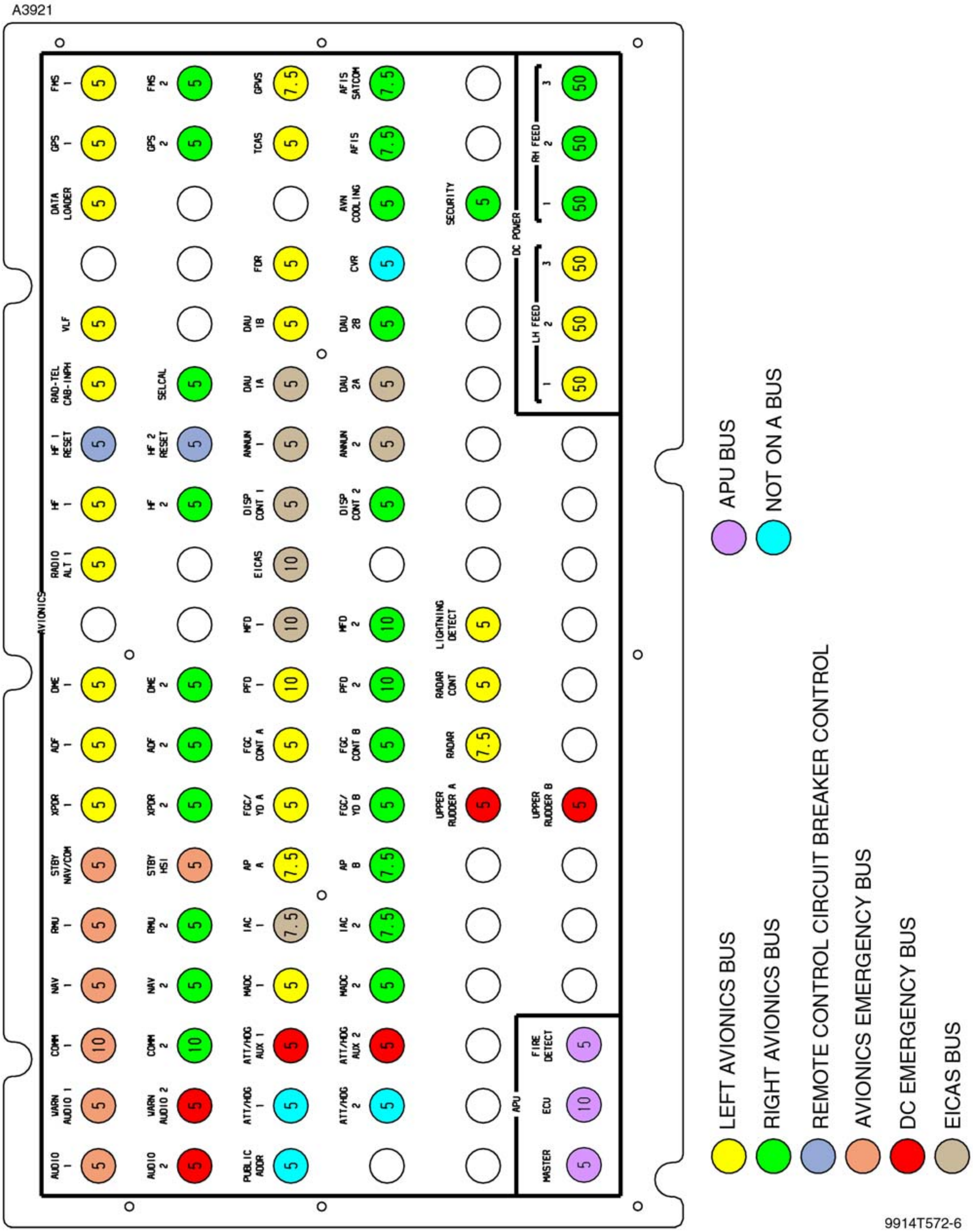


Figure 2-39 (Sheet 1 of 2)

CIRCUIT BREAKER PANEL

A3920

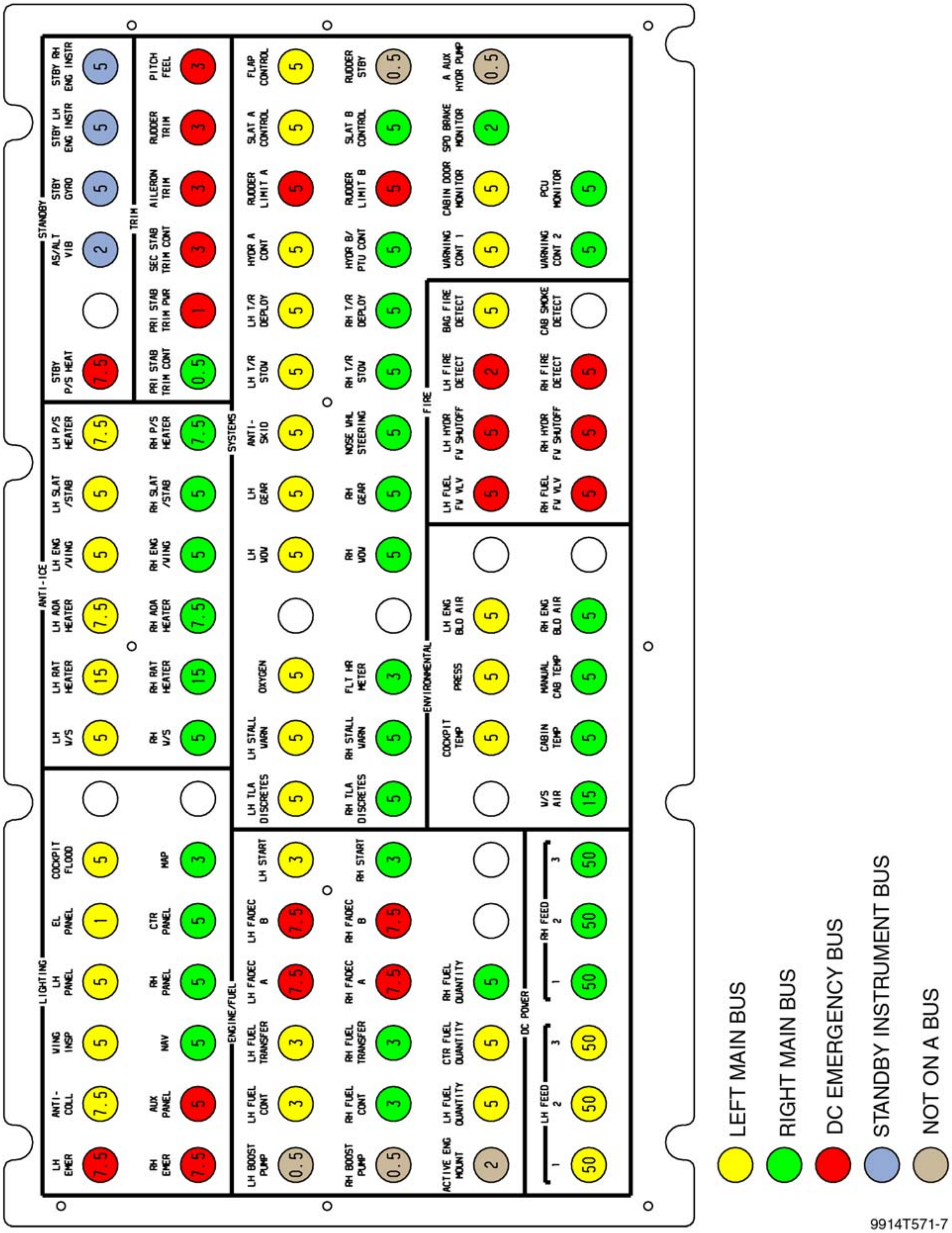


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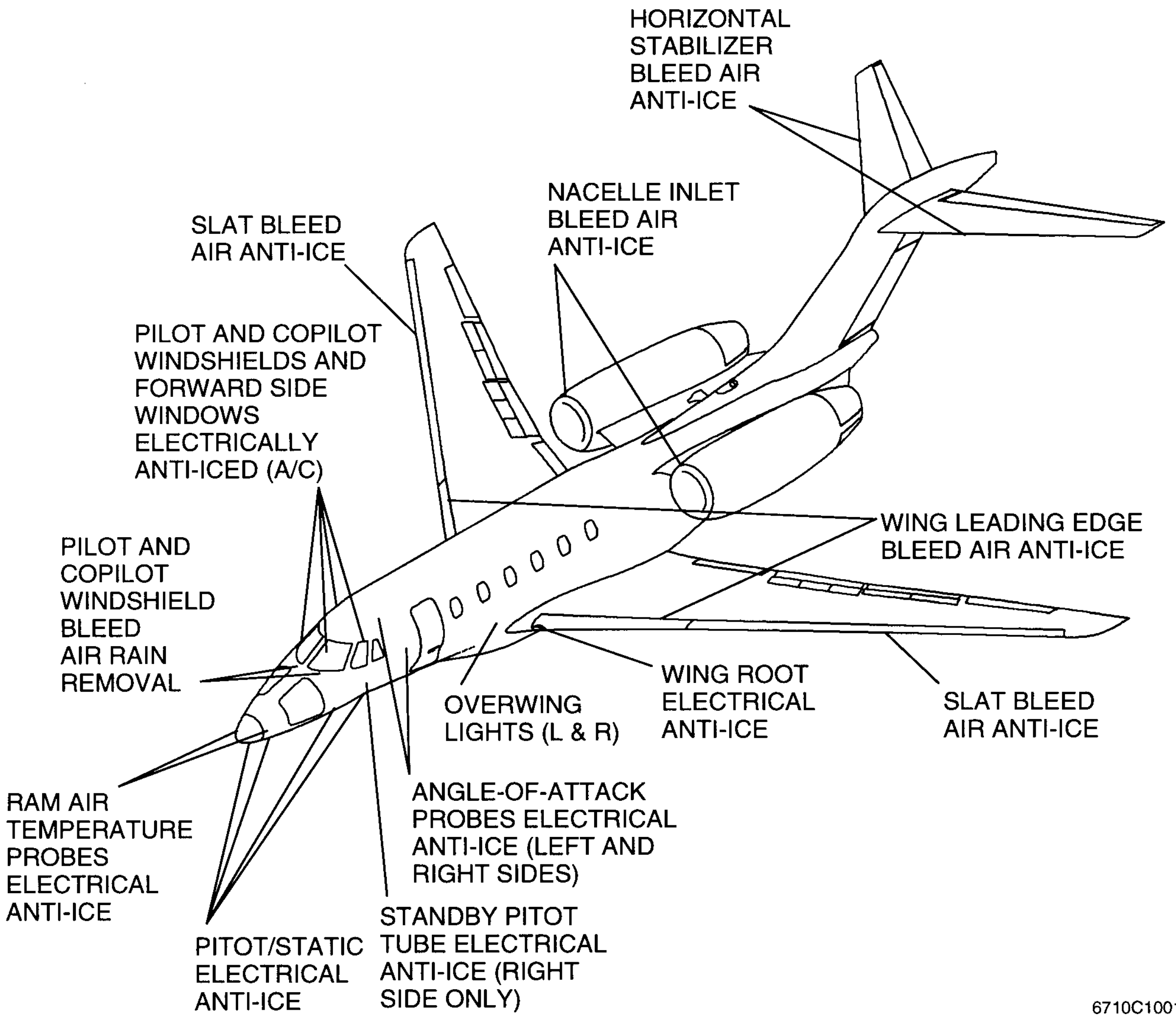
Figure 2-39 (Sheet 2 of 2)

ICE AND RAIN PROTECTION

The anti-ice systems are designed to prevent ice formation on the pitot tubes, static ports, angle-of-attack probes, ram air temperature (RAT) probes, engines, wings, wing roots, horizontal stabilizer leading edges, windshields, and overboard water drain lines. The vertical stabilizer does not require anti-icing. The various anti-icing systems use electrical heating elements or hot engine bleed air, and are activated by switches and knobs on the instrument panels.

There are many engine instrument and crew alerting system (EICAS) messages that pertain to operation of the anti-icing systems. Some are discussed here, but most are covered in detail under Engine Indicating and Crew Alerting System (EICAS), in Section Three of this manual.

ICE AND RAIN PROTECTION



DC electric power is used to anti-ice the pitot tubes and static ports, the AOA probes, the ram air temperature (RAT) probes and the wing root fillet. AC electric power is used for the cockpit windshields and front side windows. High pressure temperature controlled bleed air, or low pressure bleed air (depending upon whether the airplane is in flight or on the ground, and the position of the throttle levers) is used to anti-ice the engine inlets, inboard wings and the slat leading edges, the horizontal stabilizer leading edges, and the landing lights.

PITOT-STATIC AND ANGLE-OF-ATTACK (AOA) PROBE ANTI-ICE

Electric elements heat the pilot's and copilot's pitot tubes and static ports, the AOA probes, the standby pitot/static system, and the wing roots. The pitot and static heating elements are controlled by the LH/OFF and RH/OFF PITOT/STATIC anti-ice switches on the ANTI-ICE control panel, which is located on the tilt panel to the right of the pedestal. The LH switch controls the pilot's pitot and static heaters, and the RH switch controls the copilot's pitot and static heaters and the standby pitot and static heaters. When power is removed from the pitot heaters, or when a heater fails, a digital PITOT HTR FAIL L-R annunciation will come on in the CAS (crew alerting system) portion of the EICAS (engine indicating and crew alerting system) display. If the standby pitot heat should fail the message will be PITOT HTR FAIL SB. If a static port heater fails, an amber EICAS message, STATIC HT FAIL L-R will appear in the EICAS display unit. The standby static port is served by the left and right static ports, and so is included in this message. The left and right AOA probe heaters are electrically powered, and are controlled by the respective side pitot-static heat switch; if an AOA heater should fail, an amber EICAS message, AOA HEAT FAIL L-R, will appear.

There are two messages which can appear if the pitot/static heat or the RAT heaters are turned OFF. A cyan P/S RAT HEAT OFF indicates that the pitot/static or RAT switch(es) is/are in the off position. If the message is presented in amber it means that the throttle lever angle is above 60° and the switch(es) is/are off. In the latter case a chime will sound.

RAM AIR TEMPERATURE (RAT) HEATER

Electric elements heat the RAT probes, which are located on the left and right nose section of the aircraft. A RAT heater is an integral part of each ram air temperature probe assembly. The heating elements are controlled by the left and right PITOT/STATIC heat switches on the ANTI-ICE control panel. The RAT heaters should be on for all flight conditions. Satisfactory operation of the RAT heaters is verified by observing white digits on the ram air temperature (RAT) display, located below the ITT display, on the EICAS display tube. If one (or both) of the RAT heaters fails there will appear an amber digital annunciation: RAT HEAT FAIL L-R.

See Pitot-Static and Angle-of-Attack Probe Anti-ice, above, for additional, CAS messages.

BLEED AIR ANTI-ICE SYSTEM

Bleed air anti-ice is used to anti-ice the engine nacelle intakes, the fixed wing leading edges, the landing light lenses, the retractable slats, and the horizontal stabilizer leading edges.

Because they cannot be monitored for ice formation, engine inlet and horizontal stabilizer anti-ice should be turned on any time icing conditions are encountered. Slat anti-ice may be delayed, if it can be visually verified that ice is not forming on the slats. Windshield, pitot-static/RAT and AOA anti-ice are normally operated full time in flight. When climbing with bleed air anti-ice on, it is acceptable to use TO/MCT thrust provided ITT does not exceed 850°C.

Both engines contribute equally to the high pressure or low pressure air supply, unless one engine is shut down, in which case a wing crossover valve (WING XOVER/NORM) is provided, which may be opened to allow both wings (and slats) to be anti-iced from one engine's bleed air supply. All bleed air for the various systems using it for anti-icing is provided from a duct system. The air is temperature controlled by being passed through a pylon mounted heat exchanger. It is normally high pressure (HP) bleed air, except that low pressure (LP) bleed air is used on the ground at mid to high throttle settings when the HP precooler would be ineffective. The HP precooler regulates ram air through the heat exchanger to limit the air to a maximum of approximately 480°F. An amber HP PRECOOLR O'HT L-R CAS message will illuminate if the precooler temperature exceeds 550°F. At lower power settings, approximately 70% N_1, HP air is below 480°F and the precooler ram air doors will be closed. HP air leaves the precooler and passes through a pressure regulating and flow control valve into a supply pipe, which then distributes the air to the selected anti-ice systems.

Controlling switches in the bleed air system (other than the switches on the ANTI-ICE panel) are the throttle lever angle (TLA) switches in the throttle quadrant, and the weight-on-wheels (WOW), or squat switches, on the landing gear. The engine low pressure bleed air valves (left and right), and the high pressure/low pressure (HP/LP) shutoff valves (left and right) are positioned by the TLA and WOW switches. Depending upon the sensing of the WOW and TLA switches, the anti-ice air will be provided by either low pressure or high pressure engine bleed air. When the airplane is on the ground with the throttles below a throttle lever angle (TLA) of 32°, fourteenth stage high pressure engine bleed air is provided. On the ground, as the throttle lever is increased past 32°, power is removed from the HP/LP shutoff valve, causing it to open, the high pressure bleed air shutoff valve is powered closed, and eighth stage low pressure air is then provided for anti-ice.

When the airplane becomes airborne, the WOW switches are deactivated and electric power is automatically removed from the high pressure bleed air shutoff valve, allowing it to open. Power is then removed from the HP/LP shutoff valve, causing it to close. High pressure bleed air will then be supplied to all bleed air anti-ice systems regardless of throttle angle.

ENGINE ANTI-ICE

Anti-icing of the engine inlet lip and duct is provided by a piccolo tube that sprays bleed air onto the inside surface of the inlet lip. The air is then ducted aft adjacent to the inner fan duct wall and on to louvers that discharge the air into the intake of the engine forward of the fan. The engine itself is not anti-iced. Inlet temperature rise prevents compressor section icing. The stators and the aft sides of the fan blades may collect some icing, but can be cleared by a procedure of changing the power setting, as discussed in the FAA Approved Airplane Flight Manual.

The engine anti-ice is controlled by two switches (ENGINE LH/OFF and RH/OFF) located on the ANTI-ICE tilt panel, which control the engine nacelle regulating and shutoff valves. The valves are powered to the closed position; in the ON position, power is removed from the the valves and they move to the open position. With the engine anti-ice switches in the OFF position, the engine nacelle regulating and shutoff valves will be electrically powered closed, regardless of throttle position, and engine anti-ice will be turned off.

In case of complete electrical power failure in flight, the control valves, which are held closed by electrical power, will then fail open and engine anti-ice will be automatically provided.

Operation of the system may be checked by observing engine interturbine temperature (ITT) and fan speed (N_1) when the engine anti-ice is turned on. The ITT should increase and the fan speed should decrease.

The wing root anti-ice is also part of the engine anti-icing system, due to the fact that ice could form on the wing root and be ingested by the engine. It is controlled by the same switches (ENGINE LH/OFF and RH/OFF) as the engine bleed air anti-ice. A DC electric heating element is embedded in the bonded wing root fillet area of each wing. The elements are controlled by the same switches as the engine anti-ice, so that any time the engine anti-ice is on, the respective wing root area will also be anti-iced. Two temperature sensors, which monitor system performance and warn of overtemperature or undertemperature conditions, are included in the installation. In case of malfunction, amber crew alerting system (CAS) messages, WING CUFF HOT L-R or WING CUFF COLD L-R, will appear to indicate the status of the respective wing root area. The panel will automatically shut off when the HOT message illuminates, until the overtemperature condition clears. The panel is not considered critical, however, it is possible that ice could form and cause light fan damage in a prolonged icing encounter with a failed cuff heater.

The engine inlet anti-ice temperature is monitored by cyan and amber CAS messages (ENG A/I COLD L-R) and an amber ENG A/I HOT L-R CAS message. If the cyan ENG A/I COLD message appears, it means that the system has been turned on but has not yet warmed up to operational temperature. The cyan ENG A/I COLD L-R message may also appear with a red PYLON BLEED LEAK L-R CAS message, if the nacelle does become cold. The message is cyan in order to serve as a reminder that, due to the other problem, a power increase is not called for. The amber A/I COLD message indicates that the anti-ice system is switched on, but is below effective operating temperature. With the amber COLD message illuminated, if it cannot be determined that the engine is anti-icing, the pilot should exit the icing conditions as soon as possible. If the amber HOT message is illuminated the engine inlet anti-ice will automatically shut down until the overheat has cleared.

The wing inboard, fixed, leading edge is monitored by WING A/I COLD L-R and WING A/I HOT L-R amber CAS messages. The HOT message detects an overtemperature or internal leak in the leading edge. The wing (and slat) anti-ice will automatically shut off until the overtemperature condition has cleared. With engine anti-ice only ON, the engine and wing cold messages will normally remain extinguished at idle, once the surfaces have warmed. With the other anti-ice systems on, N_1 may have to be increased slightly above idle to keep all cold messages extinguished.

Engine anti-ice is, as the name implies, designed as a preventive system. Its use should be anticipated and the system actuated any time the airplane is operated in snow or freezing precipitation on the ground or when flight in visible moisture with RAT below +10°C is either occurring or is imminent.

Because of lower power settings during descent, it is advisable to turn on the engine anti-ice system well before entering visible moisture environment where icing conditions may be anticipated.

Because of engine bleed air extraction with system operation, maximum allowable power settings are reduced as shown in Section IV of the Airplane Flight Manual.

The engine ignition should be turned on when flying in heavy rain, as a precaution against flameout.

WING AND SLAT ANTI-ICE

The engine bleed air anti-ice system is fed by the high pressure and low pressure bleed air systems, which are discussed under Bleed Air Anti-ice System, above, in this Section.

The left and right wing leading edge inboard fixed sections are anti-iced with engine bleed air supplied to two piccolo tubes, one each side, Located in the left and right wing leading edge. The leading edge mounted landing lights are anti-iced by diffusing bleed air from the the inboard wing anti-ice Supply duct. Bleed air is supplied to the inboard left and right wing slats through a flexible hose that bends as the slats extend. The flexible supply hose feeds bleed air to a piccolo tube located inside each slat leading edge, which is exhausted overboard through openings in the aft end of the slat.

The left and right wing (and slat) anti-ice systems are normally isolated by the normally closed wing crossover valve located in the crossover duct between the left and right wing. With the crossover valve open, either wing anti-ice system (LH or RH) can be supplied by either or both engines. Check valves located in the wing supply tube at the forward end of the wing, prevent bleed air from the right system from entering the left system and vice versa. Heat from the wing leading edge is isolated from the wing structure, and the fuel barrier, by a heat shield. In case of complete electrical power failure, the fail-safe position of the wing crossover valve is to the closed position. It is powered open, and upon electrical power failure will close.

Temperature sensing devices are used to monitor anti-ice system performance and protect the wing and slat bleed air supply ducts, connectors, and the adjacent structure. System performance is also monitored by sensing the spent air temperature from the fixed leading edge and from the slats. Some of the various crew alerting system (CAS) indications, in response to conditions in the wing and slat anti-ice systems, are listed here. Additional system messages are found in Section Three of this manual, under Engine Indicating and Crew Alerting System (EICAS).

The wing inboard fixed leading edge and the extendible slats are monitored by WING A/I COLD L-R and WING A/I HOT L-R (SLAT A/I COLD and SLAT A/I HOT) amber CAS messages. The HOT message detects an overtemperature or internal leak in the wing leading edge or slat. The wing (and/or slat) anti-ice will automatically shut off until the overtemperature condition has cleared. With engine anti-ice only ON, the engine, wing, and slat cold messages will normally remain extinguished at idle, once the surfaces have warmed. With the other anti-ice systems on, N_1 RPM may have to be increased slightly above idle to keep all cold messages extinguished. The COLD message indicates that the wing (and/or slat) exhaust air is too low, which is probably caused by a power setting which is too low. The condition can be cleared by increasing engine power. The slat (and the horizontal stabilizer) anti-icing bleed air is turned off when the engine N_1 RPM is below 48%, in order to maintain the engine anti-ice bleed air temperature.

Overwing fairing sensors are installed in the wing fairing to monitor for bleed air leaks. Red WING BLD LEAK L-R CAS messages indicate that a hot air leak has been detected. The pilot should reduce power or shut off the bleed, as required, to alleviate the situation. The pylons are also monitored for bleed air leaks by PYLON BLD LEAK L-R red CAS messages. If a wing bleed air leak results in a wing or slat cold condition, the cold CAS message is changed from amber to cyan, so as not to infer that a power increase should be made.

The source of wing bleed air for the anti-ice system is from the high pressure and low pressure bleed air systems, which are discussed in more detail under Bleed Air Anti-ice System, above, in this Section.

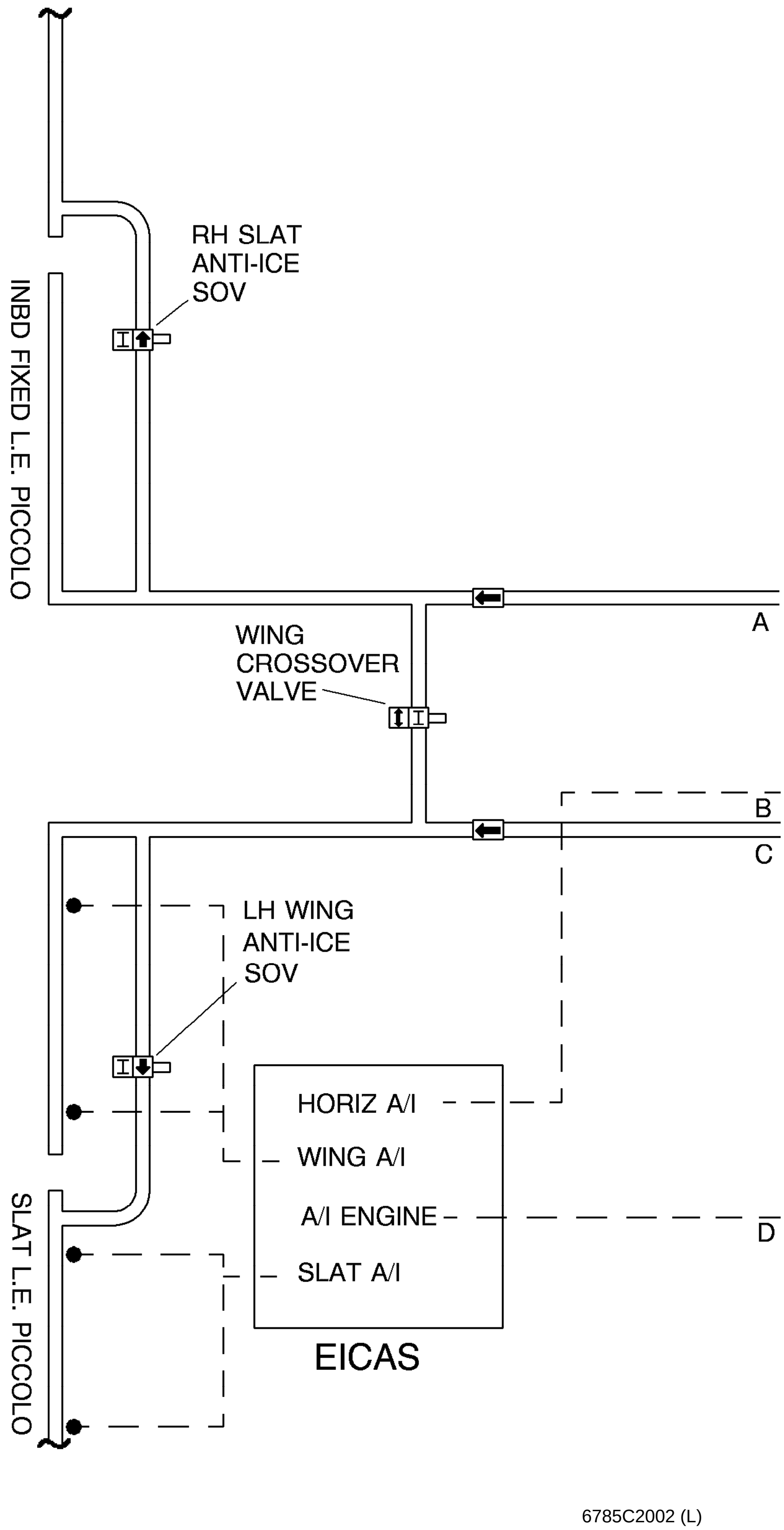


Figure 2-41 (Sheet 1 of 2)

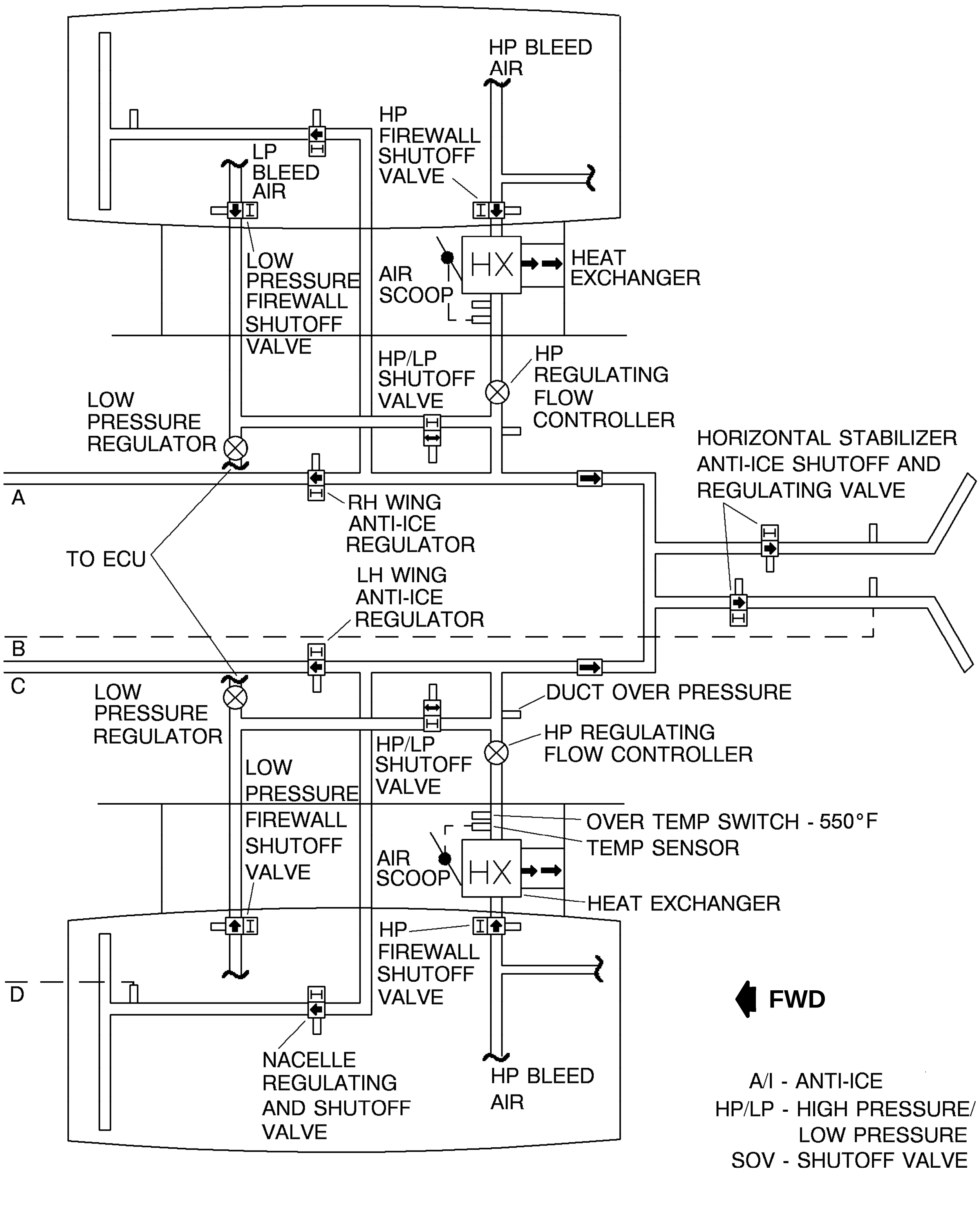


Figure 2-41 (Sheet 2 of 2)

HORIZONTAL STABILIZER ANTI-ICE

Anti-ice air to the horizontal stabilizer comes from the bleed air duct system. The bleed air is sprayed onto the inside surface of the horizontal stabilizer leading edge from a piccolo tube. The air is controlled individually by two valves - one for the left side of the stabilizer and one for the right. Check valves located upstream of a short crossover duct prevent cross flow from the left engine to the right wing supply duct and from the right engine to the left wing supply duct. The left and right horizontal stabilizer anti-ice shutoff and regulating valves open when the stabilizer anti-ice switches (STABILIZER LH and RH/OFF) are placed to the LH and RH positions. These valves are individually fed from the bleed air duct system, and therefore receive anti-icing bleed air from either or both engines, and are not affected by use of the wing crossover valve position, except that a slightly higher power setting may be required if the system is operated on a single engine.

Crew alerting system (CAS) messages are used to monitor the status of the stabilizer anti-ice system. A STAB A/I COLD L-R message indicates that the stabilizer anti-ice is not up to the required temperature, either due to insufficient engine power or due to a bleed leak in the system. A monitor for bleed air leaks is located in the bullet area of the vertical stabilizer; if it detects a leak it will cause a red STAB BLD LEAK L-R CAS message to appear in the CAS monitor. These messages do not cause the stabilizer anti-ice to be shut off. Pilot action is required; refer to the FAA Approved Airplane Flight Manual, or Section Five of this manual.

If the horizontal stabilizer bleed air supply reaches an overtemperature level, an amber CAS message (STAB A/I HOT L-R) will appear. When the CAS message appears the stabilizer anti-ice will cycle on and off, and heat damage is not likely. The anti-ice will shut off when the hot message appears and turn on after the message clears. If the message appears steadily, the stabilizer anti-ice should be manually cycled and the icing conditions left as soon as possible.

Stabilizer anti-ice (and the slat anti-ice) is automatically turned off below an N_1 power setting below 48%, due to the requirement to maintain the engine anti-ice supply temperature. A CAS STAB A/I COLD message will illuminate. In this case the message can be extinguished by increasing power. Crew alerting system messages are discussed in more detail under the Engine Indicating and Crew Alerting System (EICAS) in Section Three of this manual.

WINDSHIELD ELECTRICAL ANTI-ICE

The left and right windshields and the left and right forward cockpit side windows are anti-iced by alternating current (AC) electrical power. The power is controlled by the WINDSHIELD LH RH O'RIDE/ON/OFF switches on the anti-ice control panel. The windshield anti-ice must be turned on any time icing is detected. It may be operated full time from engine start to shutdown and will improve cockpit comfort at high altitude. It is also required for windshield defog.

The windshield electrical anti-ice is discussed in detail under the heading, Windshield Alternating Current (AC) Electrical Anti-ice System in the Electrical section in this chapter.

ICE DETECTION

Two windshield ice detection lights are mounted on the forward glare shield and are aimed at the windshield. A red light is reflected onto the windshield when ice begins to form. The red lights are not visible to the crew when the windshield is clear of ice. The windshield ice detection lights are powered on any time the instrument lights DAY/NIGHT DIM switch is ON.

Wing inspection lights are provided to illuminate the inboard portion of the wing leading edge, allowing the pilot to visually inspect for the formation of ice. The wing inspection lights are turned on by the wing inspection toggle switch (WING INSP LIGHT/OFF) located on the anti-ice control (tilt) panel. The wing inspection light has a ground adjustable gimbal fixture for precise aiming of the cone of illumination.

WINDSHIELD RAIN REMOVAL

A two-speed electric windshield rain removal fan is mounted in the nose avionics bay. It is controlled by a switch (WS AIR/OFF) on the anti-ice control panel. It normally runs at low speed, functioning as a cooling fan for the nose avionics bay. When the W/S AIR position is selected, it runs at high speed to direct high velocity air onto both windshields to aid in clearing rain. The system is primarily for ground use, but does provide a small increase in rain removal in flight. The primary rain removal in flight is caused by the natural action of the treated windshield surface and the windshield shape. If visibility deteriorates on a part of the windshield, it may be that the treated surface has deteriorated. The surface can be re-treated and restored to its original condition.

PRESSURIZATION/ENVIRONMENTAL SYSTEM

Normal cabin pressurization is generated by distributing engine bleed air, conditioned through the environmental control units, into the cabin and cockpit areas. The degree of pressurization (cabin altitude) is determined by the amount of pressurization air permitted to escape through the outflow valves. The Citation X baggage compartment is pressurized and heated through an isolation valve between the two compartments.

The system is so designed that if environmental conditioning units (ECUs) are selected ON while the airplane is on the ground, such as for cockpit and cabin cooling, high pressure fourteenth stage (HP) bleed air will be automatically selected, in order to provide adequate air for operation of the ECUs. If the throttle lever angle (TLA) is advanced past approximately 30 degrees, low pressure air will be better suited for that condition, so system logic will cause a change over to eighth stage low pressure air for the air conditioning system. In flight normally air for the ECUs will be provided by the low pressure section of the engines. If the throttle lever angle is below approximately 29 degrees in flight, high pressure air will be provided. In the approach mode, however, with the landing gear down, only low pressure air will be selected by the system. Due to the differing requirements of the air conditioning system and the anti-ice systems, air from different sections of the pneumatic system is selected automatically at various times in the flight envelope.

Air is also bled off the compressor section of the auxiliary power unit (APU) gas turbine engine, to be used for the starting of the airplane engines, for service air to pressurize the cabin and baggage door seals, to operate the vacuum ejector jet, etc., and for cabin and cockpit air conditioning, usually when the airplane is on the ground.

PRESSURIZATION

Two elements are required for cabin pressurization. One is a constant inflow of air; the other is a method of controlling the flow of air into and out of the airplane in order to achieve the desired differential pressure and resultant cabin altitude. In the Citation X the inflow of air to the cabin is constant through a wide range of engine power settings, and the outflow of air is controlled by two outflow valves located in the aft cabin lavatory area.

PRESSURIZATION SOURCE

Each engine has high pressure (fourteenth stage) and low pressure (eighth stage) ports from which compressor discharge air is bled off from the engines. Valves in each pressurization line control the bleed air flow from the respective engine through the environmental control unit and into the cabin and cockpit area for heating, cooling, and cabin pressurization.

CABIN PRESSURE CONTROL SYSTEM

The cabin pressure control system consists of a manual control valve and a selector mounted on the PRESSURIZATION control panel on the right tilt panel, a remote mounted digital controller, and two outflow valves mounted low on the left and right cabin skin, in the aft cabin lavatory area.

Two types of automatic pressurization control are normally available to maintain cabin altitude; an automatic schedule type operation (NORM) and a cabin altitude selection type (ALT SEL). Either type of operation may be selected by positioning the ALT SEL/NORM switch on the PRESSURIZATION control panel to the appropriate position. In the normal (NORM) position, the controller will follow an automatically scheduled mode. The cabin versus airplane altitude schedule is programmed into the electronics, and logic is added to automatically perform all the inflight decisions normally required by the crew. In the ALT SEL mode the operator selects the cabin altitude at which the system will govern, and the rate of change at which the cabin altitude will be established and maintained. A "pip" mark on the rate selector provides cabin altitude rate changes of approximately 500 feet per minute up and 300 down. In the NORM mode of operation, the setting on the automatic rate selector will act as a maximum and the automatic logic built into the system may not require the rate-of-change setting selected in the knob.

In the automatic modes (NORM and ALT SEL) the controller drives the primary outflow valve by modulating the electro-pneumatic transfer valve (an integral part of the primary outflow valve), and the secondary valve follows the primary by virtue of the valve interconnect line. The primary outflow valve's vacuum supply is provided by the air ejector, which is mounted in the left side of the tailcone, and is driven by the service air system, which operates on bleed air from one or both engines. A fully pneumatic backup manual control system is provided in case of electrical failure and is active when power is removed from the system by interruption of electrical power or by the selection of manual cabin pressure control. Manual control can be selected by the operator by placing the MANUAL/NORM switch in the MANUAL position, which causes the outflow valves to be pneumatically controlled by the manual control valve. Each outflow valve has an altitude limit control valve that prevents the outflow valves that limit maximum cabin altitude to approximately 14,250 feet MSL ± 750 feet. Each outflow valve also has a pneumatic cabin-to-atmosphere differential pressure limiting mechanism that causes the outflow valves to relieve any pressure in excess of 9.5 PSI differential, in addition to a delta pressure relief built into the electronic controller limiting pressure to 9.3 PSI differential.

In the altitude select (ALT SEL) mode of operation, the operator selects the cabin altitude, and the cabin altitude rate-of-change. Before landing, the operator verifies and/or selects a cabin altitude equal to landing field elevation (to land at minimum differential pressure). The landing altimeter setting, which has been entered into the micro air data computers, is then used by the pressurization controller to provide the correct pressure altitude for the pressurization system, according to the field pressure altitude and the field elevation.

The automatic schedule (NORM) mode uses a fixed schedule of cabin altitude versus airplane altitude as a nucleus for completely automatic regulation of cabin pressure while the airplane is in flight. The operator selects the landing field elevation before flight; when the landing field barometric pressure is set into the altimeters prior to landing the data is provided to the pressurization controller, which uses it to compute a cabin altitude for landing. As the

PRESSURIZATION CONTROL SYSTEM

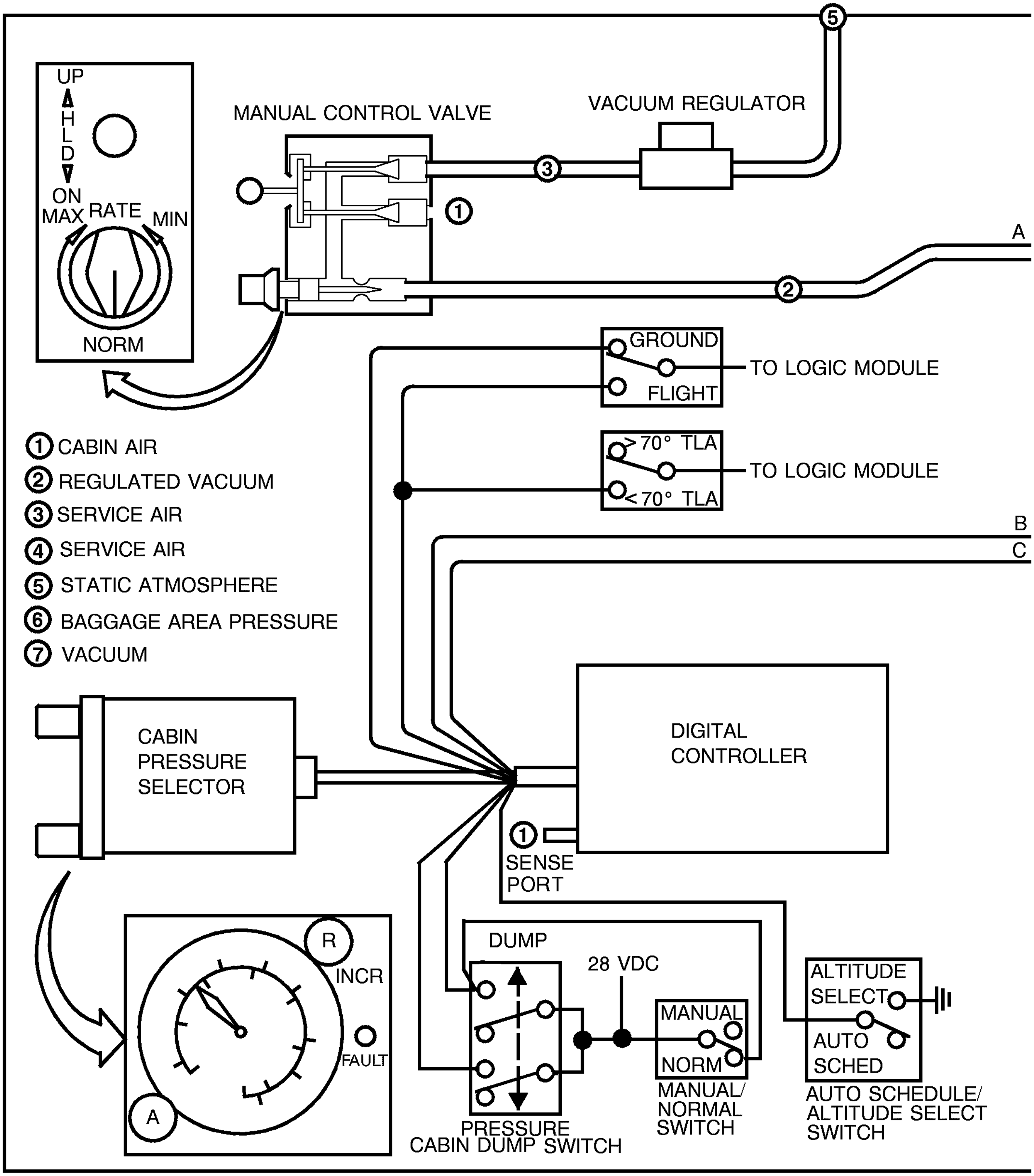


Figure 2-42 (Sheet 1 of 2)

PRESSURIZATION CONTROL SYSTEM

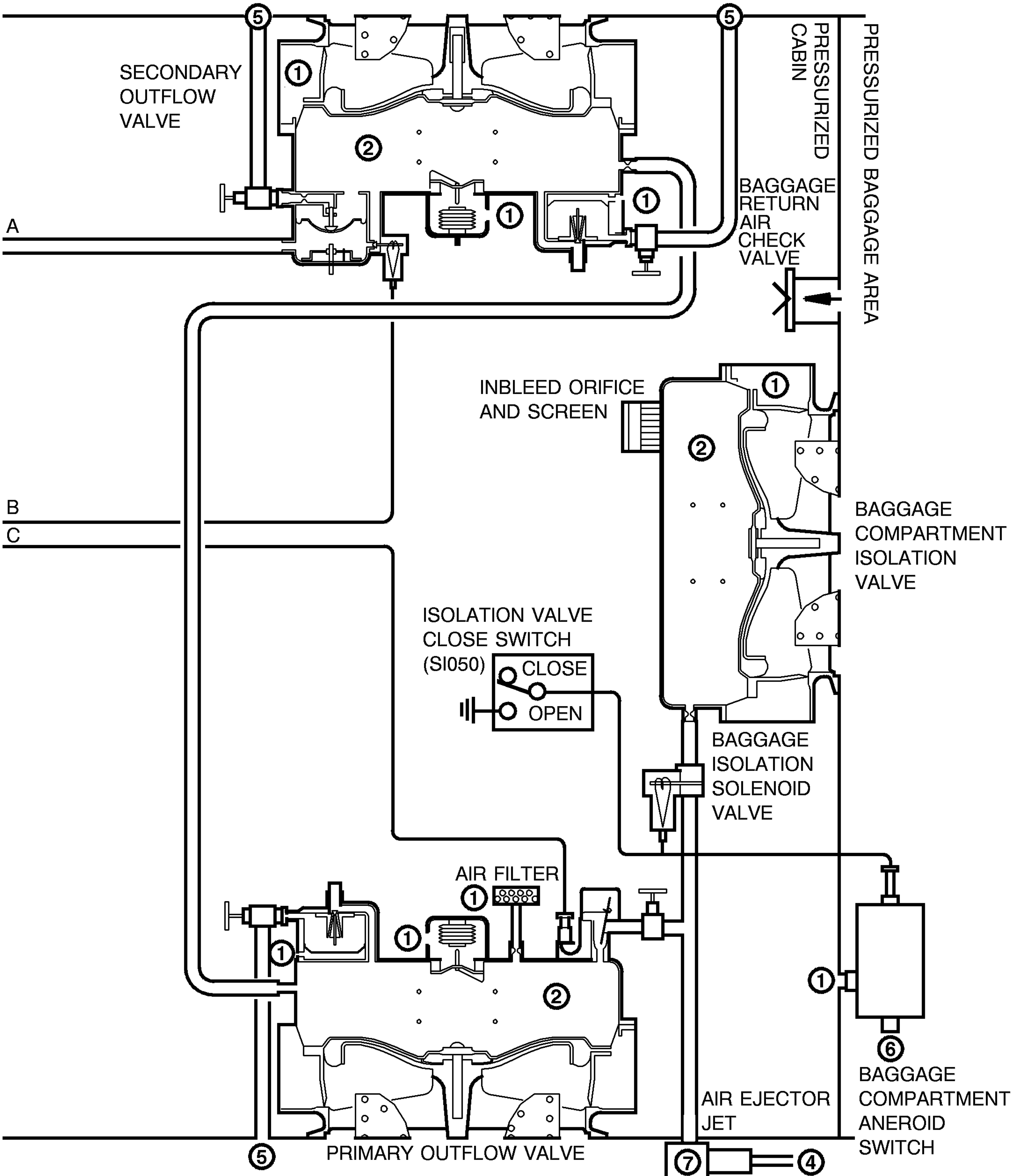


Figure 2-42 (Sheet 2 of 2)

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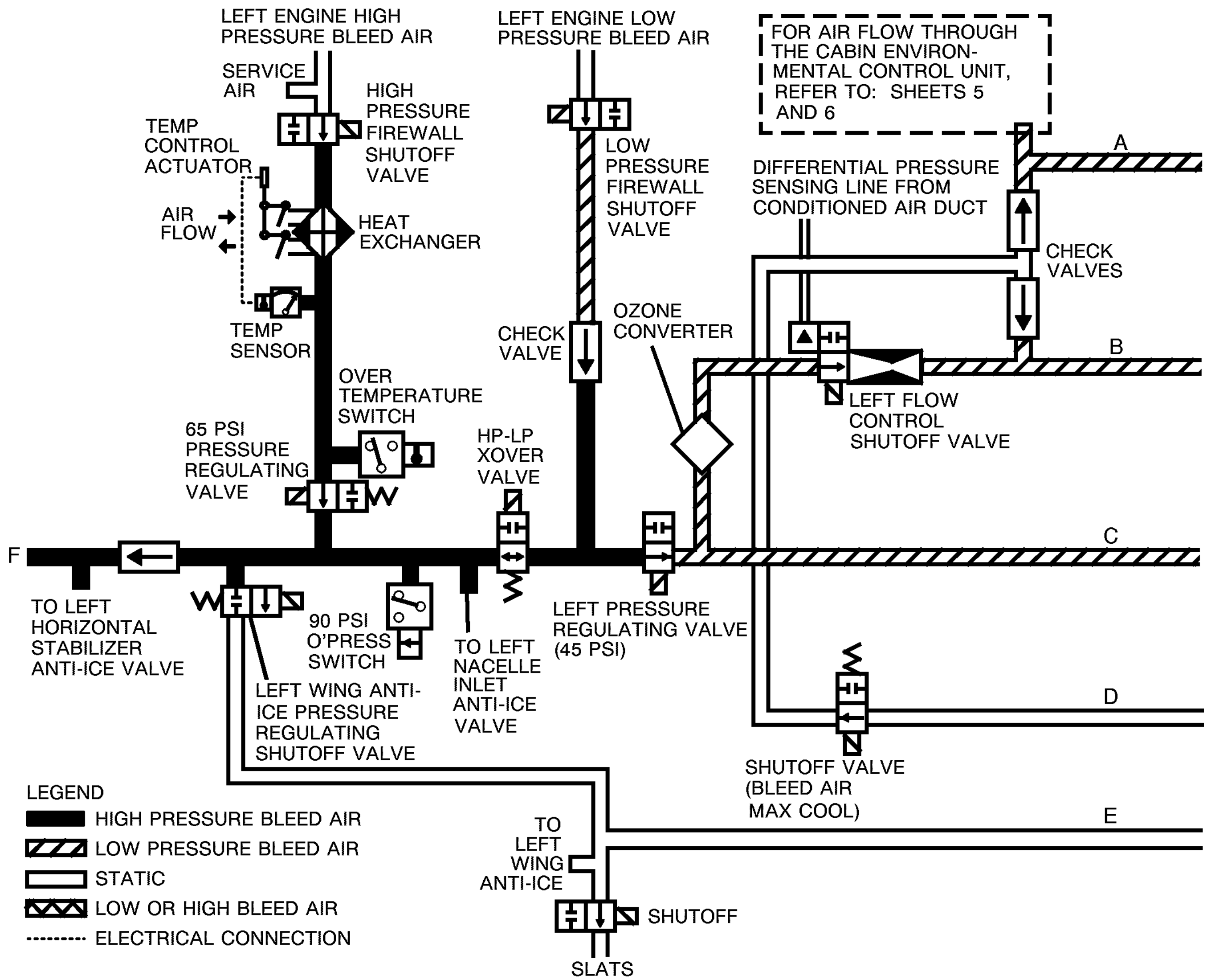
BLEED AIR SYSTEM SCHEMATIC



HIGH PRESSURE BLEED AIR SUPPLYING ENVIRONMENTAL CONTROL UNITS AND ANTI-ICE OFF

6795C7003 (L)

Figure 2-43 (Sheet 1 of 8)

BLEED AIR SYSTEM SCHEMATIC

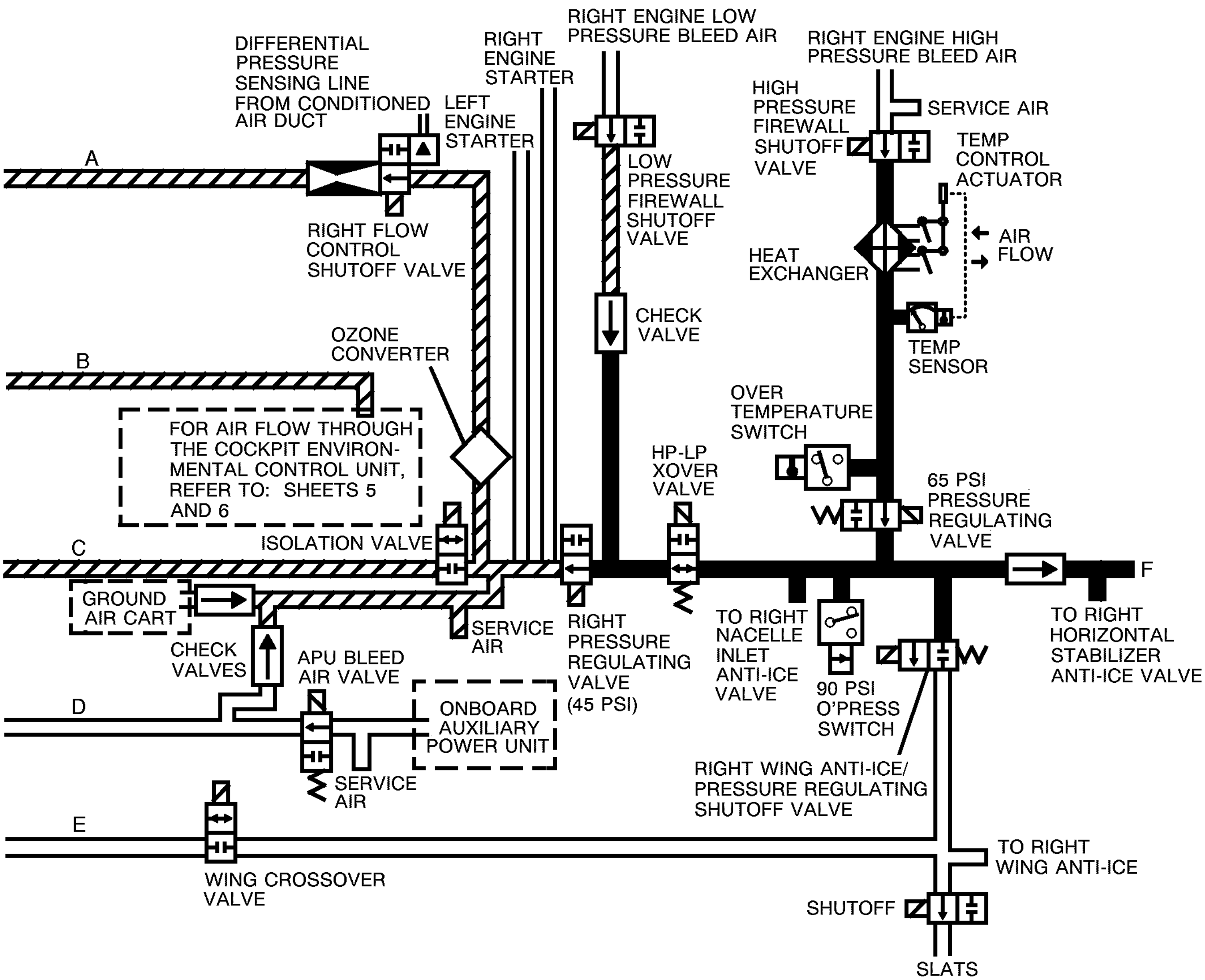
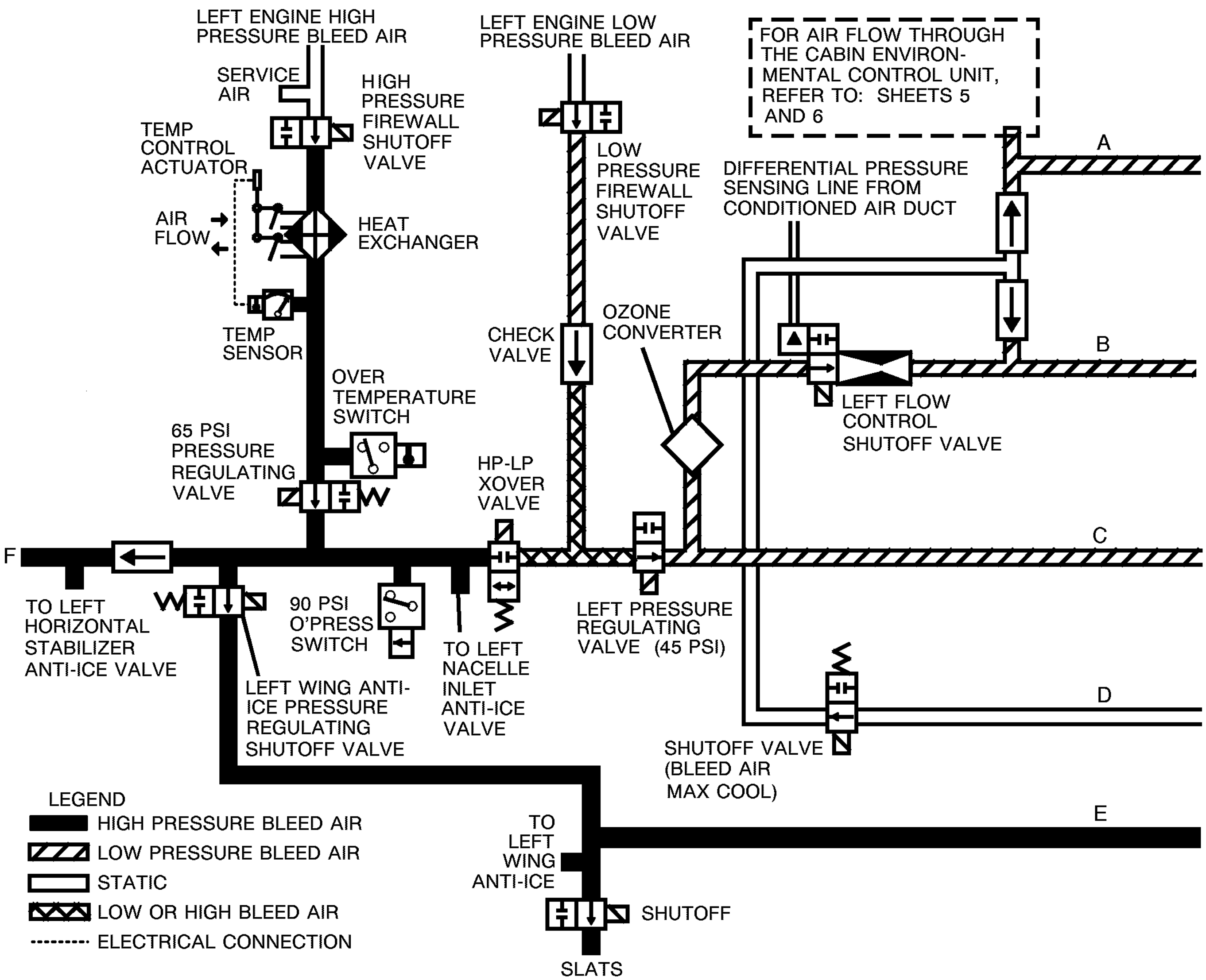


Figure 2-43 (Sheet 2 of 8)

BLEED AIR SYSTEM SCHEMATIC



LOW PRESSURE BLEED AIR SUPPLYING ENVIRONMENTAL CONTROL UNITS
HIGH PRESSURE BLEED AIR SUPPLYING ANTI-ICE SYSTEMS

6795C7004 (L)

Figure 2-43 (Sheet 3 of 8)

BLEED AIR SYSTEM SCHEMATIC

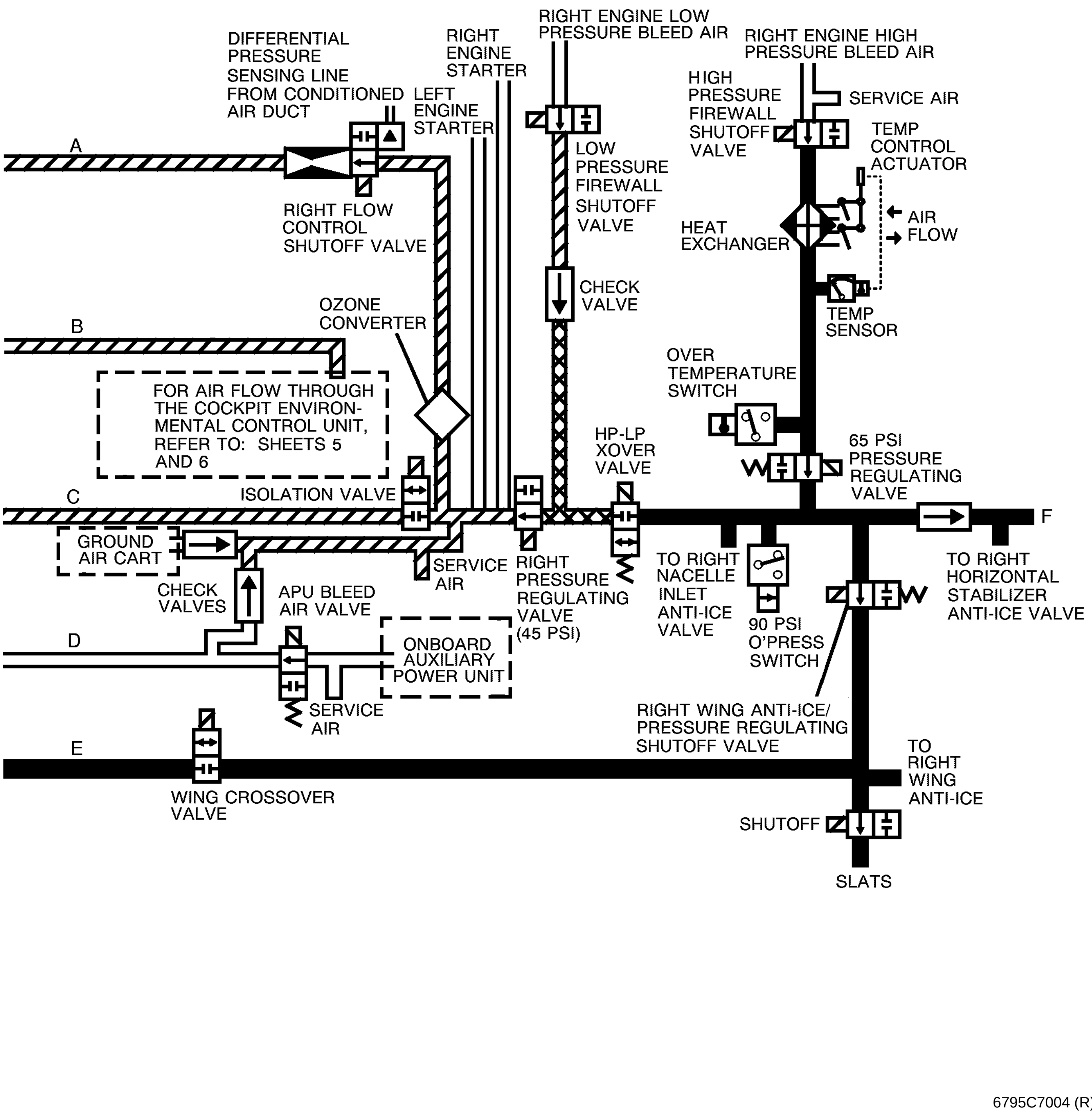
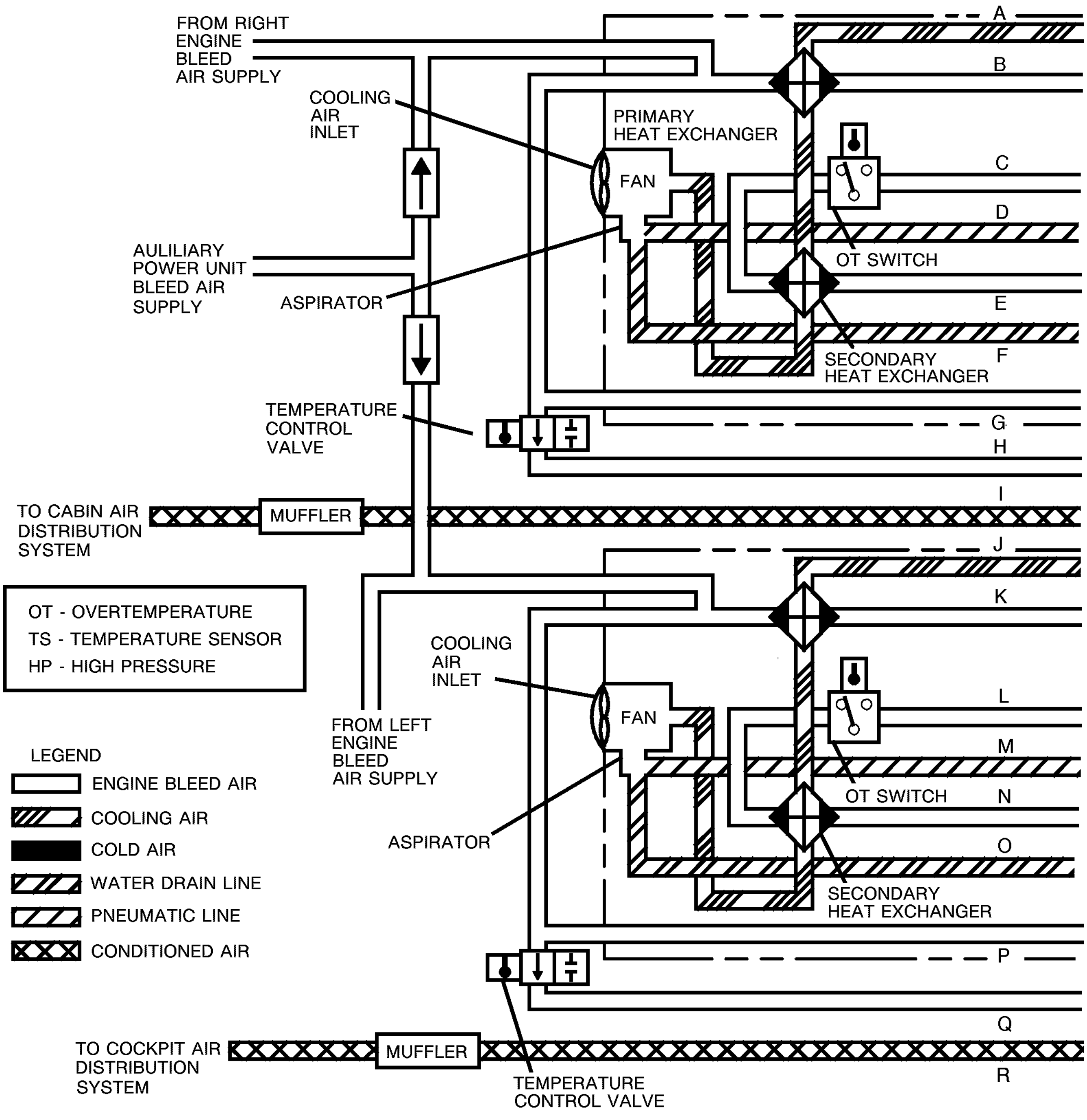


Figure 2-43 (Sheet 4 of 8)

BLEED AIR SYSTEM SCHEMATIC



BLEED AIR FLOW THROUGH ENVIRONMENTAL CONTROL UNITS

6795C7005 (L)

Figure 2-43 (Sheet 5 of 8)

BLEED AIR SYSTEM SCHEMATIC

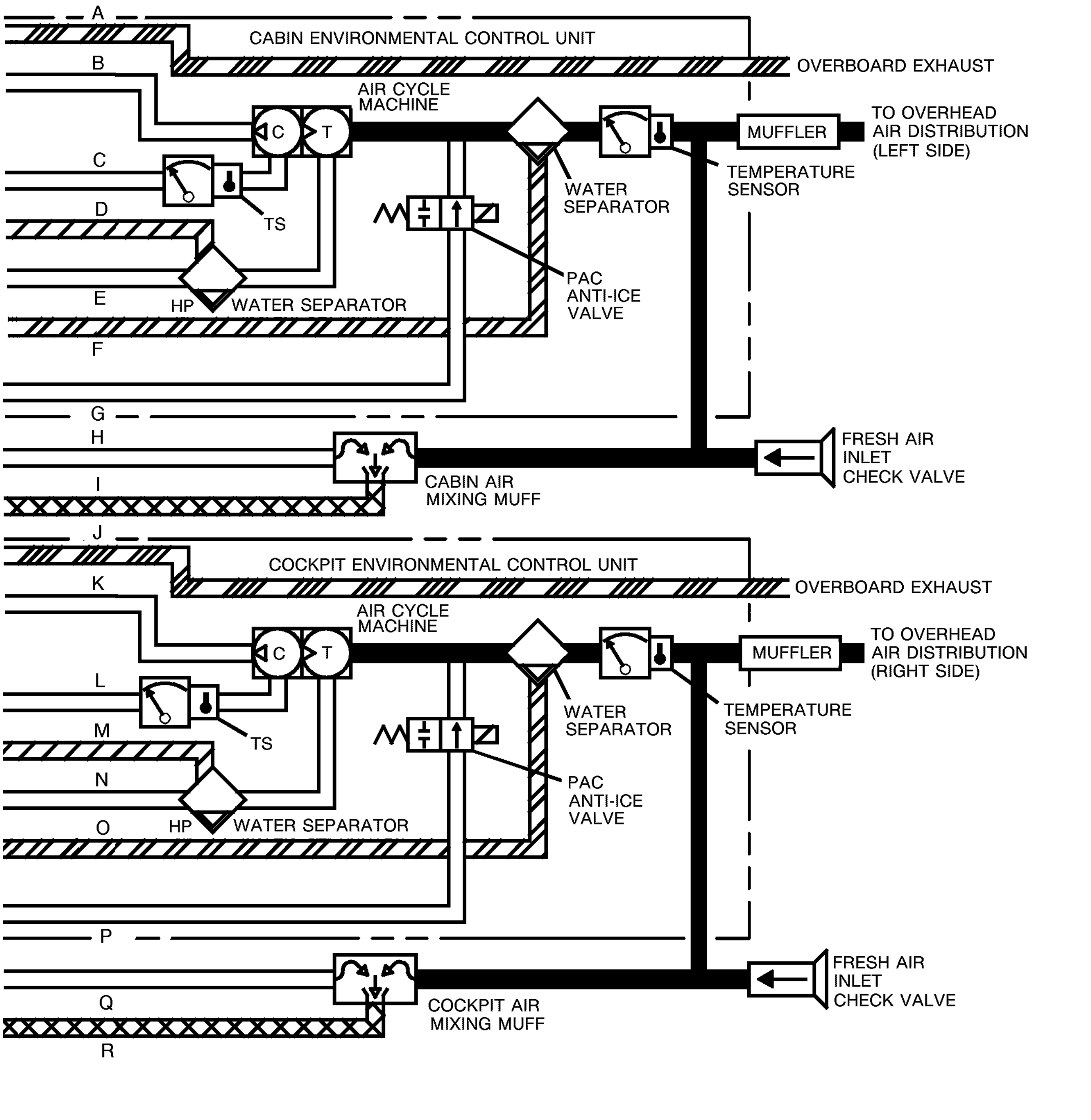
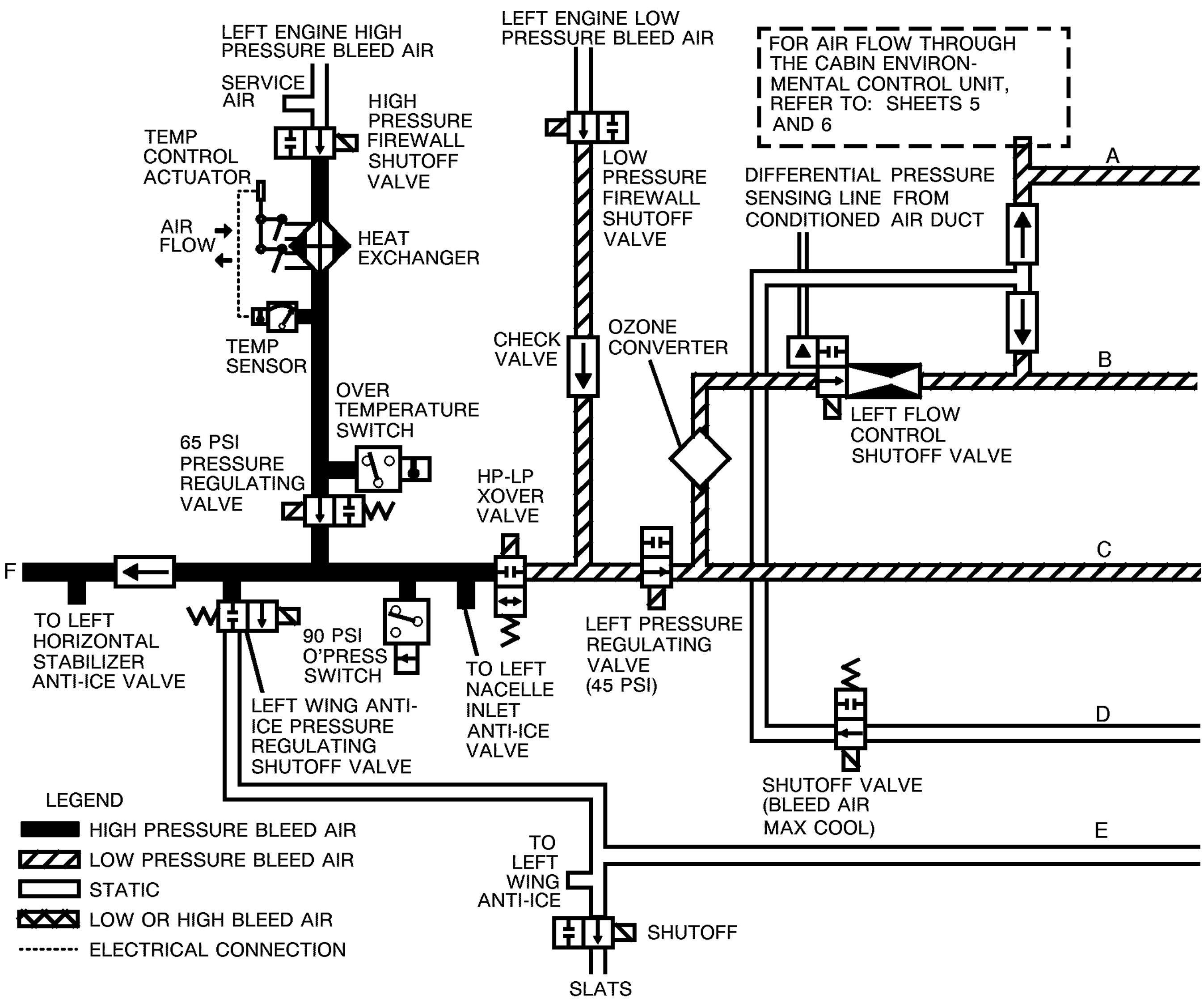


Figure 2-43 (Sheet 6 of 8)

BLEED AIR SYSTEM SCHEMATIC



LOW PRESSURE BLEED AIR SUPPLYING ENVIRONMENTAL CONTROL UNITS AND ANTI-ICE SYSTEMS OFF

6795C7006 (L)

Figure 2-43 (Sheet 7 of 8)

BLEED AIR SYSTEM SCHEMATIC

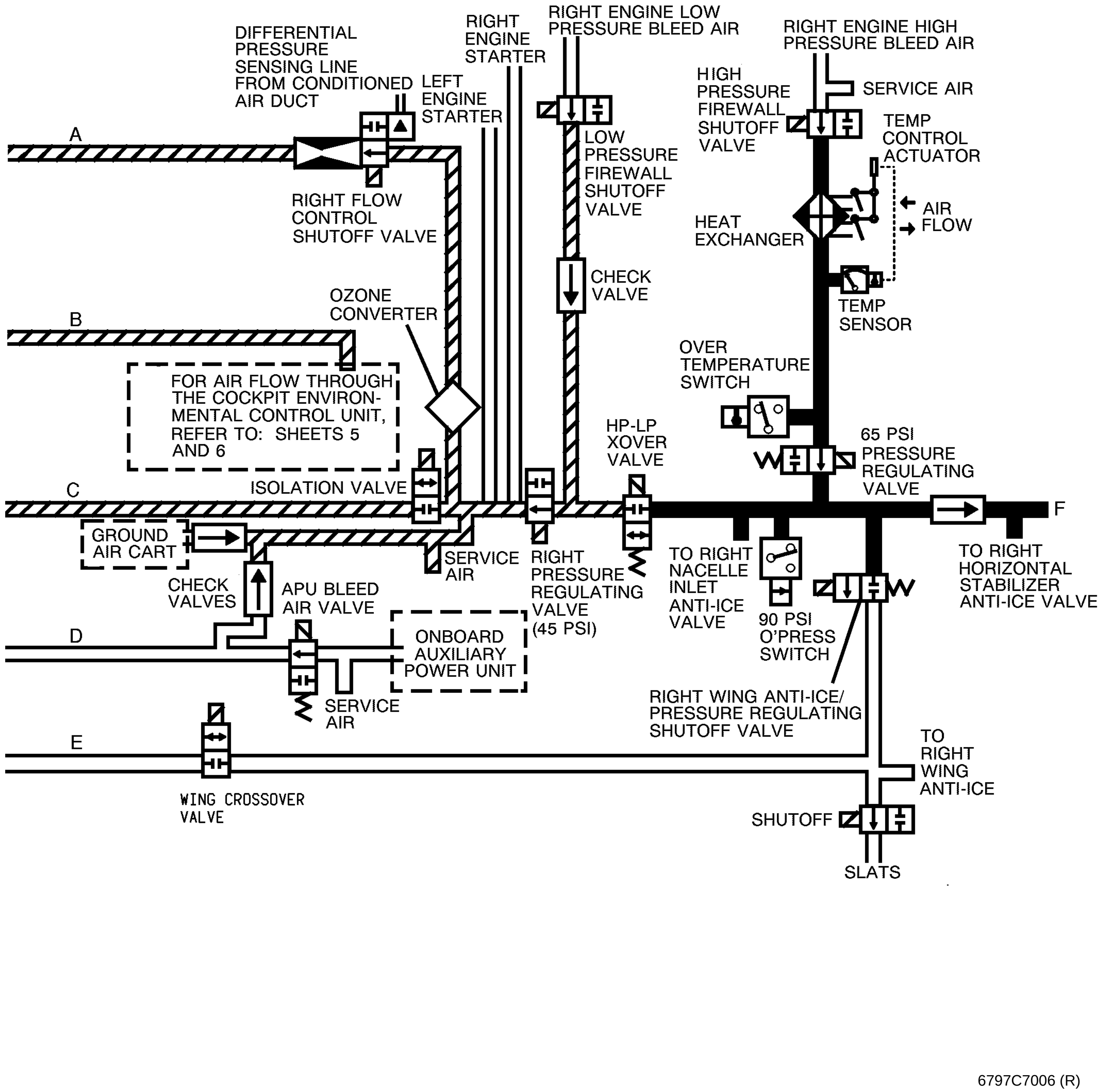


Figure 2-43 (Sheet 8 of 8)

ENVIRONMENTAL CONTROL PANEL

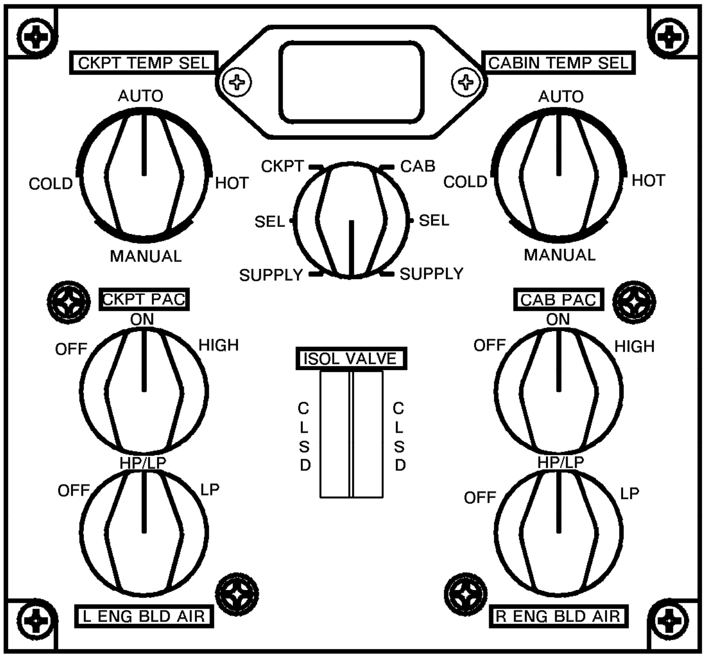


Figure 2-44

CABIN PRESSURE CONTROL

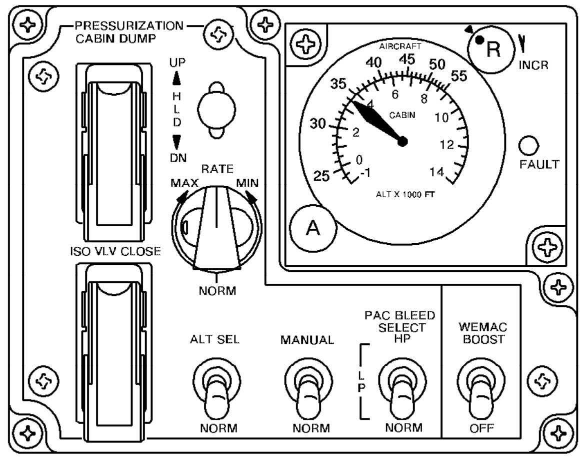


Figure 2-45

airplane lands and the landing gear switch goes to the weight on wheels position, the system enters the landing mode. The system then takes the cabin pressure to field elevation at the selected rate for one minute. After one minute, the system enters the ground mode (at least one WOW switch signaling on-ground and both throttles below 70% N_1) and calls for minimum differential pressure by driving both outflow valves full open. If, upon landing, the cabin altitude is below the actual field altitude, the system will automatically raise the cabin altitude at a rate of 500 feet per minute for one minute or until the cabin becomes unpressurized. At the end of one minute it will then enter the ground mode and dump any remaining cabin pressure at a rate of 2000 feet per minute.

In the MANUAL mode, the cabin altitude and cabin altitude rate-of-change are selected by the pilot. Selecting NORM starts a self test as indicated by illumination of the fault light. The fault light should go out within 15 seconds verifying that the controller is functioning properly and that selections of landing altitude and cabin rate-of-change are logical. If at any time during flight, the electrical power is removed from the controller and then re-established, the FAULT indication lamp will illuminate for less than one second, and then extinguish. If the FAULT indication lamp remains illuminated for longer than fifteen seconds, immediately switch to MANUAL mode of operation.

The pressurization system is capable of holding the cabin altitude to 8000 feet while flying at 51,000 feet (9.3 PSI actual differential). The system also maintains the cabin altitude to a maximum of 8000 feet at flight altitudes greater than 25,000 feet. Some capability in holding maximum pressure differential is lost when the throttles are retarded, anti-ice systems are on and LP is selected. A barometric pressure switch will cause an engine indicating and crew alerting system (EICAS) amber CABIN ALT annunciation to appear if the cabin altitude rises above approximately 8500 feet. A chime tone will be heard. Another EICAS warning (red) will appear if the cabin altitude rises above approximately 10,000 feet. In this case a dual chime will sound. Various other EICAS messages can be triggered by pressure or temperature conditions in the air conditioning system. These, with other system EICAS messages, are covered in detail in Section Three under Engine Instrument and Crew Alerting System (EICAS).

The environmental control unit is made up of two identical Environmental Control Unit Package (ECU or PAC) units; one for the cockpit and one for the cabin. An Environmental Control Unit Package (PAC) contains heat exchangers, air cycle machine and regulators and sensors to cool engine bleed air. PAC output air is mixed with engine bleed air by temperature control valves to produce conditioned air for heating, cooling, and cabin pressurization. Internal PAC temperatures are monitored by the same system which produces EICAS messages to inform the pilot of abnormal conditions. If a PAC overtemperature condition should occur, an EICAS message will be produced and the respective PAC will be shut down until it cools. Each PAC can supply adequate flow to maintain cabin pressure.

The control panel on the far right of the tilt panel contains the switches (L ENG BLD AIR and R ENG BLD AIR) which control the bleed air to the PACs. The left and right bleed air to the PACs is connected by a crossover duct which incorporates an isolation valve (ISOL VLV). If the isolation valve switch (OPEN/CLSD/OPEN) is in the closed (vertical) position, the forward (cabin) PAC is operated using right engine bleed air, and the aft (cockpit) PAC is operated using left engine bleed air. If the isolation valve is in the OPEN position, the two engine sources are connected and either PAC can be run by either engine.

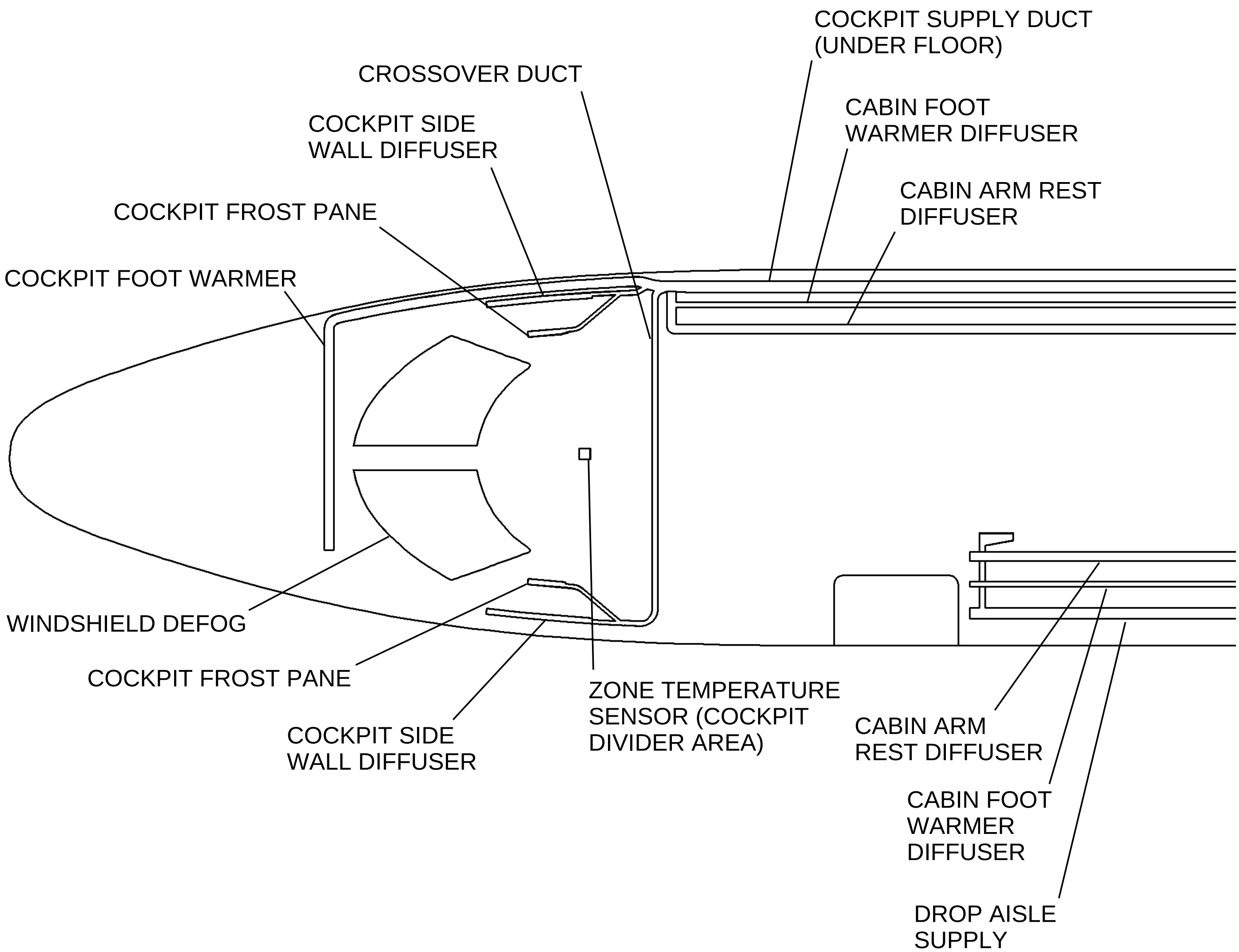
APU bleed air may be used to power the PACs in both ground and air operations. Under normal APU operations, bleed air is routed to the PACs through the engine air start crossover duct. If the BLEED AIR MAX COOL SWITCH on the APU SYSTEM control panel is turned to MAX COOL, additional APU bleed air is plumbed directly into both PACs. The APU BLEED AIR switch must be OFF to start the APU.

Engine bleed air which is used for pressurization is filtered through an ozone converter (one in each engine bleed system) before it is supplied to the PACs. The ozone converters serve to eliminate contaminants which may be in the engine bleed air. APU bleed air is not filtered through an ozone converter.

A guarded emergency dump switch provides the pilot with a rapid dump capability. CABIN DUMP position causes the outflow valves to open releasing cabin pressure and allowing cabin altitude to equalize with airplane altitude up to 13,000 ±1500 feet.

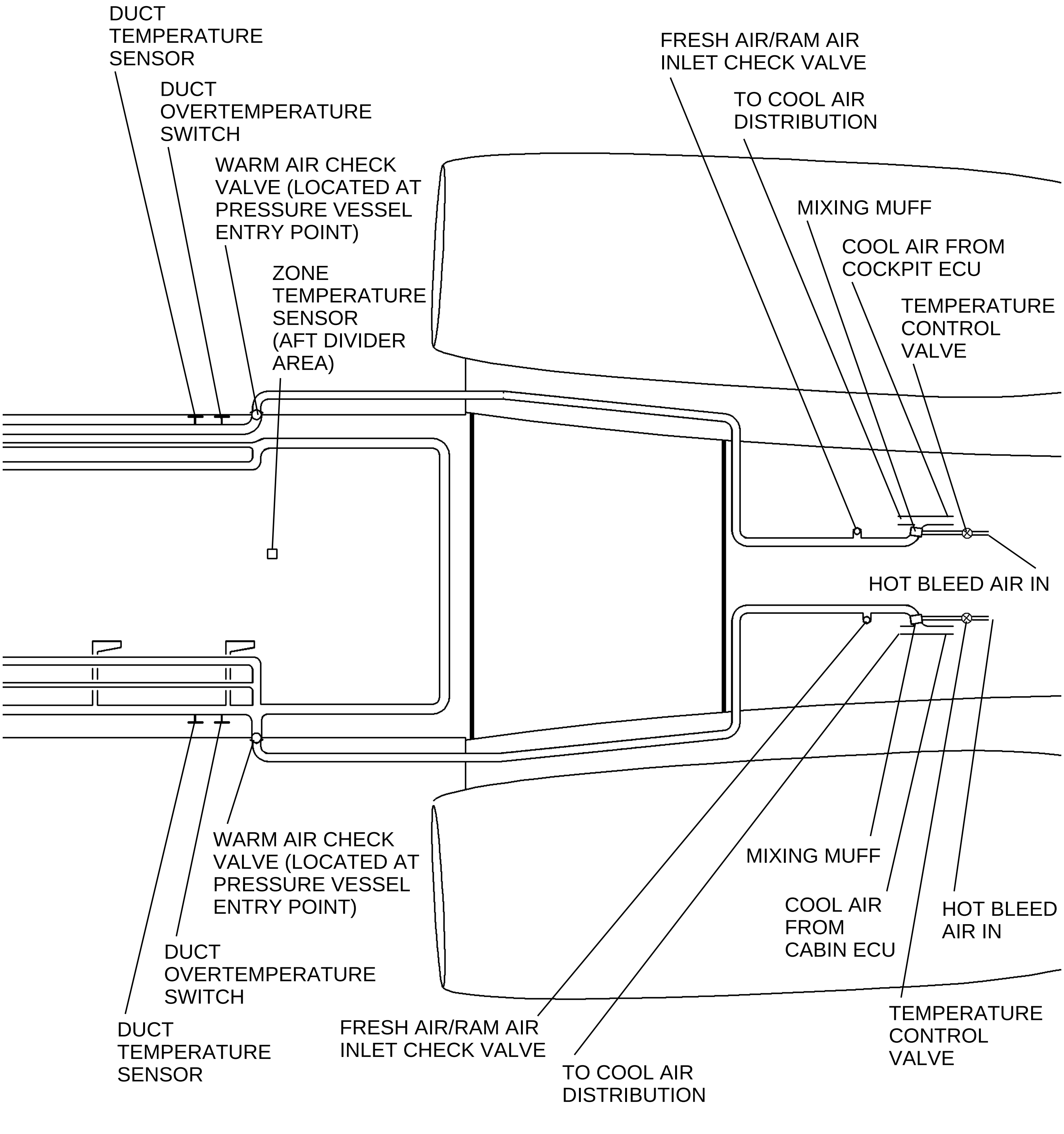
During ground operations with the landing gear squat switch closed and both throttles at less than 70 percent power setting (N_1), the outflow valves will be fully open to maintain minimum cabin-to-ambient differential pressure control. With at least one throttle advanced to greater than 70 percent fan speed (N_1), the cabin altitude will change to approximately 200 feet below that established by the minimum differential pressure. As the airplane lifts off, the landing gear squat switch opens, establishing the pressurization system in the flight mode. In the flight mode, the cabin altitude climbs, or descends at the programmed rate-of-change, to maintain the cabin altitude appropriate to the airplane altitude. When the squat switch is open, pressurization is no longer subject to throttle position.

AIR CONDITIONING SYSTEM SCHEMATIC



Warm Air Distribution Flow Diagram
Figure 2-46 (Sheet 1 of 2)

AIR CONDITIONING SYSTEM SCHEMATIC



Warm Air Distribution Flow Diagram
Figure 2-46 (Sheet 2 of 2)

In the event of automatic control system failure, cabin altitude can be raised or lowered by placing the MANUAL/NORM switch to MANUAL and positioning the manual control toggle to UP or DN. The position of the manual RATE knob (RATE MAX/NORM/MIN) will determine the cabin altitude rate-of-change. The toggle is spring loaded to the center HLD (hold) position. The manual system is completely pneumatically operated.

AIR CONDITIONING

The air distribution system directs the flow of heated air, cooled air and/or fresh air to the cabin and cockpit for environmental comfort. Outlets are located overhead, in the armrests and at floor level, including foot warmers in the cockpit, and are positioned to provide windshield defogging. Instrument panel cooling is accomplished by circulating ambient cockpit air behind the instrument panel. Two fans, located below the glare shield, pull cooling air across the electronic equipment behind the instrument panel, and also serve to assist in defogging the windshield. The avionics compartment is cooled by circulating outside air over the avionics equipment. This is achieved by the same fan as is used to remove rain from the windshield.

Citation X airplanes are also equipped with a Wemac boost system for the overhead air distribution system, which mixes cabin air with the colder overhead air to eliminate fogging from the Wemacs and which provides additional cabin and cockpit comfort. A switch labeled WEMAC BOOST/OFF is located on the PRESSURIZATION control panel.

The Environmental Control Unit Package (PAC) switches (cockpit, cabin) on the environmental control panel have OFF, ON and HIGH selections. The system is turned on after the engines are started at which time ON or HIGH may be selected. ON is the normal operating configuration, however, HIGH will provide an increased supply of conditioned air primarily for ground cooling. With the onboard auxiliary power unit operating, either (not both) the cabin or cockpit PAC selector switch may be selected to HIGH. Also on the environmental control panel, are cockpit and cabin temperature controls labeled CKPT TEMP SEL and CAB TEMP SEL. Each control has an AUTO, COLD-HOT and a MANUAL, COLD or HOT selection. A TEMP DISPLAY SEL control is provided to display either cockpit or cabin zone temperatures and their select and supply temperatures by a digital readout. The SEL position allows the selected temperature to be monitored. The SUPPLY position checks the temperature of supply air in the feeder ducts as it is supplied to the cockpit and cabin air distribution systems.

An isolation valve (ISOL VALVE/OPEN/CLSD) switch on the environmental control panel operates the normally closed isolation valve which is located in a connecting duct between the cockpit and cabin bleed air ducts. With the isolation valve OPEN, either engine will operate both environmental control unit PACs in the event of an engine shutdown. If the isolation valve is closed, the right engine operates the forward (cabin) PAC and the left engine operates the aft (cockpit) PAC.

If the cockpit environmental control unit PAC is turned OFF with the cabin PAC in ON or HIGH, a valve in a crossover duct will automatically open, allowing heated air from the cabin duct system to supply the cockpit duct system with heated air.

If electrical power is applied when the cockpit or cabin temperature selector is in the MANUAL position, the temperature controller will not properly complete its automatic power up checks. If the controller has be set to display error codes, it will flash E5 and E6 codes. To clear these codes select AUTO and cycle power to the controller, either by shutting off and restoring all electrical power or by pulling and resetting the COCKPIT TEMP and CABIN TEMP circuit breakers on the left circuit breaker panel.

BAGGAGE COMPARTMENT

In the Citation X the baggage compartment is pressurized and heated through the same integral system which pressurizes and heats the cabin. The baggage compartment system provides pressurization and temperature control to the baggage compartment and to the baggage compartment mounted avionics. Components of the system which are peculiar to the baggage compartment, however, are the baggage compartment isolation valve, the vacuum solenoid valve, the aneroid assembly, a fan, and the return check valve.

The baggage compartment isolation valve, located on the mid pressure bulkhead, controls the flow of fan driven air from the cabin into the avionics racks located above the baggage compartment. This air exhausts into the baggage compartment and then returns to the cabin through a return air check valve located on the mid pressure bulkhead. The aneroid assembly located in the baggage compartment senses cabin and baggage compartment pressures. The baggage compartment isolation valve will close automatically if the aneroid assembly senses baggage compartment pressures below an atmospheric pressure of approximately 8.5 PSI, or if the cabin to baggage compartment differential pressure is more than approximately 1 PSI. The baggage compartment isolation valve can also be manually closed by the baggage isolation valve switch (ISO VLV CLOSE) on the PRESSURIZATION control panel.

OXYGEN

The oxygen system provides supplementary oxygen to the cockpit and passenger masks. Oxygen use is not normally required since a cabin pressure altitude of 8000 feet can be maintained at the maximum certified airplane altitude with normal pressurization system operation.

OXYGEN SYSTEM SCHEMATIC

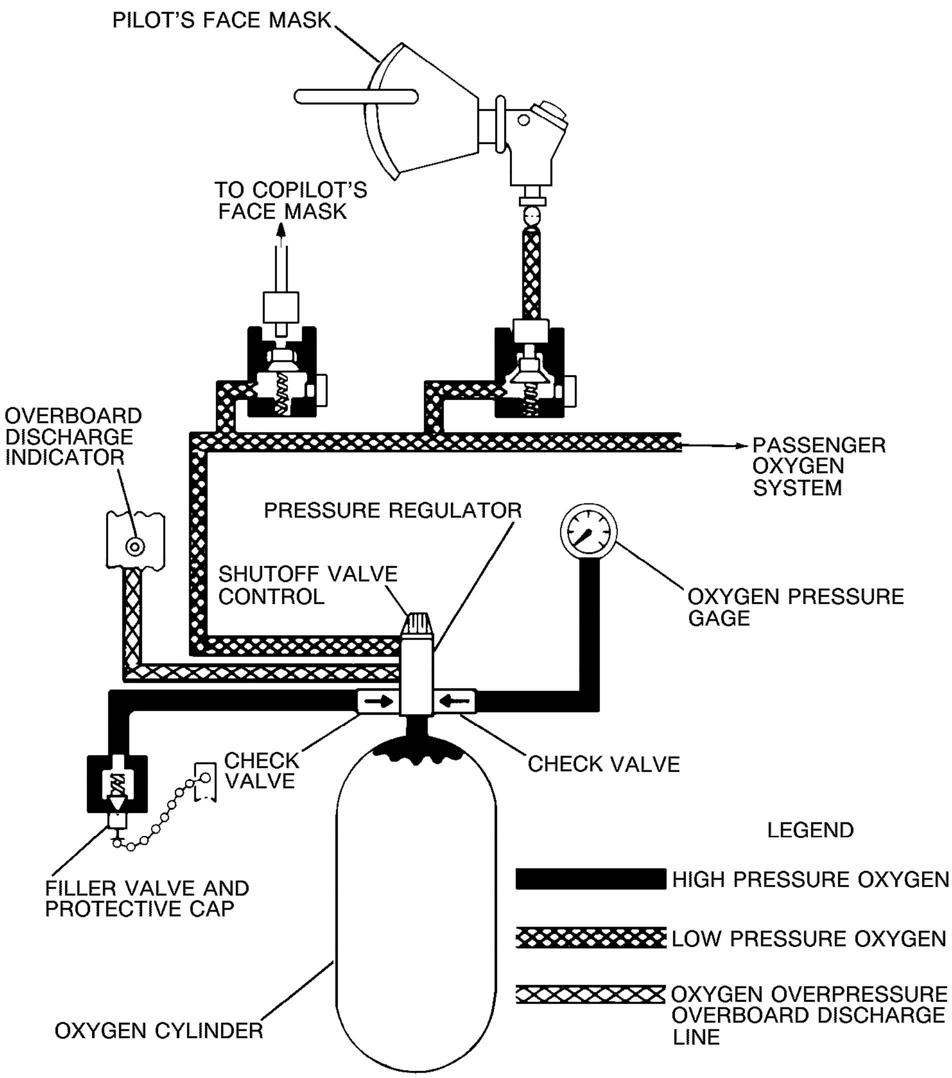


Figure 2-47

A fully charged, 49 or 76 (optional) cubic foot cylinder, located in the nose compartment, provides ample oxygen for normal flight requirements and an emergency descent. The light weight bottle is made of Kevlar, impregnated with epoxy resin, which is wound longitudinally and circumferentially over a seamless aluminum liner. Normal pressure for both systems is 1850 PSIG at 21°C (70°F). The cylinder must not be allowed to become completely discharged, since there is a possibility of contamination due to negative pressures which can occur with temperature changes. A completely discharged container must therefore be treated as if the pressure regulator has been damaged, and reconditioned.

The system also contains a pressure regulator shutoff valve and provisions for external servicing. A green inspection disc is installed in the end of the overpressure vent line which is flush mounted below the right nose compartment door. If cylinder pressure exceeds a maximum of 2700 PSI, the disc will rupture indicating a loss of oxygen. This overpressure system will actuate under only the most adverse circumstances; therefore, if the disc is ruptured, the bottle, regulator, and disc must be replaced before flight. A locking connector has been provided on the right and left flight deck consoles to supply the flight compartment occupants with 70 PSI oxygen for diluter demand mask use. Refer to 75FM-08, Normal Procedures, for Oxygen Supply Chart.

OXYGEN CONTROL PANEL

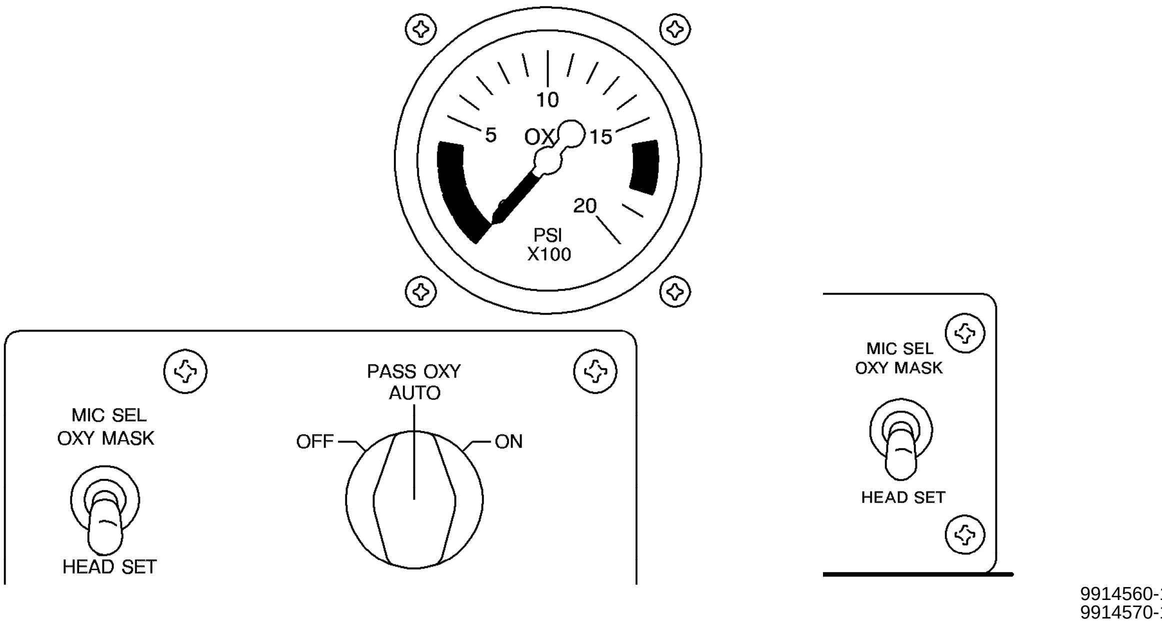


Figure 2-48

The oxygen control panel (PASS OXY) is located on the lower left side of the pilot's instrument panel and contains the OFF-AUTO-ON oxygen control, a microphone selector switch (MIC SEL) and the oxygen cylinder pressure gage. In the AUTO (normal) position of the oxygen control, an altitude sensing switch will electrically actuate the passenger solenoid valve, above 14,500 $\pm$445 feet, supplying 70 PSI oxygen pressure to the oxygen mask door actuator. This pressure is sufficient to deploy the doors and drop the continuous flow masks at each passenger seat. Oxygen will not flow from these masks until the lanyard on the respective mask has been pulled, removing the pintle pin. This conserves oxygen in the event all masks are not to be used. When the cabin altitude descends to approximately 8000 feet with electrical power available, the passenger solenoid valve will close, allowing passenger line system oxygen pressure to bleed off. The ON position is used to bypass the electrical solenoid function and provides oxygen to the passenger at any altitude. OFF position is used to shut off oxygen supply to the passengers in order to conserve the remaining supply for the crew. As the oxygen pressure dissipates, the door actuators will retract, allowing mask stowage to be accomplished. Reinstall all removed pintle pins before stowing masks.

The microphone selector switch (MIC SEL) is marked OXY MASK and HEAD SET. Selection allows for radio transmission through the headset microphone or the oxygen mask microphone. The pilot's microphone selector switch is located low on the far left side of the instrument panel and the copilot's switch is on the lower right side of the instrument panel.

OXYGEN MASKS

The crew oxygen masks are of the quick donning type with mask mounted diluter/demand pressure breathing regulators. The mask face piece fits all facial sizes and shapes and can be easily removed for cleaning or replacement. Each oxygen regulator has capability of manually selecting NORM (diluter demand), 100% (100 percent demand) or EMER (pressure breathing). One hundred percent pressure demand oxygen is provided by moving a lever on the underside of the mask to the 100% position. The mask emergency pressure is tested with a "press-to-test" (TEST) button, and is changed to emergency by turning the same button to EMER. The crew member is assured that oxygen is being received when no restriction to breathing is present with the mask donned and the selector in the 100% position. Selection of the EMER position will provide a steady flow of pressurized oxygen in the face cone. This is sufficient for protection of the respiratory tract against smoke and odor contamination at any altitude. (Above 40,000 feet, pressurized oxygen is provided in all positions; NORM, 100%, EMER.) Oxygen pressure to the masks may be verified by checking the transparent cylinder in the supply line for a green band. If no oxygen pressure is present the band will indicate red. A noise canceling dynamic microphone with transistorized preamplifiers allows for uninterrupted communications while the mask is being utilized.

To qualify as a quick donning mask, the mask must be properly stowed in its stowage box. To properly stow the mask the following procedure should be followed:

a. Open stowage box doors.
b. Ensure the oxygen line and microphone connections are secure within the stowage box.
c. With the harness deflated, grasp the face piece with one hand and allow the harness to hang below the face piece.
d. Coil the hose in the back of the stowage box.
e. Tuck the harness into the stowage box, ensuring that it fits between the coiled hose and the mask.
f. Ensure the last six inches of hose is positioned between the doors. This will allow the doors to close.
g. Continue pushing mask into box until it seats against the upper stop.

NOTE

Do not squeeze the red levers on the regulator face piece, as this will cause the harness to inflate, forcing the stowed harness out of the stowage box.

h. Close the left door. The OXY ON flag will be visible on the right side of the left door.
i. Push the PRESS TO TEST AND RESET button and ensure the OXY ON flag disappears
j. Seat the mask to the door pin, located on the left door.

k. Close the right door and ensure the mask is correctly positioned in stowage box.

CAUTION

INCORRECT SEATING OF THE MASK TO THE DOOR PIN OR INCORRECT ROUTING OF THE HOSE THROUGH THE DOOR OPENINGS MAY IMPAIR PROPER FUNCTIONING OF THE MASK.

The following procedure can be used to test the system for proper operation without removing the mask from the stowage box:

a. Depress the PRESS TO TEST AND RESET button and hold in position.
   (1) Ensure the blinker turns yellow and then black.

NOTE

Transition of the blinker from yellow to black indicates a leak-free regulator. If the blinker remains yellow and fails to transition to black. a leak is present in the system and must corrected.

   (2) While continuing to hold the PRESS TO TEST AND RESET button, depress PRESS TO TEST knob on the regulator for one second. Ensure the blinker turns yellow and then black, indicating proper regulator demand operation.

b. Release the PRESS TO TEST AND RESET button.

At cabin altitudes above 20,000 feet, or when using the mask for smoke protection, 100% oxygen should be selected. To conserve oxygen when using the mask at cabin altitudes below 20,000 feet, 100% may be deselected to revert to normal diluter demand operation.

The passenger oxygen masks are an oral-nasal type which forms around the mouth and nose area. The mask is secured to the face by an elastic headband. The mask consists of a face plate, economizer bag, three foot length of plastic tubing, a lanyard cord with pintle pin attached and head strap. An orifice is located inside the mask plastic tubing to provide constant flow to the passengers regardless of altitude.

PORTABLE OXYGEN BOTTLE

In addition to the normal oxygen system, an 11-cubic foot portable walk-around oxygen bottle is provided. The portable bottle is located in the forward part of the cabin. The bottle has multiple connections and is available to the crew and passengers.

LIGHTING

INTERIOR LIGHTING

Interior lighting is provided for the cockpit, cabin, baggage and tailcone maintenance compartments, and the refuel/defuel adapter on the right side of the fuselage.

Cockpit

Electroluminescent panels, internal instrument lighting, and floodlights illuminate all instruments in the cockpit instrument panel, side consoles, and center pedestal and are considered primary cockpit lighting. Electroluminescent panels are used to illuminate position functions of switches and controls. Primary lighting is designed to be dimmed during night operation.

Secondary lighting includes rheostat controlled floodlights, optional supplemental glareshield lighting, and overhead map lights. The cockpit and standby instruments will operate off the emergency battery when the normal system does not have power.

Ice detection lights, mounted in the glareshield, illuminate the windshields, enabling the pilots to detect ice buildup on the windshield during night flight. These lights are controlled by the DAY/NIGHT DIM ON/OFF switch on the lighting panel. When the switch is ON, the anti-ice lights will be on.

Cabin

The passenger compartment lighting includes five overhead service lights, indirect fluorescent lighting, individual passenger reading lights, dropped aisle lights, cabin door lights, cabin door threshold lights, and passenger information signs. The overhead service lights and reading lights, footwell lights, main entry door and cabin escape hatch lights, exit signs and exterior ground illumination lights serve as emergency evacuation path lighting and are powered by two emergency battery packs. Each pack is maintained at full charge through the airplane's main power bus. A two-position ON-OFF switch by the entry door operates the overhead lights for normal entry and exit. The pilot has the same control with a three-position (EMERG LT) ARM-ON-OFF switch on his switch panel. In ARM, a 5 "G" inertia switch is armed, which when actuated, illuminates all the emergency evacuation path lights.

Two sets of passenger advisory lights are controlled by a three-position switch in the cockpit. In the SEAT BELT position, the FASTEN SEAT BELT signs in the cabin are illuminated. In the PASS SAFE position, the NO SMOKING, FASTEN SEAT BELT and EXIT signs are illuminated, as well as a RETURN TO SEAT sign visible in the aft area. When the switch is off, all the signs are extinguished. Safety chimes, when installed, operate in conjunction with the NO SMOKING and FASTEN SEAT BELT signs.

A guarded cabin master switch (INTERIOR MASTER OFF/NORMAL) is located on the right cockpit side panel. It controls power to the interior master bus. Selecting this switch to OFF will remove all cabin interior power except emergency and exit lighting. This switch can be used to reduce electrical load if needed for generator inoperative conditions, or to shut off cabin electrical power in the event of a cabin electrical fire.

The Citation X is equipped with a master control box and an executive switch module which allow the upper and lower indirect lighting, the divider lights, the aisle (footwell) lights, and the cabin temperature control to be controlled from a position usually located at one of the right aft cabin seats. Other items of cabin equipment may also optionally be added to this switch panel, such as cabin speaker volume, and audio selection between compact disc player (CD) and VCR. An illuminated cabin entry switch panel, located near the cabin door, allows control of certain overhead and aisle lights to facilitate entry into the airplane. A panel located at the refreshment center allows control of the overhead lights, cabin entry light, aisle light and cabin divider light, the shades for the work surface of the refreshment center, and serves to control all window shades as well as the cabin galley and water system. The reading and table lights are controlled by touch switches which are similar to those on the executive switch module and the refreshment center switch panel. These individual reading light switches are mounted on the seat sidewall armrests.

A set/reset module in the cabin electrical system will automatically cause all of the cabin switches (lights, refreshment center equipment, etc.) to be turned off at power down of the airplane electrical system, regardless of the switch positions. When the airplane system is powered up again those items of equipment will remain off, until the switches of the individual units which were left on are recycled.

Aft Baggage Compartment

Three lights, located on the forward left side and forward and aft ceiling of the aft baggage compartment, provide interior lighting for baggage loading or unloading. An OFF/ON toggle switch, located on the door frame, is wired through a door actuated microswitch. With the switch in the ON position, opening the door will allow power to the toggle switch, allowing the light to be turned on. Closing the access door will extinguish the light regardless of toggle switch position.

Tailcone Maintenance Compartment

The tailcone is lighted by a fixed light, mounted below the fire bottle bracket, and a portable light assembly mounted on a quick disconnect swivel base. The OFF/ON switch is mounted near the access door frame and is wired through the door-closed microswitch. Closing the tailcone compartment door will extinguish the lights regardless of OFF/ON switch position.

EXTERIOR LIGHTING

Exterior lighting consists of navigation lights, anti-collision (strobe) lights, wing inspection lights, ground recognition lights (fuselage and tail mounted strobe lights), optional tail (identification) floodlights, wing and ground emergency evacuation route lights, wingtip down wash lights, landing lights, and taxi lights. The landing and taxi lights are controlled by switches located near the throttles on the center pedestal. All other exterior lights are controlled by switches located on the light panels (LIGHTS) located low on the right and left instrument panels. The wingtip down wash lights are controlled by the taxi light switch; they improve taxi operation at night by providing the pilots wingtip visibility. The ground recognition lights are controlled by the GND REC/ANTI-COLL light switch which has three positions: OFF, GND and GND REC/ANTI-COLL. GND position controls the tail anti-collision lights mounted on the under side of the tailcone and on top of the bullet fairing, and GND REC/ANTI-COLL controls both the wing and tail anti-collision lights. The landing lights also operate as recognition lights in flight. The switch RECOG/OFF on the LIGHTS panel controls the landing lights through resistors to produce a less intense light, allowing the landing lights to be used as recognition lights and to extend the bulb life.

The navigation lights consist of a colored light on each wing tip (left-red, right-green) and a white light on the tip of the bullet fairing between the horizontal stabilizers. The wing tip mounted anti-collision lights are controlled separately from the navigation lights. These lights are of very high intensity and can be disturbing to other airplanes and ground personnel if they are used during ground operation. They should be turned on just prior to takeoff roll and secured shortly after landing. Wing inspection lights illuminate the forward portion of the wings, enabling the pilots to detect ice buildup during night flight. The ground recognition lights are mounted on the bottom aft portion of the fuselage and on top of the bullet fairing for use in high density areas on the ground. The tail floodlights illuminate surface areas of the airplane and are used for visual identification during night operations. Exterior emergency evacuation route lights illuminate the wing and ground area around the escape hatch. Landing lights, one on each inboard wing, are illuminated by separate switches. Twin taxi lights are attached to the nose gear strut and are controlled by a single ON/OFF switch during ground operation only. The landing gear weight-on-wheels (squat) switches preclude taxi light illumination in flight. The taxi lights steer with the nose gear strut.

WARNING AND TEST

MASTER WARNING AND MASTER CAUTION SYSTEMS

The Master Warning and Master Caution systems are discussed here in conjunction with the Warning and Test Systems, primarily to cover the procedures for testing these systems and to clarify their relationship with the engine indicating and crew alerting system (EICAS). The Master Warning and Caution systems operate in concert with the EICAS system, which is a function of avionics, and is covered in more detail in Section 3, Avionics. The EICAS system is designed to provide the pilots with an easily interpreted comprehensive digital display of selected airplane system conditions. The EICAS system introduces versatility, comprehensiveness and redundancy not previously available with electromechanical annunciators and separate audio visual indicators; it replaces, and its capabilities go far beyond, those of the traditional annunciator panel. The crew alerting system (CAS) portion of the EICAS system refers to that part of the EICAS system which presents textual messages in the lower left-center part of the center display unit. The MASTER CAUTION and MASTER WARNING annunciator lights, one of each in front of each pilot, work in conjunction with the red and amber digital indications of the CAS system to draw the pilots' attention to conditions requiring timely corrective action. The MASTER WARNING light works in conjunction with red CAS messages and the MASTER CAUTION works in conjunction with the amber CAS messages. The annunciator system is powered from the main direct current (DC) buses through the WARNING CONT 1 and 2 circuit breakers on the left circuit breaker panel in the cockpit. The MASTER WARNING lights (pilot and copilot) will flash when activated, until the event is acknowledged by pressing one of the respective lights. The MASTER CAUTION lights will illuminate steadily, until acknowledged by pressing one of the lights. The annunciator lights are dimmed during night operation. For MASTER WARNINGS an audio tone will be repeated a maximum of three times until the warning is acknowledged. The message will blink until acknowledged. It will also appear on the multifunction display (MFD) until acknowledged, at which time it will disappear from the MFD. For MASTER CAUTION lights the illumination of the light will be accompanied by an attention chime.

The MASTER WARNING and MASTER CAUTION lights can be tested by placing the rotary TEST selector on the center pedestal to the ANNU position. This will illuminate all the lights and cause the MASTER WARNING and the MASTER CAUTION lights to illuminate.

Red digital crew alerting system (CAS) messages will cause the MASTER WARNING to illuminate. Both MASTER WARNING lights will flash when the following annunciations occur: AUTO SLATS FAIL, TR AUTOSTOW L-R, BATT 1-2 O'TEMP, APU FIRE, BAGGAGE SMOKE, CABIN ALTITUDE, CHECK PFD, EMERGENCY DESCENT, ENG VIBRATION L-R, ENGINE FAILED L-R,. ENGINE FIRE L-R, HYD O'TEMP A-B, HYD PUMP FAIL A-B, NO TAKEOFF, OIL PRESS LOW L-R, PYLON BLEED LEAK L-R, RUDDER LIMIT FAIL, STAB BLD LEAK L-R, and GEN OFF L-R. The GEN OFF L and R annunciations are amber, however, if a second generator should fail after one generator has already failed and been annunciated, the digital CAS message will turn red, annunciating both failures, and the MASTER WARNING will flash.

There are approximately 137 possible amber digital CAS messages, depending upon optional equipment installed. These messages are discussed in Section 3, Avionics, under Engine Indicating and Crew Alerting System (EICAS).

The MASTER WARNING or MASTER CAUTION lights can be reset by pressing either light. Resetting the warning or caution lights rearms the system so that it will function with the presentation of another red or amber digital message on the CAS area of the EICAS display unit. The master warning lights will also flash during the test mode and the MASTER CAUTION will illuminate, but they are not resetable in this mode.

AFT POWER AND AC JUNCTION BOXES, AND LOGIC MODULES

The main left and right power junction boxes and the alternating current (AC) junction boxes are located in the aft baggage compartment. These junction boxes incorporate a number of major relays, logic modules, and circuit breakers that supply remote signals which provide warning and caution messages to the EICAS system. Some of the logic modules record circuit breaker trips and system malfunctions for facilitation of later ground maintenance. Other logic modules are located in the pilot's side console. Refer to the airplane Maintenance Manual and to the Wiring Diagram Manual for a listing of the circuit breakers by number and function for each of the junction boxes and logic modules.

ALTITUDE AND SPEED BRAKE MONITOR SYSTEM

The altitude and speedbrake monitor system provides a warning through the appearance of an amber SPEED BRAKES CAS message if the airplane is airborne but at less than 500 feet in altitude and the speed brakes are not stowed. It is designed to warn that the speed brakes are in use below 500 feet altitude, which could result in an undesirable rate of descent near the ground. A ground signal is provided from the radio altimeter when the airplane is at less than 500 feet in altitude; a ground-in-air signal is then obtained from the left and right squat switches and the monitor circuit outputs a SPEED BRAKE signal to the CAS system.

The following configuration will give rise to an amber CAS message from the altitude and speed brake monitoring system:

- Speed brakes not in the STOWED position.
- Airplane is airborne at less than 500 feet in altitude.

An asymmetrical deployment of the speed brakes in which the asymmetry exceeds 5% will also result in an amber SPEED BRAKE CAS message, to warn of the abnormal condition.

Separate monitoring will provide a white CAS signal when the speed brakes are purposely deployed - simply as a reminder to the pilot that the speed brakes are in use. This circuit will be active any time the speed brakes are deployed in excess of 5%.

NO TAKEOFF WARNING SYSTEM

The no takeoff warning system is designed to prevent a takeoff when a hazardous condition exists which would render the takeoff unsafe due either to airplane configuration or to system malfunction(s). A cyan or red digital NO TAKEOFF annunciation advises of an unacceptable configuration or condition for takeoff. The cyan message will occur when either throttle lever angle (TLA) is less than 60 degrees and the weight-on-wheels (squat) switches show an on-ground condition. The digital NO TAKEOFF message will change to red when the TLA of either throttle is increased past 60 degrees. At this time the “NO TAKEOFF” aural warning will sound. The no takeoff annunciation can be cleared only when the situation causing it is corrected. Conditions which contribute to a NO TAKEOFF message are:

- Flaps above 5 degrees or down beyond 15 degrees
- Gustlocks engaged
- Stabilizer trim set out of takeoff range
- Rudder or aileron trim out of takeoff range
- Speedbrakes extended
- Slats asymmetrical
- Left or right slat not deployed
- Yaw damper not centered
- Park brake on
- Fuel level low
- Pitch/Roll disconnected
- Engines synchronized (N_1, N_2)
- Left or right start valve open
- Flap position 10 degrees or more with the flap override switch depressed

The no takeoff warning system is deactivated by the landing gear squat switch when the airplane is in flight.

DOOR UNLOCKED WARNING SYSTEM

The cabin door is locked with an overcenter main bellcrank, which in turn drives ten pins out of the door into receiving holes in the door frame. Inspection windows near the door handle and each pin allow for visual inspection of the locking mechanism. A green flag indicates proper pin engagement and proper handle position. Monitoring switches on the two upper and two lower pins and on the overcenter bellcrank are connected to the engine indicating and crew alerting system (EICAS), so that an amber textual CABIN DOOR OPEN message will appear in the crew alerting system (CAS) part of the EICAS display if any door pin, or the handle, does not indicate a safe condition. The digital message will appear and the MASTER CAUTION will illuminate steadily if one switch indicates differently from the others. The lower aft locking pin, when in the door locked position, actuates a pneumatic valve which allows the primary door seal to pressurize. Loss of pressure to the seal is indicated by an amber CABIN DOOR SEAL CAS message, accompanied by illumination of the MASTER CAUTION light.

The MASTER WARNING or MASTER CAUTION lights can be reset by pressing either light. Resetting the warning or caution lights rearms the system so that it will function with the presentation of another red or amber digital message on the CAS area of the EICAS display unit. The master warning lights will also flash during the test mode and the MASTER CAUTION will illuminate, but they are not resetable in this mode.

AFT POWER AND AC JUNCTION BOXES, AND LOGIC MODULES

The main left and right power junction boxes and the alternating current (AC) junction boxes are located in the aft baggage compartment. These junction boxes incorporate a number of major relays, logic modules, and circuit breakers that supply remote signals which provide warning and caution messages to the EICAS system. Some of the logic modules record circuit breaker trips and system malfunctions for facilitation of later ground maintenance. Other logic modules are located in the pilot's side console. Refer to the airplane Maintenance Manual and to the Wiring Diagram Manual for a listing of the circuit breakers by number and function for each of the junction boxes and logic modules.

ALTITUDE AND SPEED BRAKE MONITOR SYSTEM

The altitude and speedbrake monitor system provides a warning through the appearance of an amber SPEED BRAKES CAS message if the airplane is airborne but at less than 500 feet in altitude and the speed brakes are not stowed. It is designed to warn that the speed brakes are in use below 500 feet altitude, which could result in an undesirable rate of descent near the ground. A ground signal is provided from the radio altimeter when the airplane is at less than 500 feet in altitude; a ground-in-air signal is then obtained from the left and right squat switches and the monitor circuit outputs a SPEED BRAKE signal to the CAS system.

The following configuration will give rise to an amber CAS message from the altitude and speed brake monitoring system:

- Speed brakes not in the STOWED position.
- Airplane is airborne at less than 500 feet in altitude.

An asymmetrical deployment of the speed brakes in which the asymmetry exceeds 5% will also result in an amber SPEED BRAKE CAS message, to warn of the abnormal condition.

Separate monitoring will provide a white CAS signal when the speed brakes are purposely deployed - simply as a reminder to the pilot that the speed brakes are in use. This circuit will be active any time the speed brakes are deployed in excess of 5%.

NO TAKEOFF WARNING SYSTEM

The no takeoff warning system is designed to prevent a takeoff when a hazardous condition exists which would render the takeoff unsafe due either to airplane configuration or to system malfunction(s). A cyan or red digital NO TAKEOFF annunciation advises of an unacceptable configuration or condition for takeoff. The cyan message will occur when either throttle lever angle (TLA) is less than 60 degrees and the weight-on-wheels (squat) switches show an on-ground condition. The digital NO TAKEOFF message will change to red when the TLA of either throttle is increased past 60 degrees. At this time the “NO TAKEOFF” aural warning will sound. The no takeoff annunciation can be cleared only when the situation causing it is corrected. Conditions which contribute to a NO TAKEOFF message are:

- Flaps above 5 degrees or down beyond 15 degrees
- Gustlocks engaged
- Stabilizer trim set out of takeoff range
- Rudder or aileron trim out of takeoff range
- Speedbrakes extended
- Slats asymmetrical
- Left or right slat not deployed
- Yaw damper not centered
- Park brake on
- Fuel level low
- Aileron latch disengaged
- Pitch/Roll disconnected
- Engines synchronized (N_1, N_2)
- Left or right start valve open
- Flap position 10 degrees or more with the flap override switch depressed

The no takeoff warning system is deactivated by the landing gear squat switch when the airplane is in flight.

DOOR UNLOCKED WARNING SYSTEM

The cabin door is locked with an overcenter main bellcrank, which in turn drives ten pins out of the door into receiving holes in the door frame. Inspection windows near the door handle and each pin allow for visual inspection of the locking mechanism. A green flag indicates proper pin engagement and proper handle position. Monitoring switches on the two upper and two lower pins and on the overcenter bellcrank are connected to the engine indicating and crew alerting system (EICAS), so that an amber textual CABIN DOOR OPEN message will appear in the crew alerting system (CAS) part of the EICAS display if any door pin, or the handle, does not indicate a safe condition. The digital message will appear and the MASTER CAUTION will illuminate steadily if one switch indicates differently from the others. The lower aft locking pin, when in the door locked position, actuates a pneumatic valve which allows the primary door seal to pressurize. Loss of pressure to the seal is indicated by an amber CABIN DOOR SEAL CAS message, accompanied by illumination of the MASTER CAUTION light.

If the cabin vent door is unsafe, in that the cabin door vent proximity switch does not sense a closed condition, an amber CBN VENT DOOR message and MASTER CAUTION indication will appear.

The baggage compartment door has one pin, the lower forward, which depresses a door lock sensing switch; the same pin also opens the door seal pressurization valve which causes the baggage door seal to inflate. The door handle is also equipped with a proximity switch which signals the safety of the baggage door to the EICAS system. An amber digital BAGGAGE DOOR message will appear if the lower forward pin does not secure the door safety switch located at that pin position, and/or the baggage door handle is not secured.

Any time the cabin door is open with power on the airplane, the CABIN DOOR OPEN message will illuminate steadily; the MASTER CAUTION can be extinguished by acknowledging it. If the door is closed and one or more monitoring switches do not agree with the others, the CABIN DOOR OPEN will remain illuminated and the MASTER CAUTION will illuminate.

If the CABIN DOOR CAS message illuminates the flight crew should physically determine if the door is, in fact, secure. Once satisfied of this they can acknowledge the message. Acknowledgement of the message causes the logic to ignore the element that triggered the message. However, if the door is subsequently reopened and shut, the logic will be reset and will reactivate the CAS message. Upon acknowledgment the CAS message will go away only if one switch has been triggered. If two or more switches have been triggered, the message can be acknowledged (stop flashing) but it will remain on the EICAS display.

An amber digital NOSE DOOR OPEN L-R, TAILCONE DOOR, TOILET DOOR OPEN, NACELLE OPEN, BAGGAGE DOOR OPEN, or FUEL DOOR OPEN annunciation will appear if the respective nose avionics door, tailcone maintenance door, toilet service door, left or right nacelle, baggage door, or the single point refueling and/or gravity fuel doors are not properly closed. The MASTER CAUTION will also illuminate, as above, with the amber messages.

The emergency exit door on the right side of the airplane is monitored by a proximity switch on the upper door frame. If the locking pin in that position is unsafe the switch will send a signal to the CAS system which will illuminate an amber message ESCAPE HATCH OPEN. The MASTER CAUTION will also illuminate.

OVERSPEED WARNING SYSTEM

The on-side micro air data computer (MADC), backed up by the opposite MADC, feeds Mach and airspeed information to the aural warning system, which sounds a pulsing horn when speed exceeds V_{MO} or M_{MO} (maximum operating speed limit).

TEST SYSTEM

The rotary test selector switch is located in the right side of the center pedestal and offers a means of testing visual and aural warning systems. The system will function only when at least one battery switch is in BATT. A red light above the test selector switch illuminates whenever the test selector switch is in any position but OFF.

TEST SELECTOR SWITCH

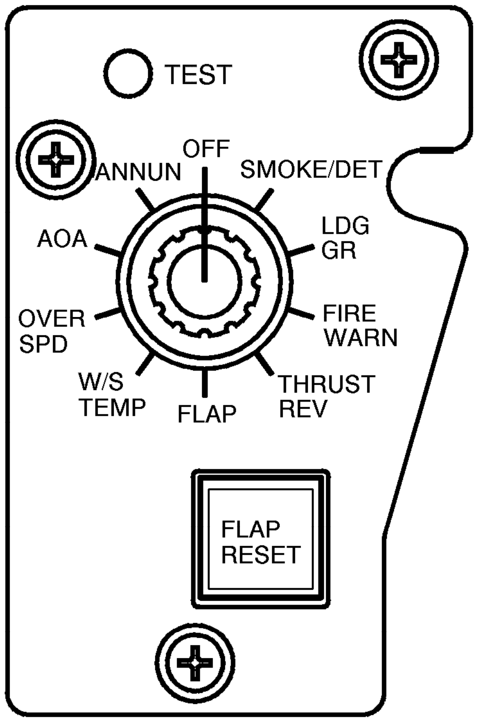


Figure 2-49

Test Selector Switch Positions

SWITCH POSITION	TEST FUNCTION	CAS MESSAGE	AURAL	LIGHTS	INHIBITS
SMOKE/ DET	Performs a self-test of the smoke detector and checks the integrity of its aural/visual warning interface.	BAGGAGE SMOKE	CHIME[1]	Master Warning	—
LDG GR	Performs a self-test of the landing gear warning systems and a lamp test of landing gear indicator lights.[2]	—	LANDING GEAR WARNING HORN (flaps must=<24°)	Landing gear module lights	—
FIRE WARN	Performs self-test of the engine fire detection systems and checks the integrity of its aural/visual warning interface.	ENGINE FIRE L-R	—	Master warning, APU fire, Engine FW Lights	Aurals muted
THRUST REV	Performs a check of the thrust reverser indicator lights.	—	—	All TR lights and Master Warning	—
FLAP	Performs a self-test of the flap controller.	FLAPS FAIL[3]	—	Master Caution and 2 flap annun. lights	—
W/S TEMP	Checks automatic control and operation of the electric windshield system.[4] Performs RAT test (CAS msg if test fail)[5].	WSHLD HEAT INOP L WSHLD HEAT INOP R WSHLD O'TEMP L-R RAT HEAT FAIL	CHIME	Master Caution	—
OVERSPD	Tests overspeed warning horn	—	OVERSPEED HORN	—	—

(Continued Next Page)

1. A double chime.
2. The gear warning horn is a dedicated horn for the landing gear only.
3. Message is displayed for the duration of the built-in test (approximately five seconds). Also flap pointer changes to amber.
4. The W/S ANTI-ICE switches must be in the ON position in order for the associated CAS messages to be displayed.
5. The PITOT-STATIC ANTI-ICE switches must be in the ON position in order for the associated CAS message to be displayed.

Test Selector Switch Positions (Continued)

SWITCH POSITION	TEST FUNCTION	CAS MESSAGE	AURAL	LIGHTS	INHIBITS
AOA	Self tests the AOA computers, checks the stick shakers and auto slats system[6] ; checks the optional LCD AOA display, and AOA indexer.	AOA PROBE FAIL L-R AUTO SLATS FAIL STALL WARN L-R	—	Optional Indexer —	Aurals muted
ANNUN	Performs lamp test of discrete annnciators.	OIL PRESS LOW L-R[7] FUEL PRESS LOW L-R HYD PUMP FAIL A-B	—	Optional annunciator lights, GPWS and wind shear annunciators.	Aurals muted
OFF	Disables all test functions. Red light will be off.	—	—		—

6. During the test, AOA computers receive a test signal to deploy slats. If there is sufficient hydraulic pressure the slats will deploy. AUTO SLATS FAIL message will appear whether or not the slats actually deploy.
7. The engine shutdown inhibits are removed. All annunciations associated with master warning will occur except aural signals, which are muted.

AFT BAGGAGE COMPARTMENT LADDER

Access to the aft baggage compartment is provided by a fold down ladder. Figure 2-50 shows the baggage ladder in the stowed position. To deploy the ladder grasp the upper end and pull out and down until the ladder rests on the threshold of the baggage door opening (Figure 2-51).

BAGGAGE LADDER STOWED POSITION

A7324

6785P1044

Figure 2-50

(Continued Next Page)

AFT BAGGAGE COMPARTMENT LADDER (Continued)

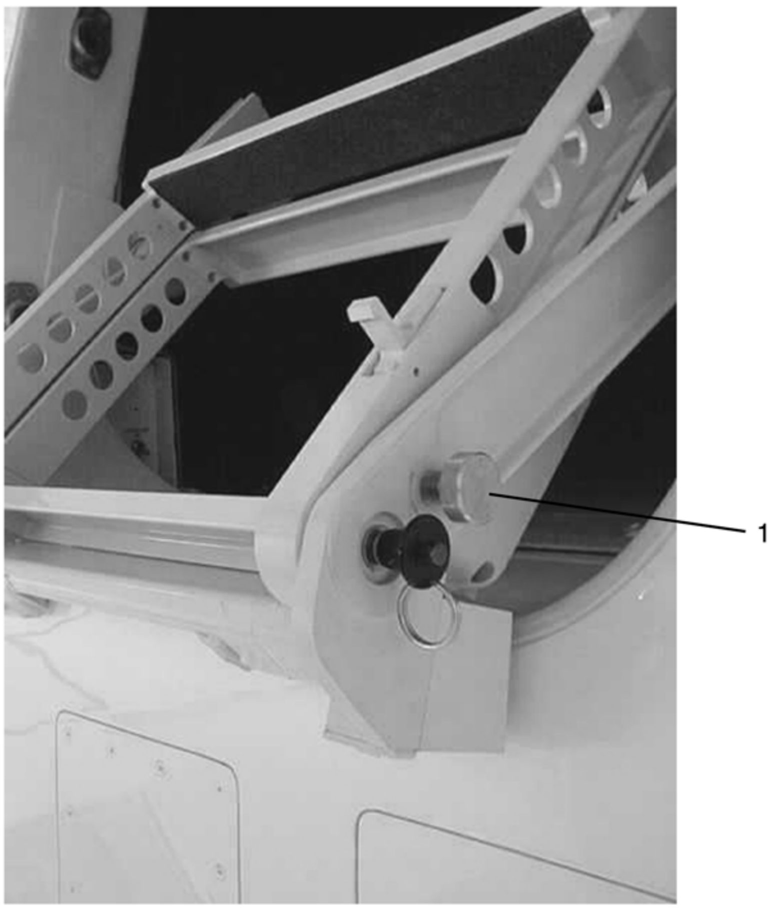
Figure 2-51 (1) shows the baggage ladder spring plunger. To initiate the unlocking sequence, pull the spring plunger out to disengage and rotate the knob 1/4 turn to lock open.

NOTE

Some airplanes are equipped with spring plungers on the fore and aft sides of the ladder.

BAGGAGE LADDER SPRING PLUNGER

A7325



6785P1045

Figure 2-51

(Continued Next Page)

AFT BAGGAGE COMPARTMENT LADDER (Continued)

Grasp the upper end of the ladder and pull out and down until the upper latches (Figure 2-52 (2)) click in the locked position.

BAGGAGE LADDER UPPER LATCHES

A7326

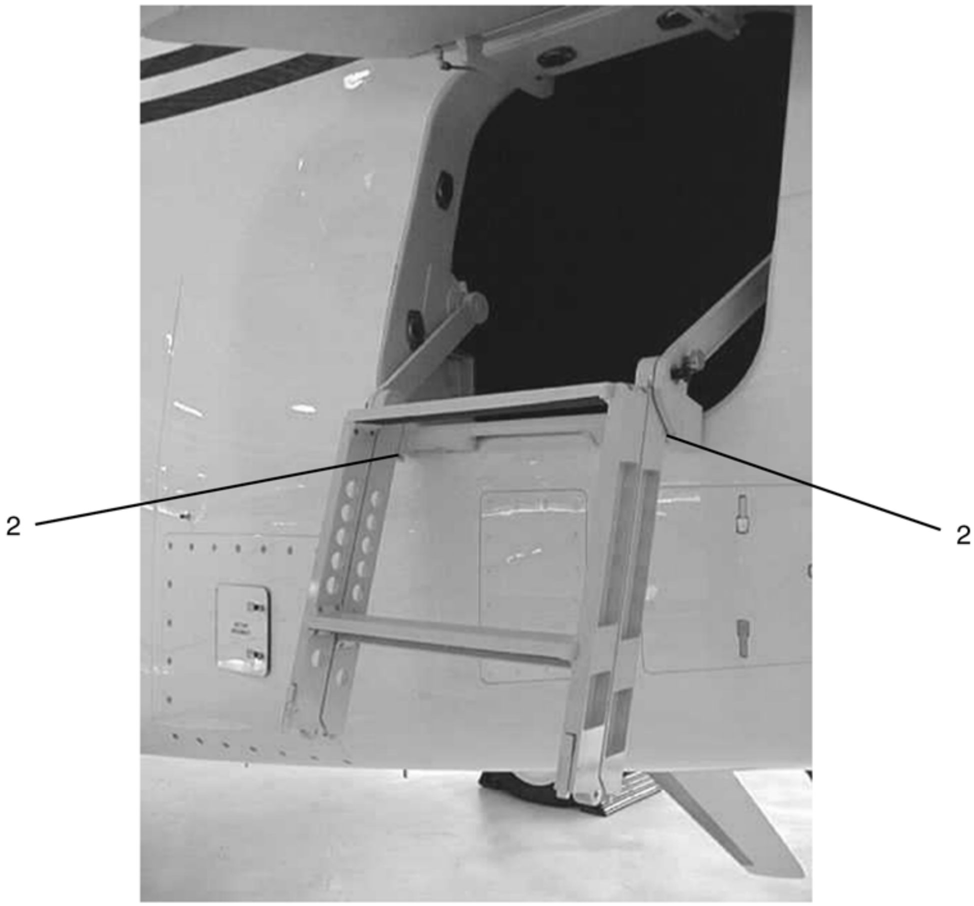


Figure 2-52

(Continued Next Page)

AFT BAGGAGE COMPARTMENT LADDER (Continued)

Grasp the upper end of the ladder and pull out and down until the lower latches (Figure 2-53 (3)) click in the locked position.

To stow the ladder fold in reverse order. Ensure the spring plunger(s) is (are) engaged when the ladder is in the stowed position.

NOTE

Depress latches at each folding point (Figure 2-53)

BAGGAGE LADDER FULLY EXTENDED

A7327

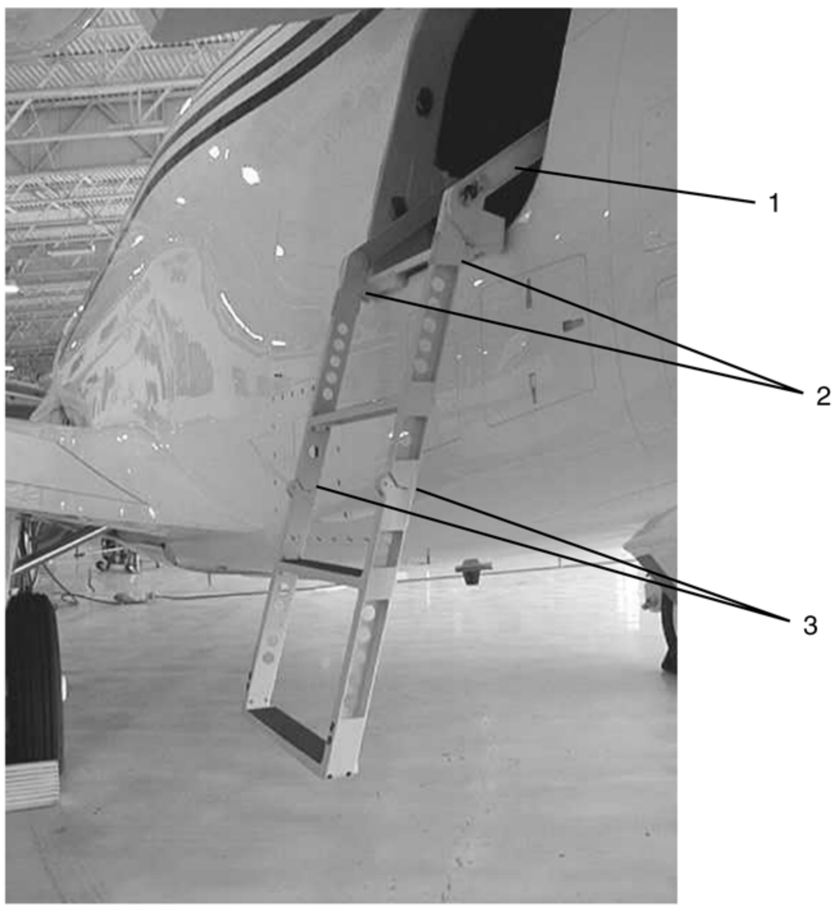


Figure 2-53

SECTION III

INSTRUMENTATION AND AVIONICS

CONTENTS

(Continued Next Page)

CONTENTS (Continued)

INSTRUMENTATION

The Citation X is equipped with PRIMUS 2000 Digital Automatic Flight Control System (AFCS). The PRIMUS 2000 is a digital flight control and guidance system which is an automatic flight guidance, flight management, and electronic display system. It combines the electronic flight instrument system (EFIS), flight director, autopilot/yaw damper system, the AH-800 attitude and heading reference system (AHRS), and the flight management system into an integrated whole. The complete indicating system is comprised of five cathode ray tubes (CRTs). The pilot's and copilot's flight instruments and flight directors are displayed, respectively, on the left and right tubes of the dual electronic flight instrument system; the electronic attitude director indicator (EADI) and the electronic horizontal situation indicator (EHSI) are displayed on a single DU-870 display unit (DU), which is referred to as a primary flight display (PFD). Each pilot also has a multifunction display (MFD), where optional and backup displays are selectable, as well as the PFD. The central cathode ray tube (CRT) serves as the engine indicating and crew alerting system (EICAS) display. All of the CRTs are interchangeable, the bottom (control) sections being removable. A traffic alert and collision avoidance system (TCAS) works in conjunction with the mode S transponder and the flight guidance system. Operation of the flight directors is discussed in the Avionics section under Flight Guidance, and operation of the various systems is discussed under their separate headings in the separate Instruments and Avionics sections, as applicable. A combined standby airspeed indicator/altimeter, a standby attitude indicator (ADI), and a standby horizontal situation indicator (HSI) are installed to provide instrumentation in the unlikely event of complete failure of the dual EFIS system. Two independent pitot-static systems, left and right, measure total pressure and static pressure for the pilot's and copilot's electronic instruments. A third, separate, system provides pitot and static pressure to the standby altimeter/airspeed indicator. The three pitot tubes and six static ports are electrically heated for ice protection.

PITOT-STATIC SYSTEM

The left and right pitot tubes provide pitot pressure to their respective pilot's and copilot's digital air data computers (ADCs). They are symmetrically located on the nose of the airplane. The standby pitot tube, which provides pitot pressure for the standby airspeed indicator, is located below the copilot's side window. Three static ports are located on each side of the airplane. One port on each side provides static pressure for the pilot's air data computer, and another set of ports provides static pressure for the copilot's air data computer. The third set of ports provides static pressure to the standby airspeed indicator/altimeter. All three static ports on each side are located in one static port plate assembly. The pilot's static system used the top static port on the left side and the bottom static port on the right side, and the copilot's system uses the reverse combination. The standby system uses the aft static port in both static port plate assemblies. The static port plate assemblies are located below the pilot's and copilot's windows.

The air data computers (ADCs) receive the pneumatic information, and in turn convert it to electrical data, each providing electrical signals for operation of the PFD displays of its respective system Mach/airspeed indicator, altimeter, and instantaneous vertical speed indicator. Both ADCs also provide altitude outputs for the two mode S transponders. The standby airspeed indicator/altimeter is powered only by static and impact pressure; the only electrical function in the system is the standby altimeter vibrator, which receives power from the standby instrument bus. If the ADCs should fail, red Xs will appear at the respective displays of airspeed and altitude, and the analog scales and digital values will disappear. On the vertical speed display, the pointer will disappear and the digital readout will be dashed out.

PITOT-STATIC SYSTEM

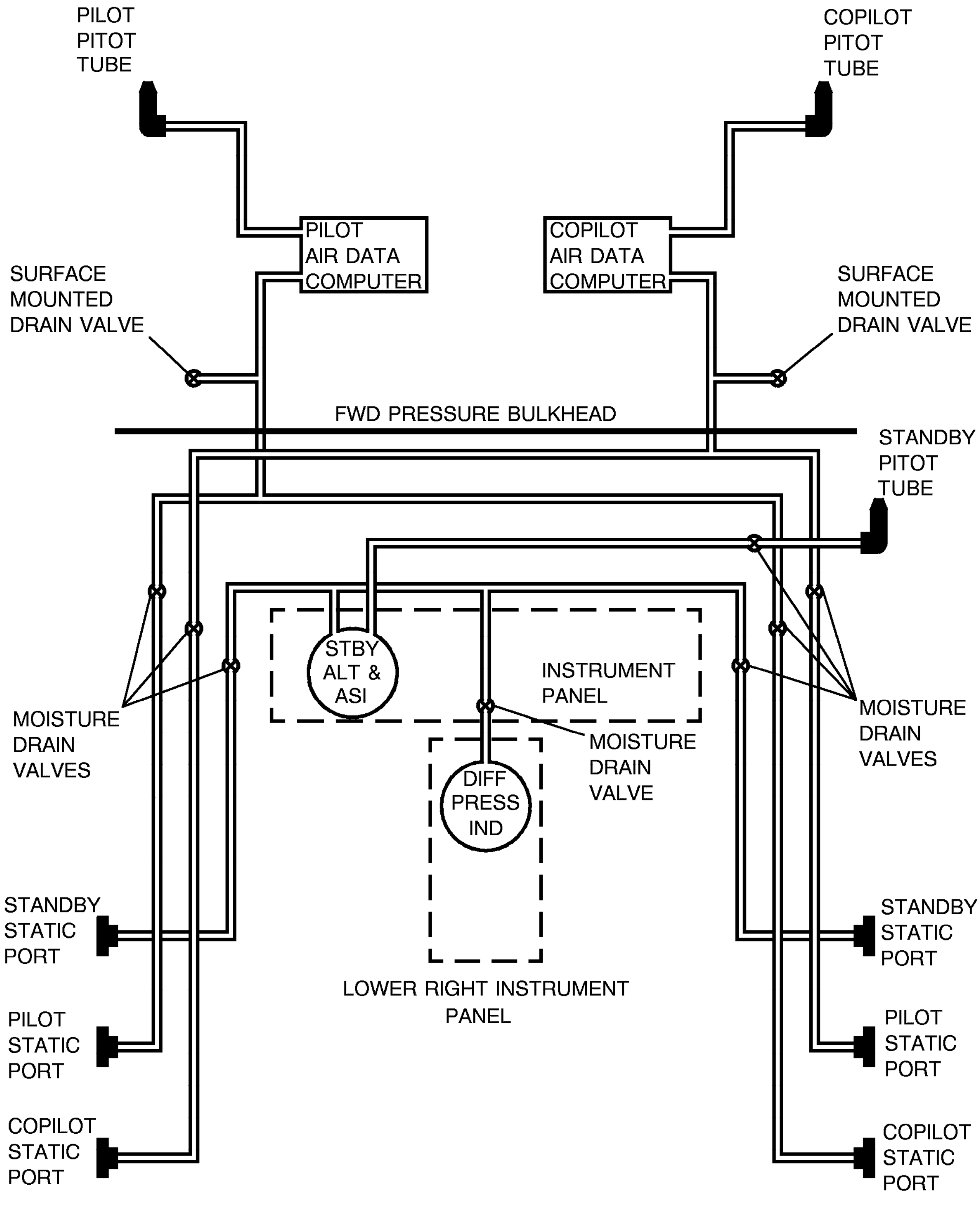


Figure 3-1

ALTITUDE DISPLAY

Both altimeters are electrically driven altitude displays which are part of the primary flight display (PFD). They receive their data from their respective digital air data computers, which convert pneumatic information into electronic signals and transmit it to the primary flight displays (PFDs). The altimeter display is located in the upper right side of the (PFD). There are two altitude displays superimposed upon each other. One display is a moving analog scale with a fixed pointer. The scale and its markings are white. The larger digits descend from the top of the scale. The other display is a rolling digital display which is located in the center of the analog tape display (the analog reference line); it gives the actual value in the display read-out window and is a magnified display of the numbers on the tape at that position. This display magnifies the digits on the scale and is readable to a 20-foot resolution. The digits within the window are white. For climb or descent rates greater than 3000 feet per minute the rolling drum digits are replaced with two dashes in order to facilitate reading of the analog scale. Below 10,000 feet, a boxed cross-hatch replaces the 10,000's digits to emphasize low altitude awareness.

A magenta altitude trend vector originates at the altitude reference line. It is a thermometer shape that corresponds to the altitude rate-of-change. It moves along the left side of the altitude tape and predicts the actual airplane altitude in six seconds if the same vertical speed is maintained. Altitude rate is output from the micro air data computer (MADC).

An altitude alert select readout is located at the top of the altitude tape depiction. It is selectable by the copilot using the right-side instrument remote controller. When the airplane is within the altitude alert operating region the digits are boxed. The set data is cyan under normal circumstances. When departing a selected altitude, the select display and the box will turn amber. An altitude select bug, a notched rectangle, travels along the left side of the altitude tape. It appears on the tape across from the altitude set into the altitude alert select display. The bug color is the same as the digit color in the altitude select window. If the bug is moved off the current scale range, half of the bug remains on the scale to indicate the direction to the set bug.

At radio altitudes of 550 feet or less, the lower part of the altitude tape changes linearly from a gray raster to brown. At zero radio altitude, the brown raster touches the altimeter reference line.

The selection of metric (hectopascals, [HP]) or inches-of-mercury (inHg) barometric altimeter settings is controlled by a push-on/push-off button (BARO/IN HPA) on the bezel of the respective MFD. A BARO set knob on the bottom of the PFD controls the altimeter pressure setting. By pressing the button next to the BARO knob (STD) , the standard datum plane (29.92) may be selected on the electronic Kollsman dial. The baro set data is always cyan. A metric altitude display is displayed directly below the baro set data. It will appear only if metric data has been selected for display with the MFD bezel control. When selected the altitude scale still displays altitude in feet. The display is always green.

A minimum descent altitude or decision height (MDA or DH) select bug, which corresponds with the digital set value, is displayed on the left side of the altitude tape. A line extends from the bug across the tape; below the line appears the brown low altitude awareness color. The bug and the digital MDA settings are accomplished by turning the knob on the lower left of the PFD bezel.

Other information which interfaces with the altimeter, but pertains more directly to flight guidance, will be covered in detail under Flight Guidance in this section.

ALTITUDE DISPLAY

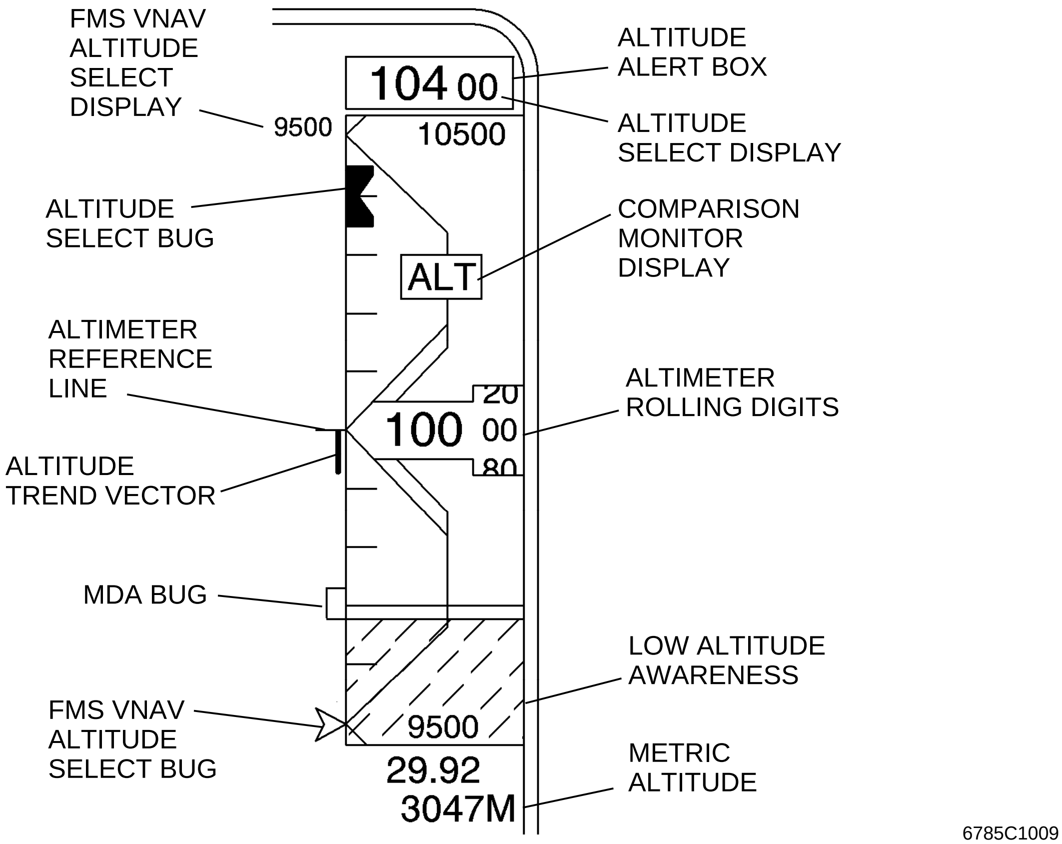


Figure 3-2

An altitude annunciation warning (ALT) will appear in the upper part of the altitude tape if the comparison monitor system senses a difference of a predetermined value in the altitude information provided by the micro air data computers.

The radio altimeter and its displays are covered under Radio Altimeter in this section.

MACH/AIRSPEED DISPLAY

In the Citation X the airspeed indicators are replaced by electronic tape airspeed displays which are a part of the primary flight displays (PFDs). The airspeed display occupies the upper left corner of the PFD, and is color coded to make interpretation of the data easier. The Mach display is digital and is located immediately below the airspeed tape.

The airspeed (analog) display is a moving scale display with a fixed pointer and calibrated airspeed marks. The scale markings on the tape are white and in 10-knot increments. The scale digits move so the larger numbers descend from the top of the display. The center of the airspeed display, which is also the analog reference line, is where the current airspeed is indicated; it is a rolling digit display, the higher numbers progressing down from the top. The rolling digit display is readable to 1-knot resolution. The digits within

AIRSPEED DISPLAY

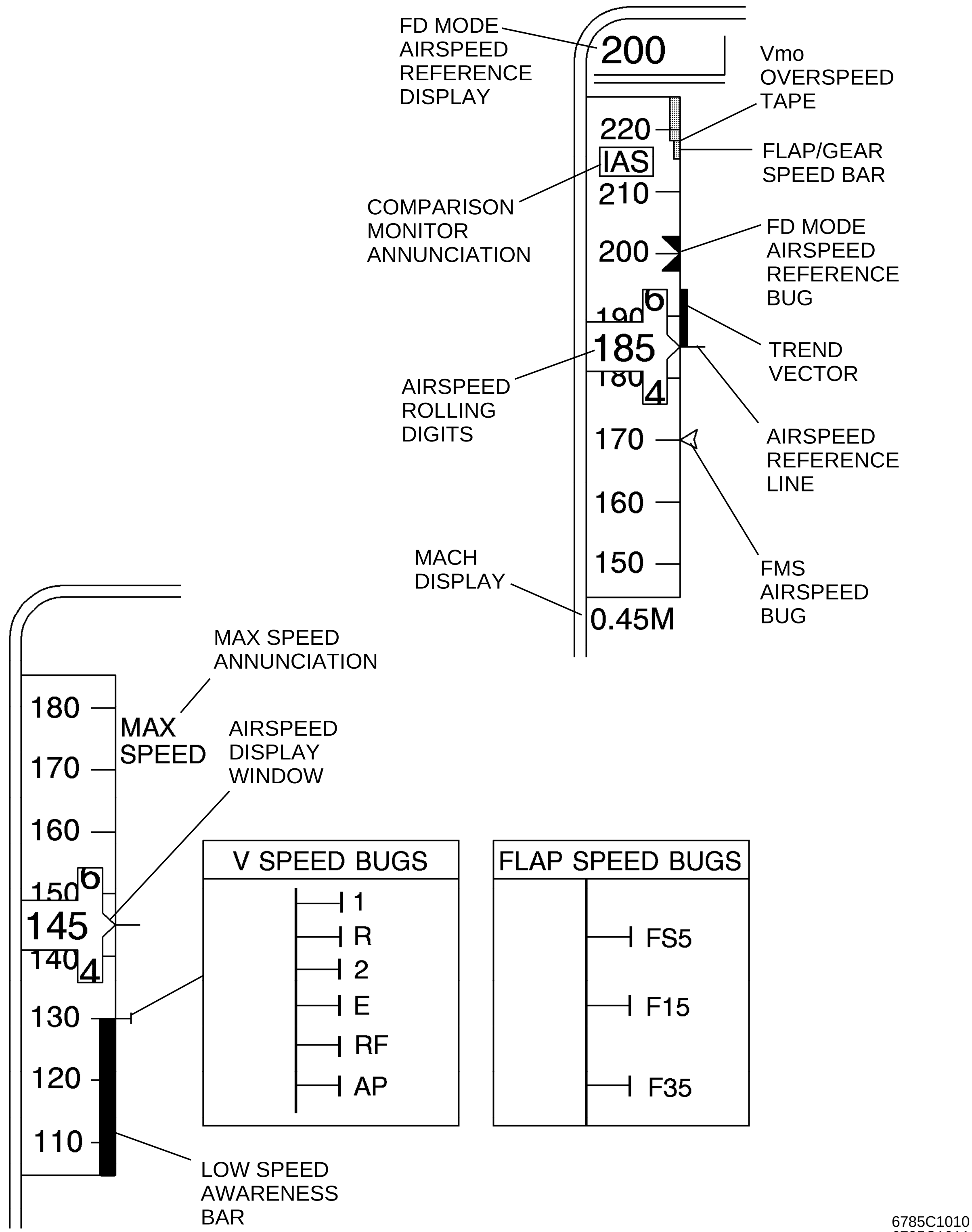


Figure 3-3

the pointer are white. If V_{MO}/M_{MO} is exceeded, the numbers in the center display turn red. When the airspeed trend vector exceeds V_{MO} by one knot, the rolling digits turn amber unless a red indication is called for.

A V_{MO} overspeed tape, a red bar, is located at the upper right side of the display. It is a fixed bar that originates at A V_{MO} and extends to the end of the scale. The V_{MO} bar will not appear until the speed which corresponds to it appears on the scale.

An airspeed trend vector is positioned along the outer right side of the airspeed tape. It is referenced to the airspeed reference line. The vector indicates what the value of indicated airspeed is projected to be in ten seconds, if the present trend is maintained.

A digital display of the current Mach is shown directly below the airspeed tape. The value is displayed when Mach passes 0.45 accelerating and is removed when it passes below 0.40 on deceleration. The digits are colored in agreement with the digital airspeed display.

A low speed awareness bar, which works in conjunction with the angle-of-attack (AOA) system, is located inside the lower right corner of the airspeed tape. It is a thermometer type annunciator which has three segments: white, yellow, and red. The white color represents an angle-of-attack of 1.2 to 1.3; yellow represents 1.1 to 1.2; red represents less than 1.1 to stall speed. The angle-of-attack indication is referenced to the airspeed reference line; when the red portion of the bar reaches the airspeed reference line, the AOA driven display indicates that the stickshaker has activated and an approach to stall has been reached. The display does not appear when the airplane is on the ground.

A flight director airspeed/Mach reference bug display is shown only when the flight director flight level change (FLC) mode is engaged. The pilot-adjustable airspeed or Mach reference digital read-out is displayed directly above the airspeed tape. The airspeed/Mach reference bug is shown on the right side of the airspeed tape. Both the read-out and the bug are cyan.

When the active flight guidance system has entered the MAX SPEED mode, an amber MAX SPD is annunciated to the right of the upper part of the airspeed tape (refer to Flight Guidance in this section).

There are six V_{SPEED} bugs, corresponding to various phases of flight, which can be set for display on the primary flight displays (PFDs). These values are input using the multifunction display (MFD) V SPEEDS menu. The blue colored V_{SPEEDS} travel along the right side of the tape. V_1 and V_R can be set equal to each other. All other V_{SPEED} bugs have a minimum required difference of 3 knots. After the speed corresponding to the set V_{SPEED} is reached $\pm$50 knots the bugs are removed from the display. The V_{REF} bug is removed only after the airspeed equals V_{REF} minus 50 knots. The enroute climb speed (V_{ENR}) is set at 190 knots.

V_{SPEED}	LABEL	DEFINITION
V_1	1	T/O Decision Speed
V_R	R	Rotation Speed
V_2	2	T/O Safety Speed
V_{ENR}	E	Enroute Cl (190KTS)
V_{APP}	APP	Approach Ref.
V_{REF}	REF	Landing Ref.

When the V_{SPEED} values are being set, and with the Mach below 0.45, the V_{SPEED} bug values sequentially replace the MACH display window until the V_{SPEED} bug is displayed on the analog airspeed scale. When on the ground, if all the T/O V_{SPEED} values have not been set and selected for display, an amber VSPD annunciation is displayed in the window.

When the airplane is on the ground and the indicated airspeed is less than thirty knots, the bottom half of the airspeed tape is replaced with the V_{SPEEDS} and their values in a column, top to bottom, as follows: E, R, 2, 1.

A flap/gear speed bar is located on the right side of the airspeed tape. It is a thermometer type of annunciation which extends from the V_{MO} overspeed tape to the airspeed limit for the airplane's configuration as defined below:

CONFIGURATION	SPEED LIMIT
Flaps 5°	250 Knots
Flaps 0° - 15°	210 Knots
FLaps > 15°	180 Knots
Gear Down	210 Knots

VERTICAL SPEED DISPLAY

Like the airspeed and altitude displays, the vertical speed display forms a portion of the flight instrument display on the pilot's and copilot's primary flight displays (PFDs). The vertical speed display is located in the lower right side of the PFDs; it is depicted as a fixed arc scale with a moving pointer, much like a conventional vertical speed would appear. There is a also digital readout, as well as the conventional analog readout. The analog scale on the display is in white and ranges from a maximum rate of +3500 feet to -3500 feet, calibrated in thousands of feet. The scale is somewhat expanded between the +1000 to -1000 feet markings. The digital reading of the actual vertical speed is displayed as white digits in a box on the zero reference line. The digital readout has a resolution of fifty feet per minute below ±1000 feet per minute. The maximum displayable value is 9999 feet per minute. For values between ±1000 feet per minute, a + or - sign is displayed in the box to indicate climb or descent. For values less than ±500 feet per minute, the digital display shows the actual vertical speed value.

For vertical speeds greater than 3500 feet per minute, the pointer is positioned applicably at the top or bottom of the scale. The digital display shows the actual vertical speed.

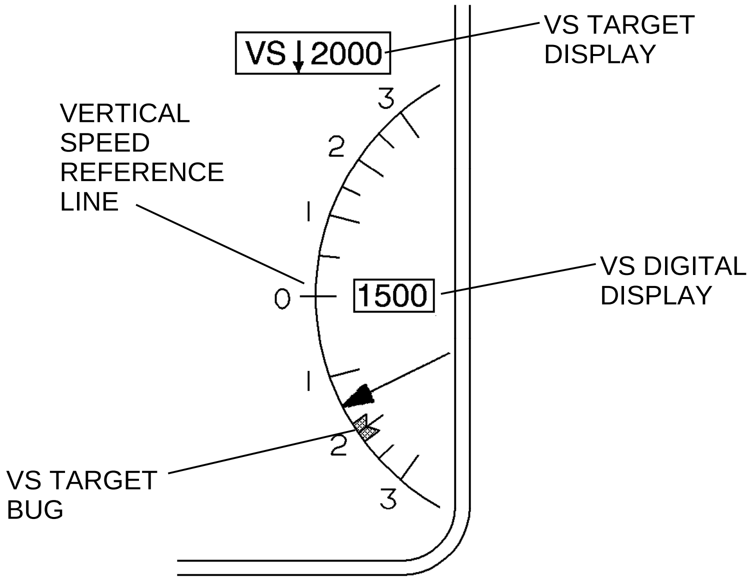
When a vertical speed mode is engaged, the vertical speed target bug will be displayed. It moves along the left side of the vertical speed scale. The bug operates with the flight director and will line up with the value on the vertical speed scale that is set with the GC-810 flight guidance controller. A digital readout is also displayed on top of the vertical speed scale, along with an up/down arrow to show direction.

When a vertical mode is selected on the flight management system (FMS) the digital readout and bug will also be displayed, the target information coming from VPATH.

If the FMS is selected as the vertical speed target source the bug and target display will be in magenta color; if the flight guidance system is selected the displays will be in cyan.

If the Honeywell TCAS II is installed, annunciations giving directions for traffic avoidance are presented on the vertical speed display. For these indications and other information pertaining to TCAS II, refer to Traffic and Collision Avoidance System (TCAS) in this section.

VERTICAL SPEED DISPLAY



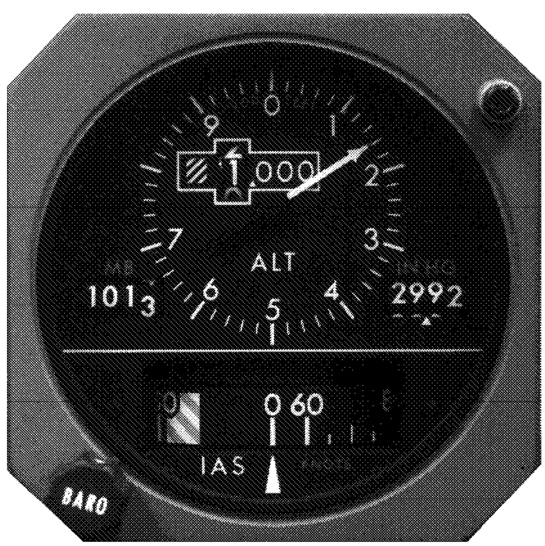
6785C1007

Figure 3-4

STANDBY AIRSPEED INDICATOR/ALTIMETER

A combination standby airspeed indicator/altimeter is mounted on the instrument panel above the pilot's multifunction display (MFD). The instrument has its own electrically heated pitot-static source and requires no other electrical power other than that which operates the altimeter vibrator, which is supplied from the emergency DC bus. An airspeed limit placard is located above the standby indicator.

STANDBY AIRSPEED INDICATOR/ALTIMETER



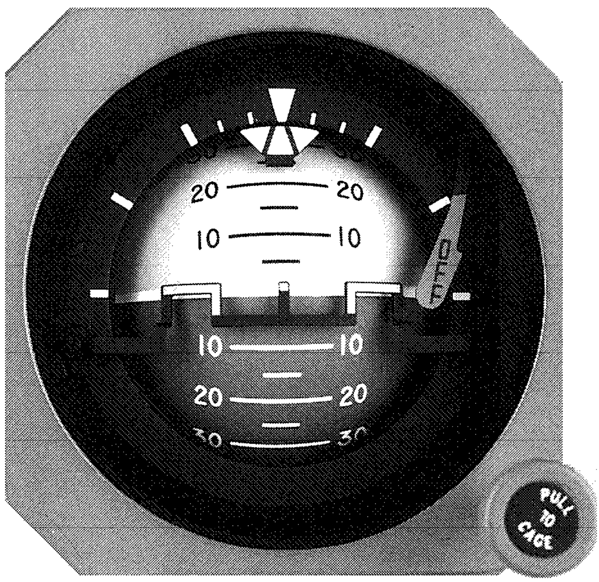
6718P1234

Figure 3-5

STANDBY ATTITUDE INDICATOR (ADI)

The standby attitude indicator (ADI) system consists of a gyro horizon and an emergency power supply provided by a lead-acid battery pack. The emergency power supply is mounted in left side of the nose avionics compartment. The gyro horizon, mounted high on the pilot's instrument panel above the multifunction display (MFD), is powered directly from the emergency power supply. In the event of a loss of airplane electrical power, the gyro horizon will continue to operate for the life of the emergency power supply batteries. A fully charged battery pack will provide thirty minutes of operating time. A green annunciator light, next to the STBY GYRO switch, will illuminate when the switch is held in the momentary TEST position, indicating that the batteries are in good condition. An amber annunciator will illuminate whenever the gyro system is on, and the airplane electrical power is not charging the emergency power supply batteries. In normal operation, the emergency power supply batteries are maintained at full charge by power from the the standby instrument bus.

STANDBY ATTITUDE INDICATOR



6785P1018

Figure 3-6

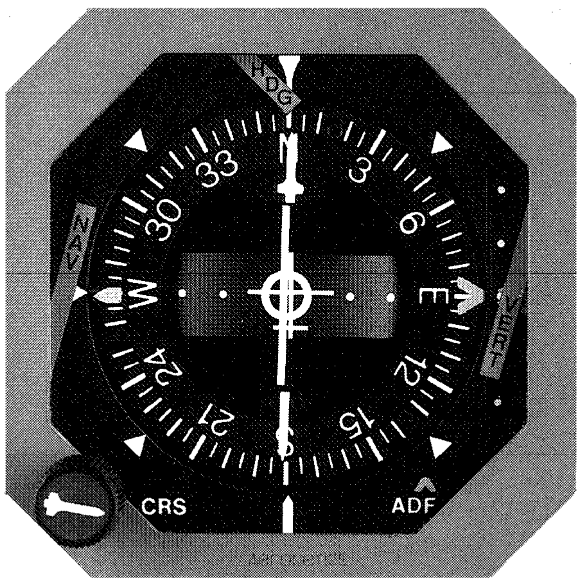
The system may also be tested by a TEST switch on the battery pack in the nose compartment; a green light will illuminate to indicate proper operation and adequate state of charge. Three amber lights on the battery pack indicate that the system is charging properly when power is on the airplane. A red light on the battery pack indicates that the batteries have attained a temperature of 55°C (130°F) or higher.

STANDBY HORIZONTAL SITUATION INDICATOR (HSI)

A standby horizontal situation indicator, (HSI) is mounted above the engine indicating and crew alerting system (EICAS) display unit, immediately to the right of the standby attitude indicator. The standby HSI is a conventional mechanical HSI which has a control knob (CRS) on the lower left bezel, for selecting desired HSI course information on the course cursor. Once set, the course cursor rotates with the compass card. The course deviation bar, which forms the inner segment of the course cursor, rotates with the cursor and moves laterally in the HSI in relation to the course cursor. An ILS glide slope indicator is located at the right side of the instrument.

The HSI displays compass heading, glide slope and localizer deviation, and airplane position relative to VOR radials. The compass card is graduated in 5-degree increments and a lubber line is fixed at the fore and aft positions. Azimuth markings are fixed at 45, 90, 135, 225, and 315 degrees of the compass face. A fixed reference airplane is in the center of the HSI, aligned longitudinally with the lubber line markings. Course deviation dots in the HSI act as a displacement reference for the course deviation bar. When tracking a VOR, the outer dot represents ten degrees, while on an ILS localizer it represents 2½ degrees. White TO-FROM arrows, in the center of the instrument, point to or from a station along the VOR radial when operating on a VOR. A red NAV flag comes into view when power is OFF, when NAV or localizer information is unreliable, or when signals from the NAV receiver are not valid. A red VERT flag will appear when the ILS glide slope signal is invalid or power to the glideslope indicator is lost. The standby HSI can display only NAV 1 information.

STANDBY HORIZONTAL SITUATION INDICATOR



6785P1017

Figure 3-7

A red heading (HDG) flag will appear in the instrument when the power to the instrument is OFF or the instrument has failed.

MAGNETIC COMPASS

A standard liquid filled magnetic compass is mounted above the glare shield.

FLIGHT HOUR METER

The meter, located above the auxiliary power unit (APU) control panel, just forward of the right circuit breaker panel, displays the total flight time on the airplane in hours and tenths. Either landing gear squat switch activates the meter when the weight is off the gear and the airspeed indicates over 50 knots. The meter receives power from a 3-ampere circuit breaker (FLT HR METER) on the right circuit breaker panel. A small indicator on the face of the instrument rotates when the hour meter is in operation.

STANDBY ENGINE INSTRUMENTS

The standby engine instrument indicator is installed near the center of the instrument panel, above the Engine Indicating and Crew Alerting System (EICAS) display unit. The indicator has six liquid crystal displays, three for each engine. Each engine has an N_1 (fan) RPM, an N_2 (turbine) RPM, and an ITT (inter-turbine temperature) indicator. The displays are operational at all times when power is on the airplane; their primary function is to display engine power settings in RPM and ITT if power is lost to the EICAS system, or in case of a complete electrical failure. The standby engine instruments are powered through a five-ampere circuit breaker located on the left circuit breaker panel. Instrument power is received from the standby instrument bus, which in turn is powered by the emergency DC bus; power is therefore available from the airplane battery to power the instrument in an emergency.

The standby engine instrument indicator is a dual redundant system, therefore, if one FADEC (full authority digital engine control) should become unreliable, a second FADEC can provide information signals to the common serial bus and to the indicator. On initial power up, the standby engine instrument indicator displays all eights (8s) and will flash the digits for approximately three seconds, indicating the built in test is operational. If the standby engine instrument indicator displays all dashes, the information on the ARINC-429 serial bus data line is not valid or the signal has been lost.

STALL WARNING AND ANGLE-OF-ATTACK SYSTEM

The angle-of-attack (AOA) system is powered by 28 volts direct current (DC) from the left and right main DC busses and incorporates transmitters, probes, flap, slat, and speedbrake position sensors, and indexers. The AOA system uses inputs from the angle-of-attack probes, the flaps, slats, and speedbrakes to compute a “normalized” angle-of-attack. The system is redundant in that the left and right systems are separate systems with separate computers and separate power sources. Power is provided from the left and right DC feed busses, respectively, through five-ampere circuit breakers on the left circuit breaker panel.

The angle-of-attack transmitters, one on each side of the airplane, are the basic sensors which detect the direction of airflow at the sides of the fuselage. Each transmitter has a conical slotted probe extending into the airstream. The probes rotate to achieve uniform airflow by nulling the pressure differential between upper and lower slots in their forward surfaces. The probe's angular position is converted to an electrical signal by a rotary variable differential transformer, which sends it to the AOA computer. An optional AOA indicator may be located on the far left side of the pilot's instrument panel.

The probes are heated for anti-icing, along with the pitot tubes and static ports. Each transducer/probe contains a case heater and a probe heater. The case heater is on when the applicable AOA HEATER circuit breaker is engaged; the probe heater is on when the applicable AOA HEATER circuit breaker is engaged and the pitot-static anti-ice switches are ON.

The flap, slat, and speed brake position sensors provide signals to the computers so that they are able to compensate for any flap, slat, or speedbrake position. The computers calculate angle-of-attack from the transmitter signals and use signals from sensors in the systems for the flaps, slats, and speed brakes to compute normalized angle-of-attack. They compensate for all configurations and weights, providing data for the operation of the stall warning system, the low airspeed awareness indications on the EADIs and the optional indexer, and to present a standard readout on the optional angle-of-attack indicator. The computers also extend the slats, if they sense an impending stall.

Only the left computer information is displayed on the optional AOA indicator and indexer, if installed.

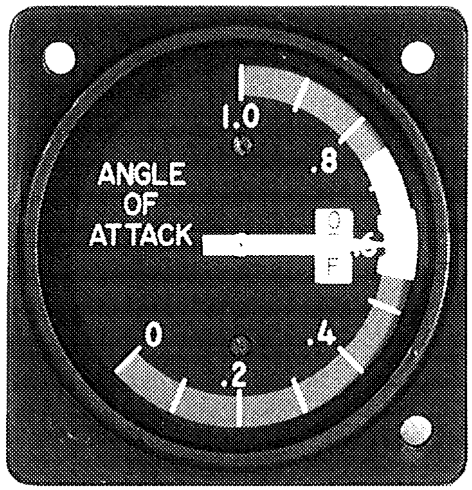
Two stick shakers are installed approximately 9 inches down from each control wheel, on the front side of the control column. When the angle-of-attack system senses an impending stall, the stick shakers are activated as a tactile warning to the pilot. Signals to each stick shaker are independently provided by the respective left and right angle-of-attack computers.

The optional angle-of-attack indicator provided on the Model 750 is a full range indicator. It is calibrated from 0 to 1.0 and marked with red, yellow, and green arcs. The indicator displays lift information with 0 representing zero lift and 1.0 representing stall. Therefore, at 1.0 where full stall occurs, 100 percent of the available lift is being produced. At 0, zero lift is being produced. With speed brake, slat, and flap position information, the display is valid for all airplane configurations and weights. The green arc (0 to 0.60) is the normal operating range of the airplane. The amber arc (0.60 to 0.80) covers the area between the normal operating range and the caution area. The middle range of 0.55 to 0.65 is represented by a symbol in the center range of the indicator; it represents the optimum landing approach airspeed (V_{APP}) area. The yellow range (0.60 to 0.80) is a caution area where the airplane can be approaching a critical angle-of-attack. The red arc (0.80 to 1.0) is a warning area and represents the beginning of low-speed buffet to full stall. At an indication of 0.83 $\pm$0.02, in the warning range, the stick shakers will activate.

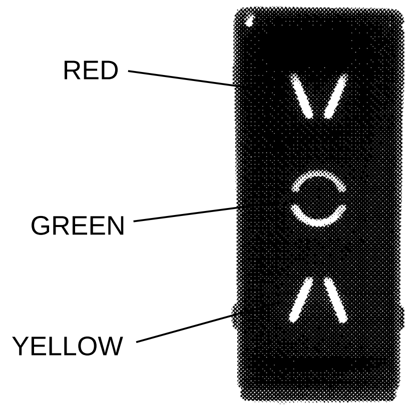
If an amber STALL WARN L-R annunciation appears in the crew alerting system (CAS) section of the EICAS display, it indicates that the angle-of-attack computer has detected a fault in the respective system and that it is inoperative. A chime will also sound. If the left system STALL WARN illuminates, the pilot's stick shaker will not operate; the optional angle-of-attack indicator will be inoperative, and the optional indexer will not operate. The respective fast/slow low speed awareness indicator (LSA) indication and slow speed warning will be inoperative unless the EFIS is reverted to the operational side, whereupon both sides will be driven by the operative system, except for the above mentioned items and the stick shaker. Refer to Electronic Flight Instrument System in this section.

If one stall warning system should become inoperative and the airplane approach a stall, the stick shaker warning from the opposite side can be detected through the control wheel.

OPTIONAL ANGLE-OF-ATTACK INDICATOR AND OPTIONAL INDEXER



INDICATOR



INDEXER

6785P1006
6285P6059

Figure 3-8

If an AOA PROBE FAIL L-R message appears in the CAS system, it indicates that the angle-of-attack system is inoperative. The effective result is the same as that discussed under STALL WARN L-R, above, and reversion is similarly possible.

An AOA HEAT FAIL L-R indicates that the respective angle of attack probe heater is inoperative. This message is also presented with an accompanying chime. An indication of anti-ice failure should be treated with caution, since a frozen probe could result in erroneous and dangerous indications. Again, reversion to the operative side is possible.

A red digital message of AUTO SLATS FAIL indicates that the angle-of-attack system has called for the slats to automatically extend and they have failed to do so. This message is accompanied by a double chime.

An optional approach indexer, mounted on the pilot's glareshield, provides a "heads up" display of deviation from the approach reference. The display is in the form of three lighted symbols which are used to indicate five angle-of-attack conditions. High angle-of-attack is analogous to low airspeed; low angle-of-attack is analogous to high airspeed. The following angle-of-attack (AOA) indications occur:

(1) Angle-of-Attack high; top (red) chevron lighted.
(2) Angle-of-Attack slightly high; top chevron and (green) circle lighted.
(3) Angle-of-Attack on reference; circle lighted.
(4) Angle-of-Attack slightly low; circle and bottom (yellow) chevron lighted.
(5) Angle-of-Attack low; bottom chevron lighted.

The top chevron points down, indicating that the angle-of-attack must be decreased to eliminate the deviation. The bottom chevron points up to indicate that the angle-of-attack must be increased to eliminate the deviation.

The indexer and the angle-of-attack indicator are supplied together as an optional installation.

AVIONICS

The Model 750 is equipped with the PRIMUS 2000 Integrated Avionics System. It is an automatic flight guidance, a flight management, and an electronic display system with five cathode ray tube (CRT) display units. These three functions are operated using an interconnected system of cockpit controls and displays, sensors, and integrated computers.

The heart of the Model 750 avionics system is the PRIMUS 2000 integrated avionics system (IAS) which combines three subsystems into two identical interchangeable IC-800 integrated avionics computers (IACs). The subsystems are comprised of the five-tube electronic display system (EDS), the flight guidance system (FGS), and the flight management system (FMS). Five more subsystems are part of the PRIMUS 2000 system, and provide data to the major system. They are: the ADZ-840 air data system, the PRIMUS II integrated radio system, the PRIMUS 870 weather radar system, and the AA-300 radio altimeter system.

Long distance communication capability is provided by a Bendix/King high frequency (HF) transceiver. The dual flight management systems (FMSs) have GPS (global positioning satellite) function. A Flitefone VI with voice privacy, and a cockpit voice recorder (CVR) are also installed as standard equipment. Optional systems such as a second high frequency transceiver, an emergency locator beacon, a Collins Proline II radio system, a second digital ADF, a flight data recorder (FDR), and Global Airborne Flight Information System (AFIS), with or without SATCOM capability, are available. A Bendix/King TCAS II (Traffic Collision Advisory System) is also available. Several different optional and additional sensors are available for the individual long range navigation systems. Single long range navigation systems may be installed with provisions for a second, or dual navigation systems may be installed at the factory.

VHF COMMUNICATION

HONEYWELL PRIMUS II REMOTE RADIO SYSTEM

The RCZ-850 integrated communications unit normally operates in the frequency range of 118 to 136.975 (or 137) MHz. The unit can be strapped to extend the upper range to 152 MHz for operation in parts of the world where those frequencies are used. The RCZ-850 unit is the communications component of the SRZ-850 integrated radio system. The COM radios are controlled from the RM-850 radio management unit (RMU), two of which are mounted on either side of the center pedestal forward of the throttles. COM 1, NAV 1, ADF 1, etc. are controlled by the left RMU and COM 2, NAV 2, and ADF 2 are controlled by the right RMU. The unit being controlled is annunciated on the control display unit of the RMU. The four radio functions: COM, NAV, ATC (Transponder), and ADF which are controlled by the RMU are all displayed on page one (main frequency select page) of the RMU. Tuning control for the desired function/parameter is obtained by pressing the line select key next to that function/parameter. The COM radio has a memory capacity for up to 12 frequencies to be selected and stored for later use.

In order to avoid unnecessary redundancy, only major points concerning operation of the Honeywell RCZ-850 integrated radio system are covered here. Additional features offered by the Honeywell RCZ-850 radio system are discussed in detail in the Honeywell Pilot's Operating Handbook, SRZ-850, Publication Number: 28-1146-50-01 dated 15 June 1988, or later revision, which is provided with the Citation X airplane. The handbook must be immediately available to the flight crew for airplanes equipped with this radio system.

Controls and Indicators

Control of the COMM radios is normally through the controls and display located in the upper left corner of the radio management unit (RMU). Any selectable parameter is changed by pressing the corresponding line key next to the displayed parameter which brings an amber box (cursor) to surround that position, which allows it to be tuned by the concentric knobs. Tuning of the COM radios is accomplished by three methods. The first method, discussed below, also provides methods to store frequencies in the memory locations. This is considered the "normal" method. Storing of the frequencies while tuning is not required, however, and is discussed there only because it may be convenient to store the frequencies as they are used for possible later use. The second method is "direct tuning", and the third is remote tuning through the Standby COM 1/NAV 1 control display unit control head which may be used when only battery power is available or desired, or in case of emergency. Operation of the Auxiliary COM 1/NAV 1 control display unit control head is discussed at the end of the VHF COM section.

Normal or preselect tuning of the COM radios is accomplished in the following manner: Press the line key next to the second COM frequency line displayed on the RMU. The amber box will move to that position if it is not already there; set the desired frequency by means of the concentric tuning knobs at the bottom of the RMU; press the upper left button on the RMU bezel (the one with vertical arrows), which will switch the pretuned frequency with the active frequency. When a frequency is preselected (set in the second line), it may result in the changing of a frequency which was identified by MEMORY, plus a number from 1 to 12, below the active frequency. The prior number has been stored in memory and the imposition of the second frequency over it is only temporary (which is identified TEMP) and will not result in the new frequency being stored in the memory, unless the STO button is pressed before the frequency is transferred to the active location (top line). In this case, the word TEMP will be replaced by the word MEMORY plus the memory position number. The pilot may progress through all 12 of the memory locations by pressing the line key near the line identified by TEMP or MEMORY in the COM box (upper left hand corner), which will move the amber box to surround that line. Turning either the large or small tuning knob will then select each memory space sequentially, showing the frequency stored there in blue on the line above the MEMORY annunciator line. Vacant memory locations will not appear. When the last occupied memory location is selected, the frequency shown on the second line, which was a temporary frequency in memory, will again be shown to occupy that space, plus the word TEMP, indicating that it is not stored in MEMORY.

When progressing through the stored memory locations, the frequency in the memory location being displayed can be transferred into the active position (tuned) simply by pressing the upper button (the one with the vertical arrows).

If the pilot desires to view all of the stored frequencies at once, he may press the PGE (page) button at the bottom of the RMU and the active frequency, with a maximum of six stored frequencies, will be displayed along with the number of their memory location. Pressing the line key adjacent to the MORE annunciator will advance the page to show the remaining frequencies with their location numbers of 7 through 12. If it is desired to insert a frequency in any particular location on these pages, move the cursor to that location by pressing the line key next to the desired memory location and the tuning knob will control that selection. The memory locations must be filled sequentially, i.e., blanks cannot be left open. If memory location eleven is vacant, for instance, and an attempt is made to store a frequency in location twelve, the word CAN'T will appear in amber at the bottom of the page.

It is not necessary to push STO to store the frequency. If deletion of a stored frequency is desired, press the line key adjacent to that memory location and press the line key adjacent to the DELETE ANNUNCIATOR. Higher memory locations will move down to fill the vacant space. If the pilot desires to place a frequency in a particular memory location, press the line key at that location to move the amber box there; press the line key at the INSERT location. The frequencies at the selected location and at higher location numbers will move up one location. The frequency in the selected location may then be modified and it will be stored.

If all the memory locations on the first memory page are not filled, the second memory page cannot be accessed.

Direct tuning of the COM radio is accomplished by selecting the cursor (amber box) to the COM preset location (second frequency line) and pressing the line key at that position for a minimum of three seconds. The preset frequency will disappear and the cursor will move and enclose the active frequency. Direct tuning is then available. Preset tuning may be restored by pressing the same button again.

An additional feature provided by the SRZ-850 integrated system is stuck microphone protection. The COM transmitter has a two-minute timer which cuts off transmission after that time has elapsed if the MIC key has not been released. A short warning tone is sounded a few seconds before the automatic shutoff. When the microphone cutoff has been activated at the two-minute limit, a MIC STK warning in red will be annunciated in the upper left corner of the RMU.

A TX annunciation at the top of the COM frequency window will annunciate whenever the transmitter is active.

When the second (first memory location) page of the display is selected, a "NARROW BANDWIDTH SELECT" annunciation will appear in the upper right corner of the display. Narrow band width is the normal selection, however, a wider bandwidth may be selected for use in areas where slightly off-channel transmitters are used. Its selection will result in improved reception in such areas. The selection is made by pressing the double arrow selector next to the annunciation. Another press of the selector will return the selection to the original.

If any of the components of the radio system fail to respond to tuning or operating commands of the RMU, the frequency or operating command associated with that particular function will be dashed out. This alerts the crew to a failure or abnormal system operation.

"Cross-side" operation of the RMU is possible by pressing the 1/2 button on the bottom of the RMU. This allows the operator to tune the opposite side radio system from that RMU. The tuning will be followed on the other RMU and so indicated. The system banners will be indicated in magenta color to serve as a reminder of the cross tuning condition.

Each time the integrated radio system is powered up with the landing gear squat switches activated, a power on self-test (POST) will be activated. If any radio or bus fails any test parameter, an error message will be displayed on a test results page. If no errors are detected, the main tuning page will be displayed.

PRIMUS II RADIO MANAGEMENT UNIT

5685P6019

Figure 3-9

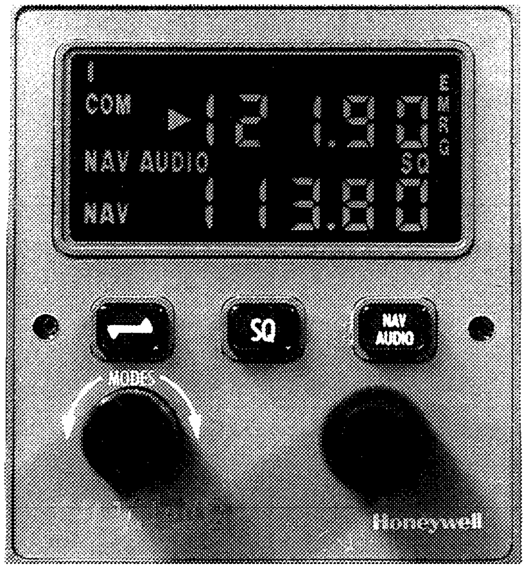
A pilot activated self-test (PAST) may be initiated by pressing the TST button on the RMU. A complete test will then be accomplished on the component represented by the window at which the yellow cursor is located. At the completion of the test, a legend will appear in the window for a short time to indicate successful completion. If the test is not successful, an error message will appear to indicate which circuit area has failed.

By pressing the DIM button on a bottom of the RMU, the tuning button may be used to dim the display. Exit from the dim mode is accomplished by pressing the DIM button again. Variations in ambient light will be automatically sensed, within limits, and automatically adjusted to maintain a desired setting.

Standby Radio Control Unit

The standby radio control (SRC) unit is located on the right instrument panel approximately above the right multifunction display unit (MFD). It may be used in two modes: normal and emergency. The modes are selected by means of the mode switch on the SRC. The mode selections cycle as the switch is turned. In the emergency mode, EMRG is displayed vertically along the top right edge of the display. The SRC is powered from a five-ampere circuit breaker (STBY NAV/COM) on the right circuit breaker panel. The circuit breaker is powered by the emergency DC bus.

PRIMUS II STANDBY RADIO CONTROL UNIT



6285X6066

Figure 3-10

In normal mode the SRC acts as an additional tuning source for the radio system. COM 1 and NAV 1 may be tuned by the SRC in this mode. The SRC verifies that the COM 1 RCZ-850 or the NAV 1 RNZ-850 (integrated COM and NAV units, respectively) are tuned to the correct frequency by checking the frequency echoed on the radio service bus (RSB). If the tuned frequency is incorrect, the frequency displayed on the SRC will be dashed out. If the appropriate RMU is illuminated, the frequency change will be seen to appear in the active display. In normal mode, the radios which are tunable by the SRC (COM 1 and NAV 1) may be also tuned from the applicable RMU. If tuned from the RMU, the frequency will also be tuned on the SRC.

In emergency mode, operation of the SRC is identical on the part of the operator. The internal tuning of the system differs in that it does not read and compare frequencies on the RSB; whatever frequencies are set in the SRC are transmitted to the appropriate NAV or COM unit and that frequency is tuned.

When tuning the standby radio control, COM frequencies are displayed on the top line and NAV frequencies on the bottom. An arrow cursor, which appears to the left of the displayed frequencies may be toggled between the NAV and COM frequencies by pressing the double arrow (transfer) switch. The line on which the arrow appears is then tunable by the tuning knobs on the SRC.

The SQ push button toggles the COM squelch open and closed. When the squelch is open, SQ is annunciated in the right center part of the display.

When the EMER button is selected on the audio panel, the NAV AUDIO push button toggles the NAV AUDIO off and on. When NAV AUDIO is on, it is summed in with the COM audio. NAV AUDIO will be annunciated at the center left of the display.

Any time the COM transmitter is being keyed, the TX annunciator in the center of the display will appear.

VHF NAV

The RNZ-850 integrated navigation unit operates in the frequency range of 108.00 to 117.95 MHz. The RNZ-850 system encompasses the functions of VHF NAV, localizer and glideslope receiver, and marker beacon receiver, as well as the addition of functions to ADF and DME which, in conventional systems, are separate units. Operation of the marker beacon system is discussed under "Marker Beacon System", below.

Glideslope paired frequencies are tuned with the published ILS frequencies as in standard VHF NAV practice. The RNZ-850 is the navigation component of the SRZ-850 integrated radio system. The two NAV integrated receivers are controlled and tuned in a similar manner to the RCZ-850 COM units discussed under VHF COMM, above. A minor difference is the requirement of the PGE (page) button to be pressed twice in order to access the NAV page which shows the first six NAV memory locations. Otherwise, changing, storing and deleting frequencies is accomplished in the same manner.

The NAV frequency window on the main tuning (first) page has an additional function called the "DME Split Tuning Mode". This function involves "DME hold" plus some additional features, and is discussed under Distance Measuring Equipment in the Pulse Equipment part of this section.

NAV 1 can be tuned by the standby radio control unit (SRC) as well as by the RM-850. Tuning by means of the SRC is discussed under Standby Radio Control Unit, above.

Both NAV 1 and NAV 2 are selectable on the pilot's and copilot's SC-840 source controller to be displayed on either EHSI. NAV 1 is displayed by the BRG "**O**" knob and NAV 2 is displayed by the BRG "◇" knob. Either NAV 1 or NAV 2 may be selected by the NAV pushbutton to provide guidance to the flight director system. The NAV 1 or NAV 2 selection switches with each press of the button. If NAV 1 or NAV 2 is selected on both sides (by pilot and copilot) the annunciation in the EHSI will be in amber instead of white. The source controller transmits data only to its on-side display controller.

Operation of the NAV displays on the primary flight displays (PFDs) is discussed under Primary Flight Displays and SC-840 Source Controller in this section.

MARKER BEACON SYSTEM

The marker beacon, VOR, localizer and glide slope receivers are all combined into one navigation receiver. Each NAV receiver encompasses all of those functions. System operation is similar and equally automatic if either the standard or optional VHF radio systems are installed. Marker beacon information is displayed on the right side of the electronic attitude director indicator (EADI) display in the primary flight display (PFD), below the glide slope scale. When the marker beacon is first approached and annunciated, the boxed identification (O-outer, M-middle, I-inner) flashes.

NAV 1 provides signals to the following:

(a) Marker beacon data to the pilot's marker beacon annunciations in the pilot's electronic attitude indicator display (EADI).

(b) VOR, localizer (ILS), and marker beacon signals to the audio control panels.

NAV 2 provides signals to the following:

(a) Marker beacon data to the copilot's marker beacon annunciator in the copilot's electronic attitude director indicator display (EADI).

(b) VOR, localizer (ILS), and marker beacon signals to the audio control panels.

The marker beacon receivers are in operation whenever the NAV receivers are ON. They operate on a frequency of 75.00 MHz. The annunciators in the pilot's and copilot's EADI's are part time displays. A colored box identifies the location of the marker beacon annunciator when a localizer frequency is tuned. The marker beacons are annunciated by the appropriately colored letters: a blue O for outer marker, an amber M for middle marker, and a white I for inner marker. The letters appear in the box when the marker beacon receiver is activated. A marker beacon tone is transmitted to the audio control panel and will be heard in the speaker/headset, if selected. A 400 Hz tone is heard at the outer marker, a 1300 Hz tone at the middle marker, and a 3000 Hz tone for the inner marker.

The audio muting system (MKR MUTE) provides the pilots with a method of temporarily cutting out the marker beacon audio. When pressed, the marker beacon signal is muted for approximately 30 seconds. The MKR MUTE switches (push buttons) are located on the audio control panels.

AUTOMATIC DIRECTION FINDER (ADF)

The automatic direction finder (ADF) function of the Primus II remote radio system is provided by the DF-850 ADF receiver module which is a component of the RNZ-850 integrated navigation unit. As discussed in the COM section above, the tuning of the complete system, which includes the ADF, is accomplished by means of the radio management unit (RMU), the RM-850.

The receiver has a frequency range of 100.00 to 1799.5 KHz in 0.5 KHz increments. A strap selectable option is available which allows tuning of marine emergency frequency of 2181 thru 2183 KHz.

Four modes of operation are available on the DF-850 ADF: ANT (Antenna), ADF (Automatic Direction Finder), BFO (Beat Frequency Oscillator), and VOICE. In ANT mode, the ADF receives only and does not compute bearing information. In ADF mode, the system receives signals and computes relative bearing to station. In BFO mode, a beat frequency oscillator is added to the signal for reception of CW signals. In VOICE mode, the reception bandwidth is widened for improved voice audio on the frequency. The VOICE mode is not used for navigation. Bearing information is available only in ADF and BFO modes. If ANT is used for tuning, random ADF needle searching is prevented. The modes are selected by pressing the lower line key adjacent to the ADF window. Progression is: ANT; ADF; BFO; and VOICE. The mode changes each time the line key is pressed. When the tuning cursor (amber box) surrounds the lower ADF Line, the ANT, ADF, BFO, and VOICE Progression may also be selected by turning the tuning knob.

When the line select key adjacent to the frequency window of the ADF is pressed, the cursor will move to the ADF frequency window and the ADF may be tuned by the tuning knobs. Tuning will increment in steps of 0.5 KHz with the small knob and 10 KHz with the large knob. If the knobs are turned faster, larger increments are selected for each turn enabling large changes to be made in much less time. The rate of increased tuning speed is proportional to the rate the knobs are turned.

The ADF has a "scratch pad" memory which will store one frequency. This is accomplished by selecting the desired frequency and pressing the STO button for two seconds. To retrieve the frequency from memory, press the line select key adjacent to the ADF frequency window for two seconds.

ADF 1 bearing information may be selected on the "O" bearing needle of the pilot's and copilot's electronic horizontal situation indicators (EHSI) display. The "◇" bearing pointer displays ADF 2, when selected. Selection is controlled by the BRG "O" knob and the BRG "◇" knob on the respective SC-840 source controller.

The ADF bearing pointer may be unreliable during HF radio transmissions.

TRANSPONDER

The ATC (transponder) function of the SRZ-850 Integrated Radio System is provided by the RCZ-851 transponder module, which is a sub-unit of the RCZ-850 Integrated Communication Unit. It functions as a 4096 code mode A transponder, as well as providing mode C (altitude) and mode S (collision avoidance) information. If the optional traffic alert and collision avoidance (TCAS) system is installed, an RCZ-851E transponder is provided. The RCZ-851 transponder is a diversity transponder, meeting higher performance requirements, however, transponder operation remains the same.

General tuning information concerning the SRZ-850 system is discussed under PRIMUS II REMOTE RADIO SYSTEM, VHF COM in this section. Specifically, tuning of the transponder is accomplished by pressing the line key adjacent to the desired ATC function on the left side of the main tuning page which is displayed on the RMU. The ATC window has two lines. The top line represents the tunable transponder codes and the second line represents transponder modes. When the line key adjacent to the transponder code line is pressed, the amber box (cursor) will surround the code digits, which are then tunable by the tuning knobs. The large knob controls the left two digits and the small knob controls the right two digits.

Pressing the mode select line button moves the cursor box to the mode select annunciator which connects the tuning knobs to the window. Either knob may then be used to select modes in the following sequence:

STANDBY - Transponder ready but not replying.
ATC ON - Replies in Modes A, C, AND S with no altitude reporting.
ATC ALT - Replies in Modes A, C, AND S with altitude reporting.
TA ONLY - TCAS traffic advisory (TA) Mode enabled (if TCAS is installed).
TA/RA - TCAS traffic advisory/resolution advisory (RA) enabled (if TCAS installed). (the sequence repeats)

Only one transponder is in operation at one time; the opposite one is held in standby for instantaneous operation, if required. The system in operation is controlled by the 1/2 select key located on the bottom of the RMU case. Pressing the key progressively cycles the transponders.

The system in operation is indicated by a "1" or "2" in front of the selected mode.

If the Mode S transponder squitter monitor fails, a SQUITTER INOP or ATC ERR warning message will be displayed in red at the bottom of the ATC window. This indicates that the MODE S transponder has an impaired or failed MODE S ability to operate as part of a collision avoidance system (TCAS).

A transponder code may be stored in memory. To accomplish that, select the desired codes and press the STO button for two seconds. To retrieve the code from memory, press the line select button for two seconds.

The IDENT function of the transponder may be activated by pressing the ID button on the RMU or by pressing the ID button on the inboard side of either the pilot's or copilot's control wheel. Pressing any ID button will activate the ID mode for approximately 18 seconds. An amber ID annunciation will appear along the top edge of the transponder window during ID mode activation.

DISTANCE MEASURING EQUIPMENT (DME)

The Primus II DME system is comprised of two RNZ-850 integrated navigation units, two NV-850 VHF NAV receivers and two DME-850 distance measuring modules. The DME transmitters of the DME-850s work in the L frequency band, and the receiver frequency range is from 962 to 1213 MHz. DME tuning normally follows the VHF NAV receiver tuning which selects the DME frequencies paired to the VHF VORTAC published frequencies. The PRIMUS II, however, has a special "hold" function which also allows the tuning of military TACAN channels in order to receive the DME portion of the TACAN signals.

DME information is presented on the pilot's and copilot's EHSI displays; the source of the data is identified in the upper left side of the EADI and the range is in the upper right side. VOR 1 or VOR 2 may be selected on either display. DME selection will normally follow the paired selection of the tuned VOR (on the SC-840 source controller), unless the 'hold' function is utilized. A selection on one display (the pilot's, for instance) will not affect the selection on the opposite display, except that the annunciation label (data source) will change to amber color to indicate that the source of the data is the same for both sides, or that there is a cross-selection condition on both sides. If the pilot desires to select a new VOR frequency, but hold the DME station, the DME button on the bottom of the RMU is pressed and the VOR selection (bearing) may be retuned, but the DME data will be held on the previous station. In this case the nomenclature (DME) will be displayed above the second line of information (which will be the frequency of the newly tuned VOR station) and the digital identification of the station on which the DME information is being held will appear to the right of the DME nomenclature. This serves to remind the crew members that the DME is tuned to a different source than the VOR, and to identify that source. Pressing the DME button a third time will cause the NAV window to resume its normal mode, with active and preset display, and will also cause the DME to return to its condition of channeling with the active VOR frequency.

Each DME has the capability to scan six channels, simultaneously tracking four selected DME channels for distance, ground speed and time to station, as well as tracking two stations for identification (IDENT) functions. Of the four channels of which it can track three functions (DIST, GS and TTG), two are dedicated to the flight management system(s) (FMS).

Normally, one DME station will be tuned to an active VOR frequency, which is annunciated on the top line of the NAV tuning window of the radio management unit (RMU). Another (preset) VOR frequency may be selected in the preset frequency window. When a frequency is set in the preselect window, the system will already be tracking the preselected station so that there will be no delay when that frequency is transferred to active.

NAV tuning, which normally also selects the associated DME frequencies, is discussed under VHF NAV in this section. Special tuning procedures applicable to DME, which are in addition to the NAV tuning, are discussed below.

The DME has a "split tuning" mode which operates somewhat like conventional HOLD functions, but provides other options. Pressing the DME button on the bottom of the RMU will divide the NAV window into two windows. The top window will remain the active VOR frequency. H will be annunciated on the bottom line, indicating that the DME frequency is holding with the active frequency which is displayed on the top line. The bottom line will be labeled DME and will have in it the active frequency displayed in VHF (VOR) format. The DME may then be tuned by pressing the line select key and changing it to a new channel. Pressing the DME button again will cause the DME (lower) window to change to a TACAN channel presentation. TACAN channels, along with their related W, X, Y, and Z channelization nomenclature will then be tunable with the tuning knobs. The DME function of all 126 TACAN channels may be tuned. No azimuth information is received in this mode. A third press of the DME button causes the NAV window to return to its normal active/preset presentation and the DME will resume tuning with the active frequency.

AUDIO CONTROL UNIT

Two Honeywell Primus II digital audio control units are supplied with the Honeywell Primus II remote radio system. Digital transmission of audio from remote units to the audio panels differs from conventional audio systems in that it requires one twisted pair of wires rather than many twisted pairs to achieve the same performance. The control units are mounted on the left side of the pilot's instrument panel and the right side of the copilot's panel respectively.

The panels have three rows of combination audio ON/OFF switches and volume controls. The small round knobs serve as audio on/off switches when pressed. When the switch is latched in, the audio for the particular receiver it serves will be off. When pressed again, the switch will move outward turning the audio on. When the audio is on, the knob of the switch may be used as a volume control. Turning it clockwise will increase the volume; counterclockwise will decrease it.

Two larger knobs on the lower part of the control panel serve as volume controls for the speaker and headset respectively, of the pilot and copilot. These knobs are in series with the smaller individual volume controls. This allows a volume selection to be made on the individual radio volume control, and then a final overall selection to be made by means of the speaker or headphone control, resulting in a more flexible individual control of all available audio signals.

A row of microphone selector buttons (push-push latching switches) is located across the top of the control panel. These buttons connect the pilot's or copilot's microphone to the selected transmitter. The receiver for the selected radio or interphone will also be selected regardless of the selection of the audio on/off switches. For night operation, a light in the top of the microphone selector button is illuminated.

The emergency COM (EMER) microphone switch, located at the upper right corner of the audio panel, when depressed connects COM 1 transceiver directly to the aircraft microphone and headphone. All electronic circuitry is eliminated and all other audio panel modes are disabled in this mode. NAV 1 audio will also be directed into the headset controlled by the panel on which EMER is activated, if NAV AUDIO is selected on the standby radio control unit (RCU).

AUDIO CONTROL PANEL

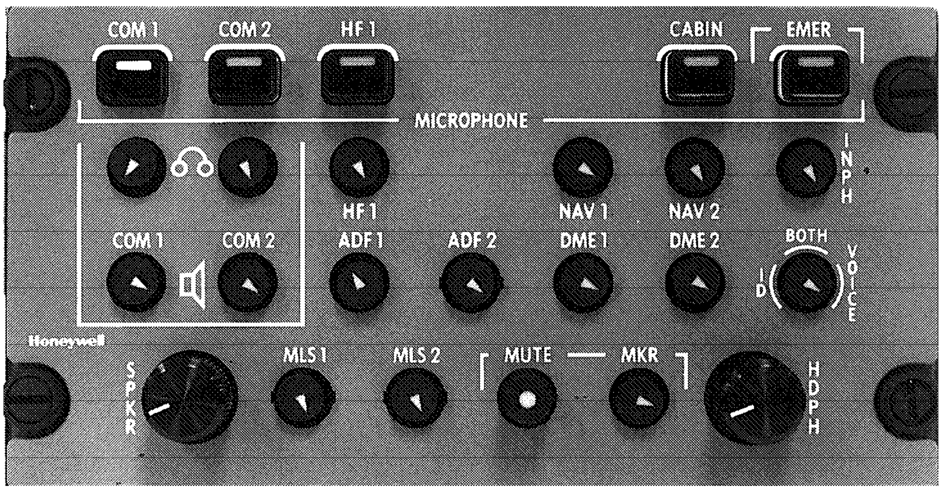


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Figure 3-11

An ID/VOICE selector is located on the right center of the audio panel. It is not a latching switch, but is active whenever NAV 1 or 2 and/or ADF 1 or 2 is selected. If BOTH is selected, both ID and voice will be heard; if ID is selected, voice signals will be filtered out and coded identification signals will be heard. If VOICE is selected, coded signals will be filtered out and voice will be heard.

The marker mute and marker aural on/off/volume control are located on the bottom row of switches on the panel. The marker mute is used to temporarily silence the marker beacon audio. Momentarily pressing the MUTE button will mute the beacon signal as long as it remains above a minimum threshold level. When it drops below the level, a time-out sequence will begin, which will mute it for a fixed period of time. The MKR button may be pressed in to disable the aural signal. When the button is out (pressed again) the marker beacon volume can be controlled with the knob, however, maximum counterclockwise rotation will not totally turn down the volume since a minimum signal is automatically retained in order not to miss the aural marker signal if it has been selected on.

TRAFFIC AND COLLISION AVOIDANCE SYSTEM II (TCAS) (OPTIONAL) WITH HONEYWELL PRIMUS II RADIO SYSTEM

The TCAS II system visually presents traffic advisories on the multifunction displays to the flight crew. The system interrogates every transponder equipped airplane within the selected range for bearing and altitude data. It uses this data to establish a track for collision avoidance predictions.

The TCAS computer performs functions that determine range, bearing, and altitude of intruder aircraft based on information computed from or contained in the reply messages. Bearing can only be determined for intruder replies received on the system directional antenna. Altitude can only be determined if the intruder is reporting altitude in its transponder's reply message.

Based on the information that can be extracted from or computed from the reply, the TCAS computer evaluates the threat potential of the intruder by calculating intruder closing rate and position relative to own aircraft. Based on this evaluation the TCAS computer categorizes the intruder as a nonthreat, proximity or traffic advisory.

For traffic advisory category aircraft, the TCAS computer outputs traffic advisory symbol position and alert data to the EFIS. The TCAS computer also outputs traffic advisory alert voice messages to the cockpit audio system.

For proximity and nonthreat aircraft, the TCAS computer outputs proximity or nonthreat traffic symbol position data to the EFIS. Voice alerts are not generated for proximity or nonthreat category aircraft. Intruders which are not reporting altitude are also detected and tracked. By using the interrogation reply, the TCAS can accomplish the following:

(1) Compute range between own airplane and an intruder.
(2) Compute relative bearing to the intruder.
(3) Compute altitude and vertical speed of an intruder (if reporting altitude).
(4) Compute closing rate between an intruder and own airplane.
(5) Issue a traffic advisory (TA) when the closing traffic is in the vicinity.
(6) Issue a resolution advisory (RA) in order to maintain safe vertical separation.
(7) Track 45 aircraft at once, displaying up to 30, and can coordinate a resolution advisory for up to three intruders at once.

Certain functions of the traffic and collision avoidance system (TCAS) are tuned through the radio management unit (RMU). Other selections are made with controls on the multifunction display (MFD). For information on the MFD, refer to Flight Guidance System in this section. The ATC/TCAS control page display provides displays and controls for the TCAS modes. To access the page, the page (PGE) button is pressed, and the ATC/TCAS line key is then pressed.

On the ATC/TCAS control page the additional selections which follow may be made. System selection (INTRUDER ALTITUDE) is possible between two altitude modes; relative altitude or absolute altitude modes. In relative altitude (REL) (green) mode, the difference between the intruder airplane's altitude and own airplane altitude is displayed. In absolute altitude mode (FL), the flight level (cyan) of the intruder airplane is displayed. If FL is selected on the Honeywell system, the selection will return to REL in 20 seconds.

A TCAS selection may be made to display only traffic that constitutes a potential threat or all traffic. The TA DISPLAY line key is used to select AUTO, whereupon traffic will be displayed on the multifunction display (MFD) only if it is a TA (traffic advisory) or RA (resolution advisory) target. MANUAL on the same key selects an MFD display in which all TCAS traffic within the viewing airspace will be shown.

In the STANDBY (green) mode the TCAS computer shows no traffic displays and does not reply to other airplane interrogations. The standby mode is selected by pressing the STANDBY line key on the main tuning page, thereby causing the transponder not to transmit and disabling the TCAS system.

The primary TCAS selection is displayed in the lower left window of the RMU main tuning page. Control of those displayed functions is possible by means of the line keys and/or the tuning knobs, once the tuning box is moved to the desired function with the line key. Range and altitude bands are selectable. The following are included:

Altitude band select - With the NORMAL altitude band selected (green) the altitude display encompasses a range of ±2700 feet; with ABOVE (cyan) selected the altitude display changes to a range of -2700 feet to +7100 feet from own airplane altitude. If BELOW (cyan) is selected, the range becomes from, -7100 feet to +2700 feet from own airplane altitude.

Range (green) - Selectable at ranges of 6, 12, 20, and 40 NM. Selection is made by pressing the RANGE line key or by turning the tuning knobs once the tuning box is transferred to the RANGE function by pressing the line key.

TCAS Display 1/2 - This is the annunciation of which side's (pilot or copilot) TCAS display features the RMU is controlling. When the cursor is in the window, the 1/2 button is used for the selection. At power down the selections store.

Flight ID is a mode S coding which reflects the current flight's call sign. The outer tuning knob moves the character position designator and the inner tuning knob selects the desired alphanumeric character.

The flight level 1/2 selection on the ATC/TCAS control page displays the transponder's encoded altitude and the air data source (digital air data computer 1 or 2) for that altitude (i.e., DADC 1 and DADC 2).

The TCAS system has a self-test which may be activated by pressing the TST key. “TEST” will be displayed when the test is active. During the test the TCAS traffic displays will show test pattern traffic symbols, red and green resolution advisories, during the test sequence. The sequence takes approximately ten seconds. If the test is completed successfully the system will return to the set operating modes and aurally annunciate TCAS SYSTEM TEST OK on the cockpit audio system. For a failure in the TCAS system “TCAS FAIL” will be displayed in yellow on the TCAS display and the audio system aurally annunciates TCAS SYSTEM FAIL. TEST will operate either on the ground or airborne.

The TCAS system requires an operating mode S transponder with encoded altitude data included in the interrogation replies. When the transponder is set to STBY, the receiver transmitter may automatically change to standby mode or turn itself off.

TCAS ZOOM WINDOW

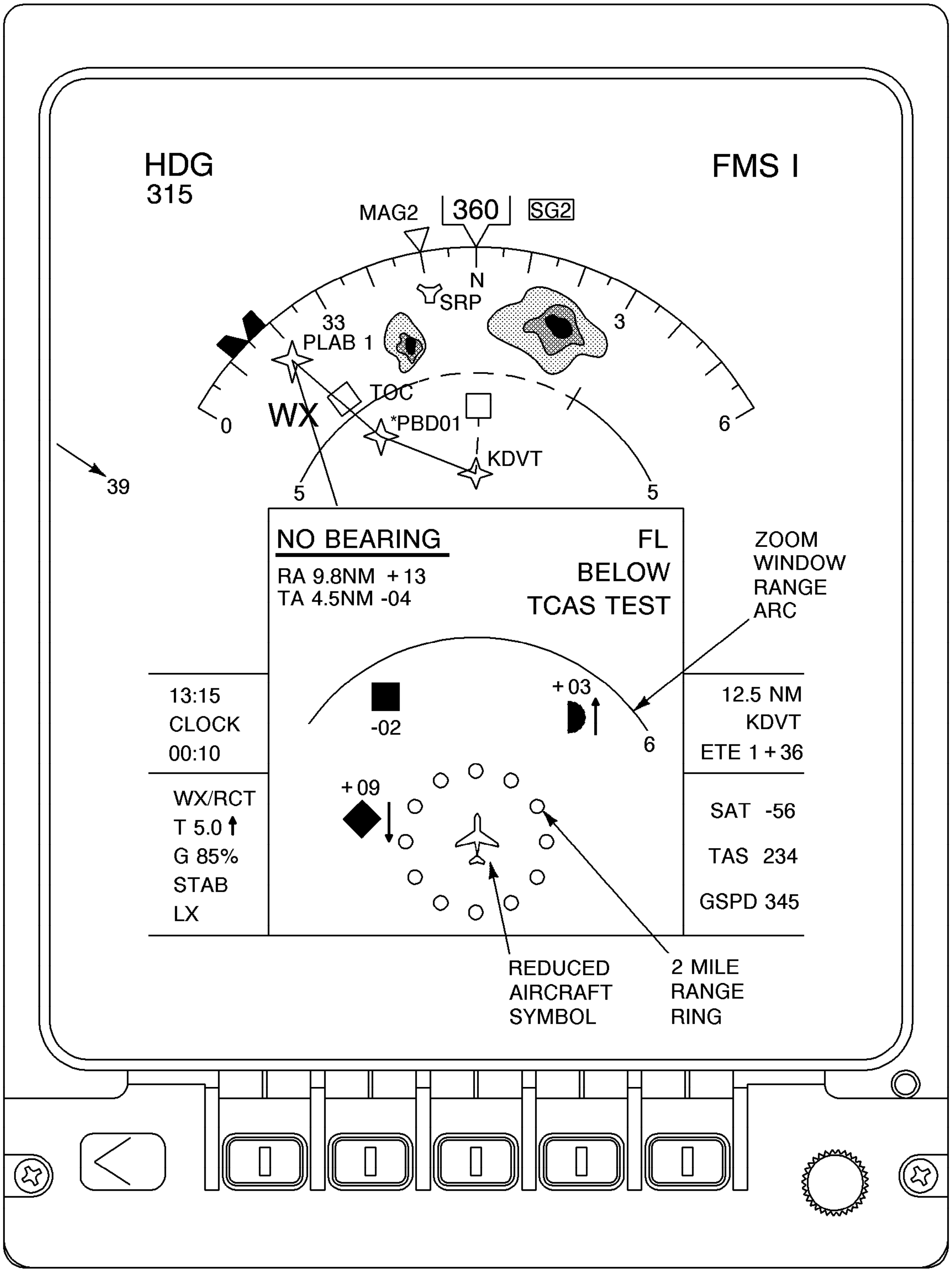

Figure 3-12 (Sheet 1 of 2)

TCAS MAP MODE WITH TRAFFIC ENABLED

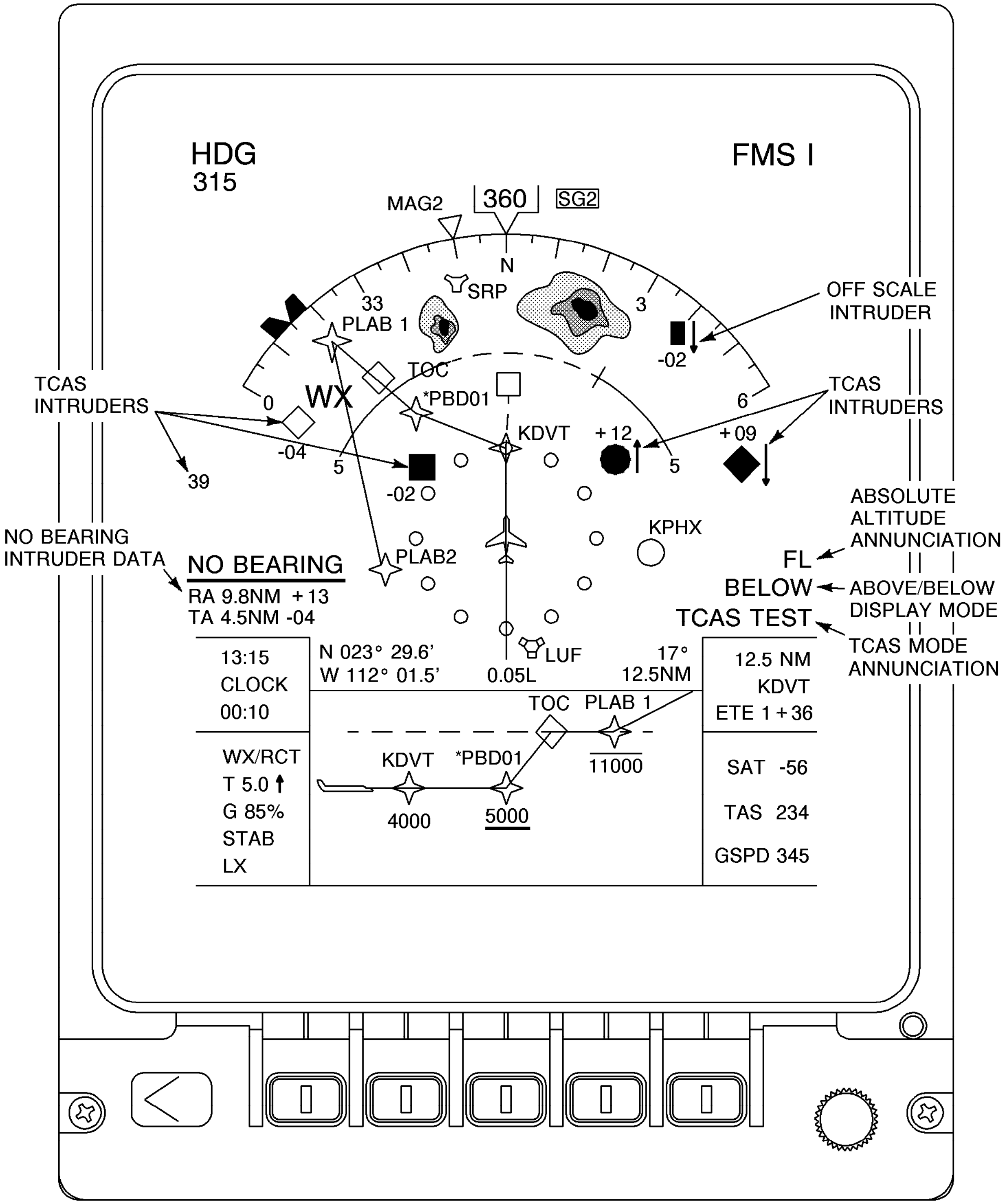

Figure 3-12 (Sheet 2 of 2)

HF COMMUNICATION

KHF-950 WITH KFS-594 CONTROL PANEL

The KHF-950 is a 150-watt transceiver that provides 280,000 frequencies at 100 Hz increments with 99 channel preset capability in the HF band (2.0000 to 29.9999 MHz). It operates in AM or single sideband. The KFS-594 is a compact control panel which has all the controls and indicators located on the radio set control.

Controls and Indicators

All controls and indicators are located on the radio set control. A two position FREQ/CHAN switch in the upper right corner determines the form of operation. The depressed position establishes the channelized form of operation. The flush position provides direct frequency operation. A momentary MODE pushbutton switch, next to the FREQ/CHAN switch, selects the mode of operation (LSB, AME or USB). This switch is not active during transmit. Frequency or channel selection is controlled by two concentric knobs on the lower right of the panel. The outer knob is used for frequency selection and the inner knob for channel. Frequency control is not functional when the FREQ/CHAN switch is in the CHAN position.

Channel frequency can be changed by use of the PGM and STO switches on either side of the concentric tuning knobs. An ON/OFF/VOLUME control applies power to the system and controls volume. A SQUELCH knob provides control of the squelch threshold. A pull/on CLARIFIER knob is used for fine tuning up to 250 Hz and is active during receive operation only.

USB is used for communication with other stations operating in single sideband on the upper sideband. AME allows communication with the older AM or AME stations. AME mode is not compatible with stations operating on USB. LSB mode is disabled.

An optional second KHF-950 may be installed, in which case an additional KFS-594 control panel will be installed. It is usually installed at the bottom of the pilot's instrument panel.

To Tune the HF system antenna coupler to the frequency selected, rotate the VOLUME knob out of the OFF detent. Receiver frequency will be displayed after approximately one minute of warmup. Key the transmitter by momentarily pressing microphone button. The antenna coupler will tune automatically. Channel number will continue to be displayed; however, frequency will be blanked until automatic tuning is complete. After tuning, adjust for desired squelch threshold. During reception, adjust CLARIFIER control for maximum signal clarity or most natural sounding voice.

An HF XFER push button/annunciator light is provided on the panel next to the HF control. It provides the capability of transferring HF communications to the Flitefone Six. Either pilot may establish communication, alert the passenger by CABIN CALL or by using the dedicated interphone button on the Flitefone (or if no intercom button is installed, by dialing 42#) and then, when the flitefone handset is out of the cradle, pressing the HF XFER button; the button will illuminate. The passenger may then receive HF transmissions over the passenger compartment handset and answer by pressing the push-to-talk handset switch

HF COMM KFS 594

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Figure 3-13

which will key the HF transmitter. The button will remain illuminated until the passenger communication is complete, and the handset is returned to the cradle. If necessary the crew member can regain control of the HF by pressing the applicable HF mic button on the audio control panel (or, in the case of Collins radio installations, selecting it on the rotary switch) and pushing the push-to-talk button on the control wheel. The system is designed primarily to allow the passenger to use the marine radio-telephone system, or ARINC communications.

HF and VHF SELCAL (Optional)

The SELCAL system is a five-channel, 16-tone decoder designed for use with HF and VHF communications radio receivers. In order to receive the SELCAL codes and be alerted to a call, the radio must be tuned to the proper frequency on which a call is expected, and the audio switch for that radio may be turned off. In this case there must be no intent, of course, to receive regular uncoded communications.

The primary purpose of the HF SELCAL option is to allow the crew members to turn off the HF or VHF receiver at the audio panel and not have to continuously monitor it. A white digital message (SELCAL HF 1-2, SELCAL VHF 1-2, etc.) will appear on the crew alerting system (CAS) portion of the engine indicating and crew alerting system (EICAS) in order to call attention to an incoming call on the selected HF or VHF frequency. A chime will also be heard. In order to answer the call the crew member must reset the system by selecting the microphone selector switch on the audio panel to the annunciated radio (if not already there) and press the push-to-test switch on the control wheel (or microphone). Normal communications will then ensue. While the EICAS SELCAL digital annunciation is illuminated, an additional incoming call cannot be detected on that radio, so it is important to acknowledge and respond to calls promptly. The SELCAL system is passive, in that it does not interfere with regular HF or VHF communications.

When power is first applied to the SELCAL system, the system performs a power on self-test. If it finds an error in the programmed code, annunciators will flash, an audio will be heard, and the unit will not respond to reset commands. A self-test may also be generated by placing the rotary TEST switch, located on the center pedestal, in the annunciator test position. While in annunciator test all SELCAL receiver annunciators will illuminate and an audio signal will be heard. If a channel should fail the test, an annunciator for that channel will not illuminate. If the programmed code is invalid, no annunciator will illuminate and the unit will appear to have done nothing.

EMERGENCY LOCATOR BEACON (Optional)

The optional locator beacon system consists of a three-frequency emergency locator transmitter (ELT) designed to assist in locating a downed airplane. The ELT has a self-contained battery pack which must be changed every three years when one cumulative hour of operation is logged on the battery pack. The system is activated automatically, by an impact of 5 +2, -0 G's along the flight axis of the airplane, or manually by a pair of switches (ON/ARMED/RESET and HORN CANCLD) on the aft end of the right circuit breaker panel. When the ELT is activated, a modulated omni-directional signal is transmitted simultaneously on the VHF and UHF emergency frequencies of 121.5 and 243.0 MHz, respectively, and the international emergency satellite frequency of 406.0 MHz. The modulated signal is a downward swept tone signal which starts at approximately 1600-1300 Hz and sweeps down to 700 Hz every two to four seconds continuously and automatically.

When the ELT transmits on 406.0 MHz, it transmits the airplane tail number and identification, which is picked up by satellites and retransmitted to monitoring stations world-wide. The satellites also have the capability of providing a fix on downed airplanes,pinpointing their location.

The locator beacon system is normally controlled from the guarded ON/ARMED/RESET switch located on the right circuit breaker panel. The ON position activates the emergency locator transmitter (ELT) and the ARMED position arms the impact switch. The RESET position on the switch is used to electronically reset the ELT transmitter if it has been energized by the G (impact) switch because of a hard landing, sudden stop, or some other cause. RESET will turn off the transmitter and rearm the G switch. If the ELT becomes activated a light will flash in the cockpit and an aural signal will be heard. The HORN CANCLD push-button is used to silence the aural warning.

The ELT is installed in the airplane aft tailcone equipment area, being bolted to the upper equipment area. It is housed in a sealed case, and when connected to the airplane system, is powered by the airplane 28-volt DC system. It can be powered by the airplane batteries. When removed from the airplane, or if activated when there is no power available from the airplane system, it operates on its own 5-ampere-hour 12-volt lithium batteries which have a lifetime of at least fifty hours of operation. Removing the ELT from the airplane requires gaining access to the ELT by removing the ceiling panel in the baggage compartment and removing the ELT bolts by using a wrench, and by disconnecting the external antenna connector. It can be used as a portable installation, since its battery pack is self contained and a master switch is included on the transmitter, however, the installation was not specifically designed for the ELT to be used as a portable unit. A two-position ON/ARMED - OFF switch is located on the unit, as well as an indicator light which will blink when it is transmitting. Proper operation is indicated by a series of quick flashes followed by a flash rate of once every three seconds. The ELT will start transmitting after a thirty-second delay after being turned on. The ON/ARMED - OFF switch must be turned OFF before the unit is removed from the airplane or it will begin to transmit, since the switch is automatically activated by a magnetic switch upon removal.

The external antenna for the emergency locator beacon system is located on top of the aft fuselage forward of the vertical fin, nearly adjacent to the engine intakes.

MAGNASTAR C-2000 DIGITAL AIRBORNE TELEPHONE (Optional)

The MagnaStar C-2000 can be used to place and receive voice calls, send data transmissions via modem as well as send and receive facsimile transmission. A central processor on-board each MagnaStar equipped aircraft controls and coordinates the handset(s) for all voice calls, data and fax modem transmissions, and in-cabin intercom functions. The MagnaStar continually scans and monitors ground based radio cells for the clearest usable communications channel while inflight. The LCD on the handset indicates the availability of a channel. The system searches for the optimum channel when a call is initiated and connects the calling and receiving parties. The system allows for multiple handsets and two simultaneous calls may be placed (voice, fax, or data). Reliable and clear connections are ensured at all times through digital technology. Coverage is provided throughout North America above 17,000 feet (much of the United States is covered at lower altitudes) and additional coverage is available on the ground at many major domestic airports.

All operations are performed via the handset. The handset features adjustable volume and a telephone system numerical keypad. The two-button volume control is located on the side of the handset and should be used to adjust the volume to the users desired level. Two additional keys are also included: “+” and “End Call.” The LCD on the handset displays information and “menu” style selections, making the need for separate instruction uncommon. A credit card reader is also provided in the handset allowing optional billing to individual user accounts.

NOTE

> The standard handset has a magnet activated hook switch in the holder and therefore operates in a typical “on-hook” and “off-hook” manner. Additional (optional) handsets custom mounted or portable (which plug into jacks) do not provide the hook switch. To place these handsets “off-hook,” depress the “+” key; to return the phone to “on-hook,” depress the “+” again.

While the handset is “on-hook,” available services will be displayed on the LCD. To place a call, remove the handset from its holder and select the type of call you wish to make (“1” for a voice call). In the case of a voice call to someone on the ground, the following would be keyed: “1” + “Area Code” + “Number.” To terminate any dialing sequence and return to the main menu, press “End Call.”

Calls to the airplane may be made in three ways:

Aircraft Aircall number (assigned to the aircraft) are permanently stored by the C-2000 upon registration. The Aircraft Aircall number will ring at all handset locations.

Station Aircall numbers (assigned to each handset) are permanently stored by the C-2000 upon registration. The Station Aircall number will ring at the assigned handset location.

GTE Airfone Calling Card/“Personal” numbers (encoded into GTE Airfone Calling cards) can be used on any MagnaStar or GenStar equipped aircraft and must be registered on each flight. Up to nine GTE Airfone calling card numbers may be registered on a C-2000 equipped aircraft.

To initiate an Aircall, the ground part must dial 1-800-AIRFONE. When prompted, enter the Aircall number of the aircraft, a station handset, or of an individual traveler, then enter the callback telephone number of the ground party. To return a call to the displayed callback number, take the handset off-hook and press either “1” or “2.” Pressing “1“ will charge the call to the aircraft account and automatically dial the number. Pressing “2” will allow you to charge the call to a credit card; after pressing “2” wait for the tone and then swipe the card or manually input the card number.

The C-2000 has many features not included in the operating manual. For more detailed information, refer to the MagnaStar C-2000 System Digital Airborne Telephone User’s Guide.

FLIGHTFONE 800 (Optional)

The Flightfone is a fully digital wireless multi-channel airborne telephone system which provides continuous coverage throughout the United States including Hawaii and Alaska, with additional coverage in Canada and Mexico.

To place a call to a party on the ground: remove the handset by pressing the release key and press the “On” button. Wait for the beep and/or the green light which indicates ready for use. A dial tone should now be present (10 to 45 seconds on average to receive a dial tone). Dial “1” + “Area Code” + number for all direct bill calls. (If direct billing is not activated a message will appear on the display to use a credit card.) Volume may be adjusted by pressing and holding the volume control on the side of the handset until the desired level is reached. To end the call press “End” on the handset or press “New” to end the current call and place another call. After call(s) is completed, tug gently on the cord to retract. Re-insert the handset into the cradle cord end first, pressing firmly to lock.

To receive an incoming call when the phone rings, remove the handset from the cradle and press “On” to begin talking. Press the “End” key to end billing.

The Flitefone 800 has many features not covered in the operating manual. For more detailed information refer to the Global Wulfsberg Flitefone 800 Operating Instructions.

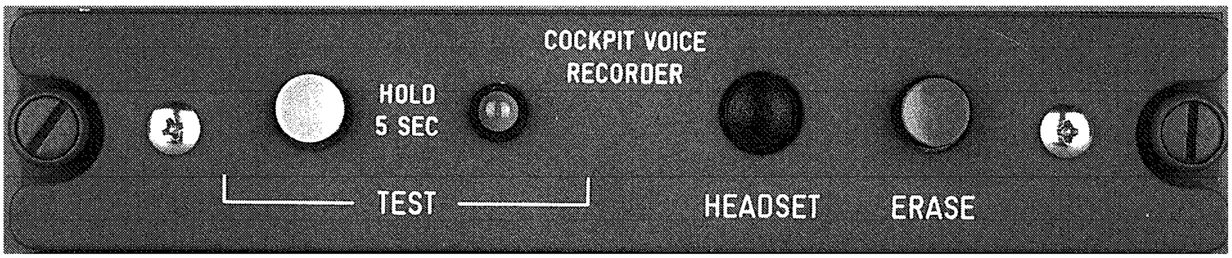
FLIGHTFONE 801 (Optional)

The Flightfone 801’s operation is similar to the Flightfone 800, except the 801 does not incorporate the voice privacy features of the Flightfone 800 series.

COCKPIT VOICE RECORDER (CVR) (Optional)

An A-200S cockpit voice recorder system provides a continuous 30-minute record of all voice communications originating from the cockpit as well as sounds from warning horns and bells. The system is protected by a 5-ampere circuit breaker (CVR) located on the right circuit breaker panel.

COCKPIT VOICE RECORDER CONTROL PANEL



S251-1120-00

Figure 3-15

The sensitive microphone is located in the instrument panel near the lower right corner of the fire tray. The system is energized when the battery switch is in the BATT position. The control panel, located on the center pedestal, contains a TEST button, and an ERASE button. System operation is checked by pressing the TEST button. When the TEST button is held down for five seconds illumination of the green light on the control panel indicates correct functioning of the voice recorder system. Pressing the ERASE button for approximately 2 seconds will cause the entire record to be erased. Erasure can only be accomplished on the ground with the main entry door opened.

The installation is equipped with a five-G switch which will activate any time the airplane is subjected to a five-G force; this will disable the system's erasure mechanism until a reset button on the G-switch is pressed. The switch is located under the lower shelf in the forward left corner behind the forward niche panel in the tailcone baggage compartment. Access to the switch is a maintenance function, since the forward overhead panel in the baggage compartment must be removed. The ELT is also equipped with an underwater locator device which is located with the recorder mechanism in the tailcone baggage compartment.

DIGITAL FLIGHT DATA RECORDER (Parts 91 and 135) (Optional)

On Citation X airplanes which are equipped with more than 9 passenger seats and are operated under FAR Part 91 or FAR Part 135, a digital flight data recorder, which continuously records at least 17 parameters of airplane and systems operation, is required. A continuous recording of 8 hours is also required. The optional flight data recorder (FDR) installed in the Citation X records the information digitally by a solid state method, and far exceeds the minimum requirements of number of parameters and recording time.

The flight data recorder system consists of a solid state flight data recorder, a G switch, and a remotely mounted accelerometer. The flight data recorder interfaces with the data acquisition unit (DAU) in order to obtain airplane system and flight data information. The accelerometer provides information to the DAU. The G switch is a power interrupt switch, which removes power from the flight data recorder, in order to prevent recording over data in an airplane mishap, if the recorder should still have power available. The flight data recorder uses a modular crash survivable memory unit (CSMU), for protection of the solid state flight data recording memory. The CSMU retains the most recent 25 hours of digital flight data and timing information. The flight data recorder may be upgraded, if desired, to a fifty-hour recorder by exchanging the CSMU.

An underwater locating device is attached to the CSMU, to aid rescue/recovery personnel with sonar type equipment in locating the CSMU. If the airplane is submerged, the underwater locater will activate within four hours.

Recorder operation begins upon airplane power-up and continues until electrical power is shut off. Recorder operation requires no attention from crew members. Continuous internal checking of the transcribed data is accomplished by the installation to ascertain that correct data is being recorded. An engine instrument and crew alerting system (EICAS) cyan textual annunciation (FDR FAIL), will appear if the flight data recorder becomes inoperative, or if a system fault is detected.

An Event Marker button is located at the far left lower part of the instrument panel. Its purpose is to mark the location in the progress of the flight of an event the pilot may wish to have recorded for later reference. The flight data recorder receives its power from the right main DC bus through a 5-ampere circuit breaker (FDR) on the right circuit breaker panel.

COLLINS PROLINE II SERIES 400 RADIO SYSTEM (Optional)

The Collins Proline II Series 400 radio system is a complete, dual, system which integrates the communication, navigation, transponder (ATC), automatic direction finding (ADF), and traffic alerting and collision avoidance (TCAS) systems into one integrated whole, all of the components of which are tunable by one radio tuning unit (RTU) in each system. For example, COM 1, NAV 1, ADF 1, etc. are controlled by the left RTU and COM 2, NAV 2, and ADF 2, etc., are controlled by the right RTU. The unit being controlled is annunciated on the control display unit of the RTU. All of the components (except the ADF, which may or may not have the optional ADF 2) are duplicated in left and right (1 and 2) systems. Each side is independently operated by its own radio tuning unit, but each side can be redundantly (cross-side) tuned by the opposite tuning unit, by pressing the 1/2 button, which transfers RTU controls, on the RTU bezel. The radio tuning units are mounted on either side of the center pedestal immediately forward of the throttles, and the COM, NAV, ADF, TCAS, and ATC radio units which they control are remotely mounted. Audio controls and microphone/transmitter selection for the VHF-422 radios and the HF radios, as well as identification and monitoring reception for all other receivers, is controlled by the respective Avtech audio control panel mounted on each side of the instrument panel, operation of which is also discussed in this section. The proline II system monitors its own operation, performing a power-up self-test and continuous self-tests during operation.

In order to avoid unnecessary redundancy, only major points concerning operation of the RTU-4210 radio system are covered here. Additional features offered by the Collins RTU-4210 radio system are discussed in detail in the Collins RTU-4210 Radio Tuning Unit Pilot's Guide, First Edition, 11 August 1995, or later edition, which is provided with the Citation X airplane. The pilot's guide must be immediately available to the flight crew for airplanes equipped with this radio system.

VHF Comm Transceivers

The Collins VHF communications system may have either VHF-422A or VHF-422B units installed. The “A” units have a frequency range of from 118.000 through 136.975 MHz, and the “B” units have a range of from 118.000 through 151.975. The “B” units are required for operation in parts of the world where those higher frequencies are used. The transmitter has a built in self-test, temperature monitoring function, and a stuck microphone timer. It will shut down after two minutes from initial keying, both in order to avoid generating too high a temperature and, in case of a possible stuck microphone switch, to preclude constant transmission which can block a frequency. The COM receiver squelch may be selected off on the COM main display page, in which case SQ OFF will be displayed in cyan on the top level page and the preset tuning pages. The COM 1 antenna is mounted on top of the aft fuselage, and the COM 2 antenna is mounted on the bottom of the aft fuselage.

VHF NAV Receivers

The NAV is tunable in 50 KHz steps in the frequency range of 108.00 MHz to 117.95 MHz. Optional installations extending independent DME frequencies of 133.00 to 135.95 MHz are available. The NAV receivers have some messages which will appear on the RTU that pertain only to their operation. If the NAV is being autotuned by the flight management system (FMS) “AUTO” will be displayed in cyan in place of the active NAV preset number. If the marker beacon sensitivity level is set to the high setting, a cyan MK-HI annunciation will appear in yellow on the top level of the NAV main display (and the PRESET pages in some installations). The RTUs may be turned remotely by the FMS sets; the left FMS tuning the left RTU, and the right FMS tuning the right RTU. Neither RTU will tune the NAV radio when STBY is displayed.

The DME portion of the NAV radio installation can be tuned independently of the azimuth. To accomplish the split DME tuning follow these steps:

1. Press the DME-H function key on the right side of the RTU; this will select DME hold. The hold frequency will be displayed in green followed by a yellow H.
2. Press the DME hold line key to show the tune window.
3. Turn the tuning knobs to set the desired DME hold frequency.

The VOR/DME can be automatically tuned (autotuned) by the flight management system (FMS). When the FMS is autotuning the VOR/DME, AUTO is displayed in cyan below the active NAV frequency on the top level, main, and preset pages.

RTU-4210 Radio Tuning Unit

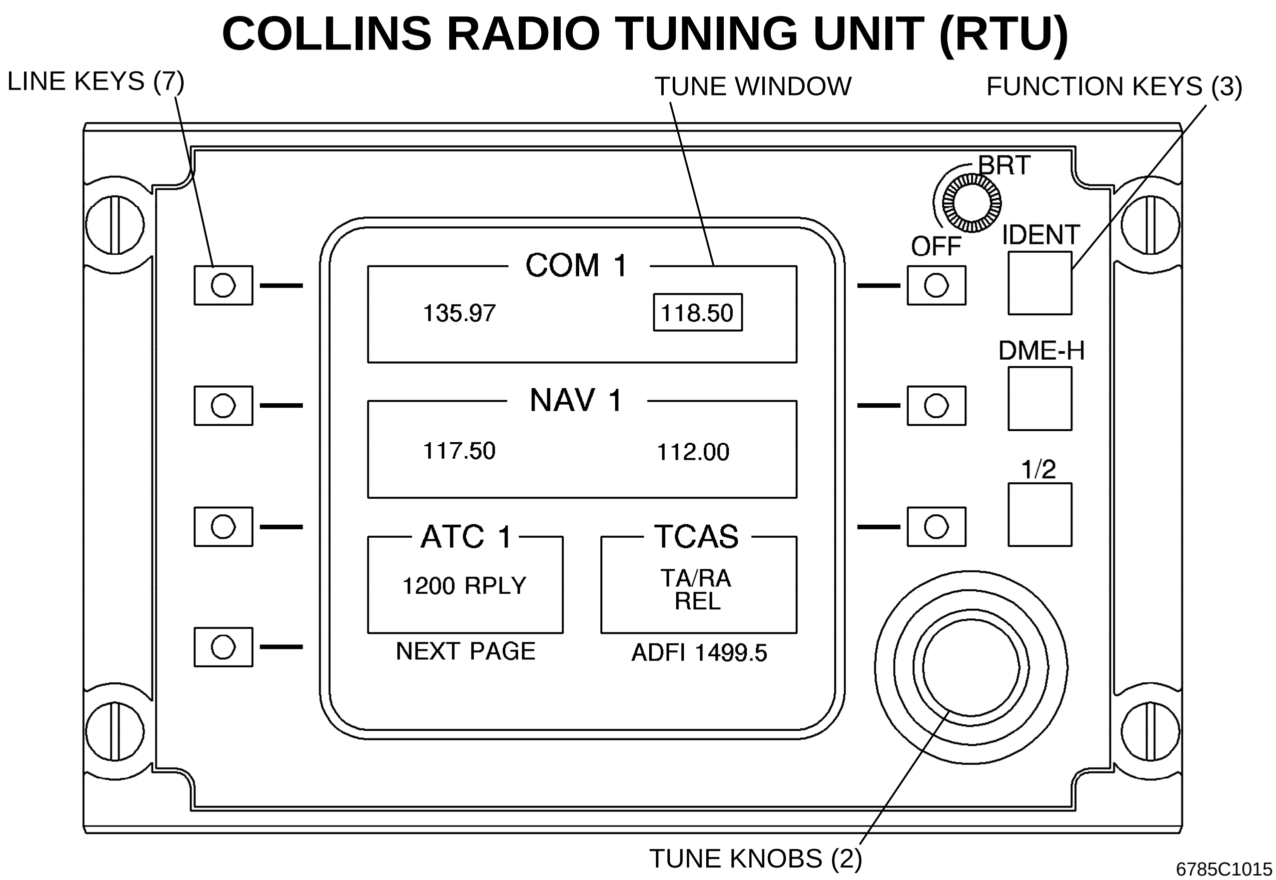


Figure 3-16

The RTU-4210 radio tuning unit is the master control/display unit which controls the Collins Proline II Series 400 integrated radio system. The VHF, COM, NAV, ADF, and transponder radios can be tuned either directly, by pushing the respective line key on the radio tuning unit (RTU) to bring the tuning window to the desired radio display, and then turning the knobs when the tuning window surrounds the frequency display, or by using the preset tuning in frequency mode or preset tuning in preset mode, which requires accessing another page.

The tuning control line keys are used to select individual radio frequencies, preset numbers, codes, and modes for control, When a frequency, preset number, or code is selected for control, the tuning window is displayed around that value to confirm selection. The tune window moves to surround a frequency, preset number, or code when the line key at that point is pressed. Operation of the tuning knobs will then change the value of the number surrounded by that window. The power-up position for the tuning window is around the COM preset (top-right) frequency on the top page level. The tuning knobs (lower right side of case) are used to set the frequencies, preset numbers, and codes. The largest digits (left-most) are set with the large knob and the less significant ones with the small knob.

There are three page levels at which the radios can be tuned: the top level page, the main display page, and the preset page. There is also a configuration error page, and the cross-side radio tuning inoperative page. The latter page appears when an attempt is made to cross-tune with one of the RTUs and the operation is unsuccessful. If this page appears, press the 1/2 key again or press any line select key to reselect the onside tuning RTU. The configuration error page appears when the RTUs do not have identical configuration codes. Loss of radio control is possible in this situation; maintenance is required.

The top level page (see illustration) is a subdisplay for the radios controlled by the RTU. The radios can be tuned from the top level page; the top level page also provides access to the second level top page and the individual main display pages, as well as the individual preset pages. The automatic direction finder (ADF) is tuned from the second top level page; the top level frequency of the ADF, which is shown on the top page is not tunable. The RTU will return to the top level page after twenty seconds of inactivity.

For radios (such as the ADF) which have a second top level page to show subdisplays for those functions not accessible on the top level page, push the NEXT PAGE line key on the top level page top access the second top level page.

Each radio controlled by the RTU has a main display page which provides displays and controls for radio tuning and provides control over the radio modes. Radios which are tunable with numbered presets also have a PRESET PAGE display/control on their main display page. Accessing the main display page requires only pressing the line key twice; once to show the tuning window for the radio desired, and the next to access the main tuning page.

The COM, NAV, and ADF radios are each provided with five preset pages, each one displaying four of the twenty total available preset frequencies. Each page displays also the preset page number, the tuning mode, and the active (green) frequency. To access a preset page from the top level page, push the desired radio's active (left) line key twice, first to show the tune window, and the second time to access the main display page. Push the PRESET PAGE line key on the main display page to access the selected radio's preset page.

Radio Tuning

The four radio functions: COM, NAV, ATC (Transponder), and ADF which are controlled by the RTU are all displayed on page one (main frequency select page) of the RMU. Tuning control for the desired function is obtained by pressing the line select key on the radio tuning unit (RTU) next to that function. The left line select keys control the active frequencies and the right ones control the preset frequencies. Generally, the left keys are active and the right keys are preselect. The COM, NAV, and ADF radios have a memory capacity for up to 20 frequencies to be selected and stored for later use. The radios can be tuned either from the top level or the main display pages for the COM, NAV, ADF or applicable radio. The radios may be directly tuned, if desired, by pushing the active line key to show the tune window, and turning the tuning knob (lower right corner). When the active frequency is directly tuned, the previously active frequency (which was in the tuning window) is lost.

To preset tune the COM, NAV, or ADF in the frequency mode, accomplish the following procedure:

1. Determine if the frequency mode is active by checking for the absence of a preset number below the preset (right) display. If there is no small number, it is not active - select FREQ for the tune mode on the COM, NAV, or ADF, etc., preset page (accessing the PRESET page is discussed below in this section).
2. If the tune window is showing around the preset display, turn the tune knobs to set the desired frequency (skip to step five).
3. Press the preset line key to show the tune window.
4. Turn the tune knobs to set the desired frequency.
5. Push the preset line key (with the tune window showing) when the preset frequency is needed, in order to exchange the active and preset frequencies. If the tune window is not showing, press the preset key twice, first to show the tune window and the second time to exchange the active and preset frequencies. After twenty seconds of inactivity the RTU will return the display to the top tuning page. The ADF (except for direct tuning) is primarily tuned from either the main display page or the second top level page; the tuning procedure remains as above.

To preset tune the COM, NAV, or ADF in the preset mode, accomplish the following procedure:

1. Determine if the preset mode is active by checking for the presence of a preset number (1-20) below the preset (right) display. If there is no small number, it is not active - select PRESET for the tune mode on the COM, NAV, or ADF, etc. preset page (accessing the PRESET page is discussed above in this section).
2. If the tune window is showing around the preset display, turn the tune knobs to set the desired frequency (skip to step five).
3. Push the preset line key to show the tune window.
4. Turn the tune knobs to set the desired preset number into the preset display.
5. Push the preset line key (with the tune window showing) when the preset frequency is needed in order to exchange the active and preset frequencies. If the tune window is not showing around the preset display, press the preset key twice, first to show the tune window and the second time to exchange the active and preset frequencies. After twenty seconds of inactivity the RTU will return the display to the top tuning page. This automatic return does not apply to the ADF tuning page, which is located on the second top level page.

Tune Mode on Preset Pages (Freq/Preset)

To access a preset page press the active line key adjacent to the desired radio twice; first to obtain the tuning window, and second to select the main display page. Pushing the PRESET PAGE line key on the main display page will then show the preset page. Once accessed, the frequency in the preset display on the top level and the main display pages can be set manually (frequency mode), or selected from a list of numbered presets (preset mode). Push the TUNE MODE line key to select frequency or preset tuning mode. The active state, “FREQ” or “PRESET”, is displayed in large cyan letters.

Twenty numbered presets are available for programming on five preset pages. Each page displays four available presets. To program the presets proceed with the following:

1. If the tune window is showing around the preset page number, turn the tune knobs to select the desired preset page/preset number (skip to step four).
2. Push the line key adjacent to the preset page number to show the tune window.
3. Turn the tune knobs to select the desired preset page/preset number.
4. Push the line key adjacent to the preset to be programmed (the tune window will appear there, confirming the selection).
5. Turn the tune knobs to set the desired frequency, and program the selected preset number.
6. To continue programming presets, select another preset number (step four), or select a different preset (step two).
7. Push the RETURN line key twice to return to the top level page.

The VHF COM radio has one preset frequency (emergency communications frequency, 121.50 MHz) that cannot be changed.

The radios can be tuned from the preset page. To tune the radios from the preset page, turn to tune knobs (with the tune window showing around the preset page number) to access the desired preset number/preset page. Then, press the line key adjacent to the desired preset two times, first to show the tune window there, and second to tune the radio to the selected frequency and return to the top level page.

Certain procedures and characteristics apply only to the ADF. The ADF is tuned from the ADF main page (except direct tuning, if desired), which may be accessed by pressing the NEXT PAGE line key on the top level page; otherwise its tuning is generic. On the ADF main page, selection of the antenna (ANT) or ADF mode is made by pressing the line key to the left of that function annunciation. If ANT is selected the ADF bearing pointer will not function and ANT will be displayed in large cyan letters on the ADF top level, main display, and preset pages. Beat frequency oscillator (BFO) (ON or OFF) is selected by pressing the line key to the right of that annunciation. The BFO active state is displayed on the ADF main display page in large cyan letters (ON or OFF). When BFO is on, BFO is also displayed in cyan on the top level and ADF preset pages. Pressing the TEST line key will result in ADF self-test. TEST will be displayed in cyan throughout the self-test cycle. In installations having the extended frequency range (2179 to 2185 KHz) preset position 20 is permanently tuned to 2182.0 KHz, and EMER is displayed in place of 20.

Recall (RCL) Preset Function

The recall preset function allows storage of the last directly tuned, previously active frequency, when in the preset tuning mode. This allows the operator to reselect a directly tuned previously active frequency from the preset list, without actually programming the frequency on the preset page. To pretune a frequency for recall accomplish the following steps:

1. Select PRESET TUNE MODE on the applicable radio preset page and press the RETURN line key twice to return to the top level page.
2. Press the active line key to show the tune window.
3. Turn the tuning knobs to tune the desired frequency.
4. Press the preset line key twice, first to show the tune window, and second to exchange the active and preset frequencies. The frequency will be displayed in the preset display, and is programmed into the preset list as the "RCL" preset frequency.

ADF TUNING (TOP LEVEL PAGE)

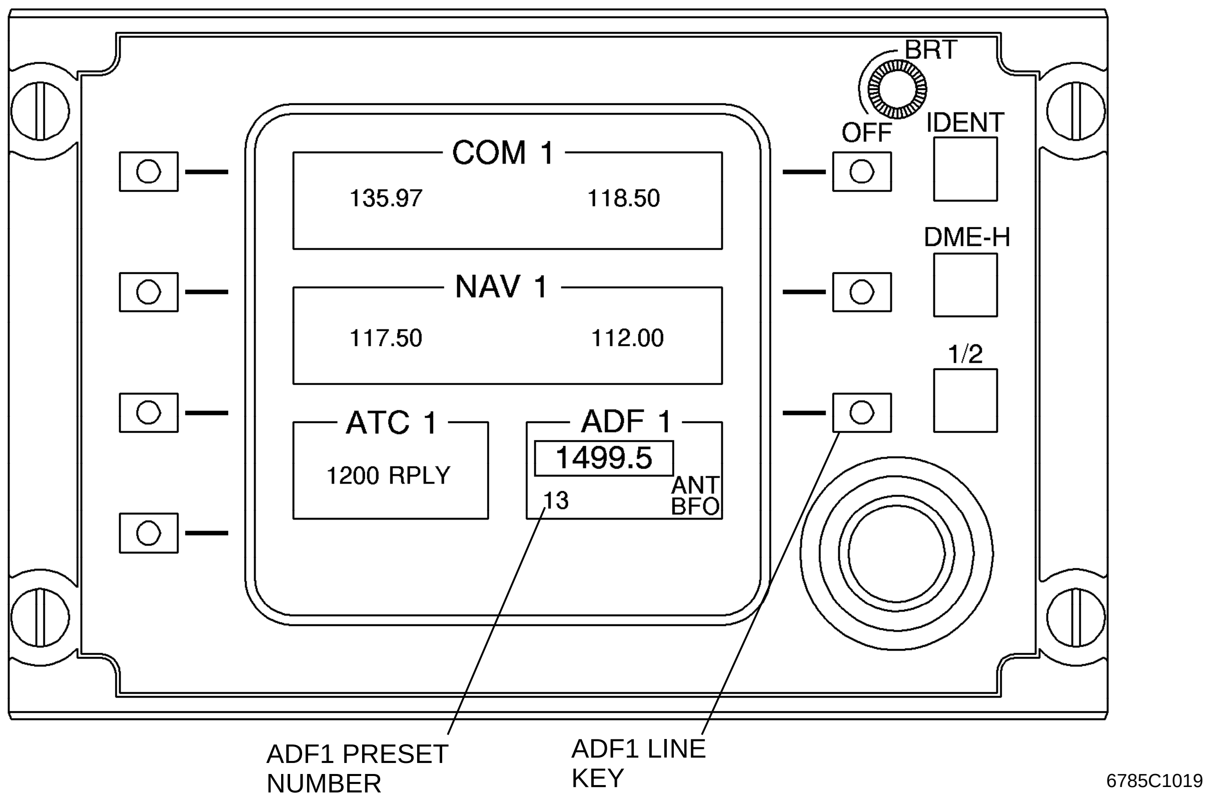


Figure 3-17

Tuning on the Preset Page

Tuning of the COM, NAV, or ADF to a preset frequency can be done from the preset page, if desired. Press the line key adjacent to the desired preset number/frequency (the tune window will confirm selection); next, press the line key adjacent to the desired preset number/frequency a second time (with the tune window showing). The radio will tune to the selected preset number/frequency and the RTU will automatically return to the top level page.

ATC Transponder

The ATC (transponder) function of the optional Collins Proline II Series 400 integrated radio system is provided by the TDR-94 transponder. It functions as a 4096 code mode A transponder, as well as providing mode C (altitude) and mode S (collision avoidance) information. Its tuning is controlled by the radio tuning unit (RTU).

Tuning of the transponder is, in general, similar to the tuning of the other radios, however, tuning actions that are peculiar to the transponder are covered here. Specifically, control of the transponder is accomplished by pressing the line key adjacent to the desired function (on the top level page or on the main tuning page) to the desired ATC function displayed on the RTU. The ATC system has two transponders, but only one of them can be in operation at a time; the other one is held in standby, ready for immediate operation if selected. The same ATC subdisplay shows on the onside and cross-side RTU displays. Operation of the one operating transponder is possible from either RTU. If the pilot's and copilot's RTU are tuned at the same time, the pilot's will have precedence. (This is also true of the other radios; if one side is in cross-tuning mode and an attempt is made to control one radio at the same time from two RTUs, the pilot's control will take precedence.)

Selection of the operating transponder (1 or 2) is made with by means of a rotary switch (TRANSPONDER 1/STANDBY/TRANSPONDER 2) located on the center pedestal. STANDBY position will place both transponders in standby mode.

The ATC identification (squawk) is displayed in green on the top level and ATC main display pages when the transponder is set to ON. When the transponder is in standby the code will be displayed in white. To set the identification code from the top level page, press the ATC line key to show the tune window, and turn the tuning knobs to set the code.

The IDENT code can be set directly either on the ATC main display or on the top level page. It can also be exchanged with a preset code on the main display page. To preset a code proceed as follows:

1. Press the ATC preset line key to show the tune window.
2. Turn the tune knobs to set the desired code. The code in the preset display is ready for use, but the transponder is still transmitting the active (green) code.
3. When the preset code is needed, push the ATC preset line key (with the tune window showing) to exchange the active and preset codes. If the tune window is not showing, push the preset line key twice, first to show the tune window and the second time to exchange the active and preset codes.

When the transponder is replying to an ATC interrogation RPLY is displayed in cyan on the top level and ATC main display page. When IDENT is active RPLY will not be displayed.

An identification (IDENT) pulse can be sent by pressing either the IDENT button on the right side of either RTU case or by pressing the IDENT button on either control wheel. Pressing any ID button will activate the IDENT mode for approximately 18 seconds. When the IDENT is active ID is displayed in cyan on the top level and on main display page.

A standby mode is provided which can be used to interrupt transmissions of the selected transponder. To select standby (STBY) press the ON/STBY line key (on either RTU) to select ON or STBY. The active state is displayed in large cyan letters. When standby is selected STBY will be displayed in cyan on the top level page.

When the selected transponder has failed, XPDR FAIL is displayed in yellow on the top level page and the ATC main display page.

Mode C (altitude reporting) is controlled by a line key on the ATC main tuning page. Press the ALT line key in order to turn altitude reporting ON or OFF. ON or OFF will be displayed in large cyan letters to annunciate the status. When ALT is OFF the transponder will operate in mode A. In this case ALT OFF will be displayed in cyan on the top level and ATC main display pages.

Since the installed transponder has mode S capabilities, TYPE S is displayed in cyan on the ATC main display page. The installed TCAS system requires an operating mode S transponder with encoded altitude data included in the interrogation replies. When the mode S transponder is set to STBY, or the selected transponder is not transmitting mode S, the TCAS receiver-transmitter may automatically change to standby mode or turn itself off.

A transponder self-test can be initiated by pressing the TEST line key when the main display page is selected. When the test mode is active TEST is displayed in large cyan letters.

Audio Control Panel

Two Avtech digital audio control units are supplied with the Collins remote radio system. Digital transmission of audio from remote units to the audio panels differs from conventional audio systems in that it requires one twisted pair of wires rather than many twisted pairs to achieve the same performance. The control units are mounted on the left side of the pilot's instrument panel and the right side of the copilot's panel respectively.

The panels have four rows of combination audio ON/OFF switches and volume controls. The small round knobs serve as audio ON/OFF switches when pressed. When the switch is latched in, the audio for the particular receiver it serves will be off. When pressed again, the switch will move outward turning the audio on. When the audio is on, the knob of the switch may be used as a volume control. Turning it clockwise will increase the volume; counterclockwise will decrease it. The S/T button in the top row controls whether a sidetone is heard when transmitting, and controls the volume of it. The ADF 2 button is inactive if that option is not installed. The INT button at the upper right corner controls the volume of the hot mic interphone between the pilot and copilot, and the ground cord, when plugged in.

The two small knobs at the bottom of the control panel serve as volume controls for the speaker (SPKR) and headset (HDPH). These knobs are in series with the individual volume controls. This allows a volume selection to be made on the individual radio volume control, and then a final overall selection to be made by means of the speaker or headphone control, resulting in a more flexible individual control of all available audio signals.

The rotary selector switch (COM1, COM2, HF1, HF2, PA, EMER) located at the lower left corner of the audio panel, connects the pilot's or copilot's microphone to the selected transmitter. The receiver for the selected radio or interphone will also be selected regardless of the selection of the audio ON/OFF switches. PA position selects the cabin speaker system.

AUDIO CONTROL PANEL

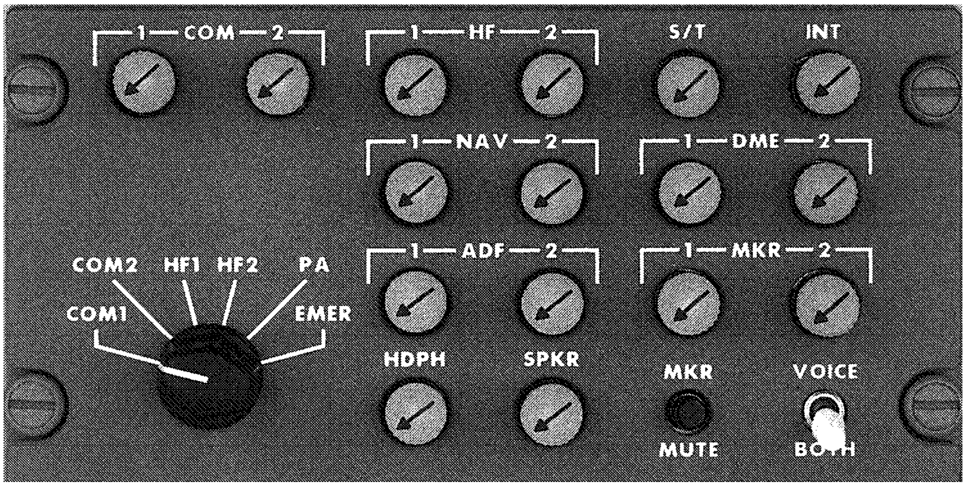


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Figure 3-18

The emergency COM (EMER) microphone position of the microphone selector switch, when selected, connects COM 1 transceiver directly to the aircraft microphone and headphone. All electronic circuitry is eliminated and all other audio panel modes are disabled in this mode.

A VOICE/BOTH toggle switch is located at the lower right corner of the audio panel. It is active whenever NAV 1 or 2 and/or ADF 1 or 2 (if installed) is selected. If BOTH is selected, both ID and voice will be heard; If VOICE is selected, coded signals will be filtered out and voice will be heard.

A marker mute button is located to the left of the VOICE/BOTH switch, and the marker aural on/off/volume controls (1 - MKR - 2) are located on the row of switches above the VOICE/BOTH switch. The marker mute is used to temporarily silence the marker beacon audio. Momentarily pressing the MUTE button will mute the beacon signal for a fixed period of time (approximately thirty seconds). The MKR button may be pressed in to disable the aural signal. When the button is out (pressed again) the marker beacon volume can be controlled with the knob, however, maximum counterclockwise rotation will not totally turn down the volume since a minimum signal is automatically retained in order not to miss the aural marker signal if it has been selected on.

Traffic and Collision Avoidance System II (TCAS) (Optional) with Collins Proline II Series 400 Radio System (Optional)

The TCAS II system visually presents traffic advisories on the multifunction displays to the flight crew. The system interrogates every transponder equipped airplane within the selected range for bearing and altitude data. It uses this data to establish a track for collision avoidance predictions.

The TCAS computer performs functions that determine range, bearing, and altitude of intruder aircraft based on information computed from or contained in the reply messages. Bearing can only be determined for intruder replies received on the system directional antenna. Altitude can only be determined if the intruder is reporting altitude in its transponder's reply message.

Based on the information that can be extracted from or computed from the reply, the TCAS computer evaluates the threat potential of the intruder by calculating intruder closing rate and position relative to own aircraft. Based on this evaluation, the TCAS computer categorizes the intruder as a nonthreat, proximity or traffic advisory.

For traffic advisory category aircraft, the TCAS computer outputs traffic advisory symbol position and alert data to the EFIS. The TCAS computer also outputs traffic advisory alert voice messages to the cockpit audio system.

For proximity and nonthreat aircraft, the TCAS computer outputs proximity or nonthreat traffic symbol position data to the EFIS. Voice alerts are not generated for proximity or nonthreat category aircraft. Intruders which are not reporting altitude are also detected and tracked. By using the interrogation reply, the TCAS can accomplish the following:

(1) Compute range between own airplane and an intruder.
(2) Compute relative bearing to the intruder.
(3) Compute altitude and vertical speed of an intruder (if reporting altitude).
(4) Compute closing rate between an intruder and own airplane.
(5) Issue a traffic advisory (TA) when the closing traffic is in the vicinity.
(6) Issue a resolution advisory (RA) in order to maintain safe vertical separation.
(7) Track 45 aircraft at once, displaying up to 30, and can coordinate a resolution advisory for up to three intruders at once.

Certain functions of the traffic and collision avoidance system (TCAS) are tuned through the radio tuning unit (RTU). Other selections are made with controls on the multifunction display (MFD). For information on the MFD, refer to Flight Guidance System in this section. The TCAS system is tuned from the main tuning page; to access the main tuning page, press the TCAS line key, on the top level page, twice. The TCAS main page display provides displays and controls for the TCAS modes and the TCAS range. Active modes are displayed in cyan on the main display page and in the TCAS subdisplay on the top level page.

The three possible TCAS modes are TA/RA (traffic alert and resolution advisories), standby (STBY), and TA ONLY (traffic advisories only). Push the top left line key to select the desired mode. In the TA/RA mode the TCAS computer displays traffic on the traffic display and gives resolution advisories as required.

In the standby (STBY) mode the TCAS computer shows no traffic displays and does not reply to other airplane interrogations.

In the traffic alert only (TA ONLY) mode the TCAS computer does not give resolution advisories (RA), nor does it display RA traffic.

System selection is possible between two altitude modes; relative altitude or absolute altitude modes. In relative altitude (REL) mode, the difference between the intruder airplane's altitude and own airplane altitude is displayed. In absolute altitude (ABS) mode, the mean sea level (MSL) altitude of the intruder airplane is displayed.

Normally the TCAS system displays traffic in a range of from 2700 feet below own airplane to 2700 feet above own airplane (NORM mode). In the Collins radio option, additional selections of traffic warnings concerning intruding airplanes, up to a maximum altitude of either 9900 feet above or below own airplane altitude (or both), may be made. Pressing the ABOVE or BELOW line keys on the main tuning page, selects the respective additional coverage; or, if desired, both additional “windows” may be selected. It should be kept in mind that if both extended altitude selections (ABOVE and BELOW) are made, traffic in an altitude range of 19,800 feet will be shown on the display.

With the main tuning page selected, the tuning knob may be used to select the desired TCAS display range. The available range displays, in nautical miles, are 6, 12, 20, and 40. The selected range appears in a box immediately to the left of the tuning knob. Clockwise rotation of the knob selects higher ranges and counterclockwise rotation selects smaller ones. The range selections do not “wrap around” at either end of the scale.

The TCAS system has a self-test which may be activated by pressing the TEST line key. “TEST” will be displayed in large cyan letters when the test is active. During the test the TCAS traffic displays will show test pattern traffic symbols, red and green resolution advisories, and TCAS TEST (in white letters) during the test sequence. The sequence takes approximately ten seconds. If the test is completed successfully the system will return to the set operating modes and aurally annunciate TCAS SYSTEM TEST OK on the cockpit audio system. For a failure in the TCAS system “TCAS FAIL” will be displayed in yellow on the TCAS display and the audio system aurally annunciates TCAS SYSTEM FAIL. TEST will operate either on the ground or airborne.

The TCAS system requires an operating mode S transponder with encoded altitude data included in the interrogation replies. When the transponder is set to STBY, the receiver transmitter may automatically change to standby mode or turn itself off.

PRIMUS 2000 INTEGRATED AVIONICS FLIGHT CONTROL SYSTEM

The PRIMUS 2000 Integrated Avionics System is a state-of-the-art system which integrates into a unified whole systems which have been, in older technology, parts of varied and differentiated units. Its digital busses and interconnecting computer circuits provide capabilities and performance that have been unattainable in the past. It combines three subsystems into two identical interchangeable IC-800 integrated avionics computers (IACs) which are the hearts of the dual system. The subsystems are: the electronic display system, the flight guidance system, and the flight management system.

The integrated avionics system, itself, consists of the ADZ-840 air data system, the AH-800 attitude and heading reference system (AHRS), the PRIMUS II integrated radio system, the PRIMUS 870 weather radar system, and the AA-300 radio altimeter system.

Systems which can be optional parts of the Citation X configuration are the LZ-850 lightening sensor system (LSS), the Bendix traffic alert and collision avoidance system (TCAS II), and the LASEREF III inertial reference system (IRS) which, if installed, replaces the AH-800 attitude and heading reference system.

The automatic flight guidance, flight management, and electronic display systems are operated through cockpit sensors, displays, and controls which direct the computers. The automatic flight guidance system (FGS) commands flight director guidance, autopilot, yaw dampers, and automatic trim (elevator and Mach trim) functions. Attitude and heading information from the AHRS and air data information from the micro air data computer are fed into the flight guidance computer in the IACs, which control the flight of the airplane and optimize performance.

A central serial wiring network, consisting of redundant buses of the avionics standard communications bus (ACSB) nomenclature, connects all the units on a bus. Left and right back-up busses connect units on their respective sides of the airplane, assuring communication redundancy. Further redundancy is assured by the integrated avionics computer in that it communicates fault isolation between the flight guidance computer, the electronic display system, and the flight management systems, keeping a fault in one area from affecting other IAC functions.

In order to avoid unnecessary redundancy, only major points concerning operation of the PRIMUS 2000 Integrated Avionics System are covered here. A more detailed discussion of the Citation installation is found in the PRIMUS 2000 Integrated Avionics Flight Control System for the Citation X, Pilot's Manual Pub. No. A28-1146-104-00 dated October 1995, or later edition, which is provided with the Citation X airplane. The Pilot's manual must be immediately available to the flight crew of Citation X airplanes.

ELECTRONIC DISPLAY SYSTEMS

The electronic display systems (EDS) display information from remote sensors concerning automatic flight control systems, flight management systems, caution and warning systems, and airplane performance. It displays this data in analog and digital form in the pilots' primary flight displays (PFDs), the multifunction displays (MFDs), and the engine indicating and crew alerting system (EICAS) display.

PRIMARY FLIGHT DISPLAY

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Figure 3-19

Organization of the displays is as follows:

Primary flight display (PFD) - Integrates attitude, heading, air data information, and flight director modes with command bars, weather radar, and navigation information. Combines information from these disparate sources into one easily interpreted comprehensive display.

Multifunction display (MFD) - Displays heading, navigation map, weather radar, optional checklist, and optional traffic and collision avoidance system (TCAS) information.

Engine Instrument and Crew Alerting System (EICAS) - Displays engine data, flight control data, systems status data, and warning/caution/advisory/status messages.

Both the PFDs and the MFDs are equipped with bezel buttons along the lower edge of the display units (DUs). The PFDs also have a conventional slip/skid indicator attached to the bezel.

The RA/BARO button on the PFD bezels controls the bug on the altitude display for setting the minimum decision height/minimum descent altitude (BARO) or for setting the radio altitude bug for minimum radio altitude (RA). Pressing the RA/BARO button causes the MINIMUMS knob to alternate which bug it controls. The STD button on the right of the bezel, when pressed, returns the barometric setting to 29.92 in. Hg., or its metric equivalent, 1013 millibars, if metric function has been selected on the MFD bezel menu (PFD setup menu). If cross-side digital air data computer data is being displayed on a PFD, the BARO setting knob of that display will be inoperative; also when a reversionary mode is selected on a PFD, the menu item keys on the selected PFD are inoperative.

Certain of the display formats of the PFDs and the MFDs are controlled by the DC-840 display controller. Other MFD and PFD displays are controlled by the bezel controller buttons located in the MFD and the PFD bezels. Pressing the MFD bezel buttons selects menus, which present selectable parameters, or, in some cases, selects submenus which will in turn present further selectable parameters. The menus/parameters are sufficiently identified so as to make their function self evident. The "top" menu, which is the default menu, is menu one; pressing the < button selects the succeeding menu, and further pressing brings back the original menu page.

The rotary knob on the bottom right of the MFD bezel is used to control the range selection of the map or plan display on the MFD in preset increments. Some menu selection buttons can change the knob function so that it can set flight parameters. When the weather radar is selected for display, the WC-840 weather radar controller has precedence and will control the range.

DC-840 DISPLAY CONTROLLER

The DC-840 display controller selects formats for the primary flight displays (PFDs), multifunction displays (MFDs), and the engine indicating and crew alerting system (EICAS). It controls navigation format control for both the PFD and the MFD, controls the weather presentation on the PFD and the MFD, and the optional traffic and collision avoidance system (TCAS) presentation, also on both the MFD and PFD. It also controls whether or not the EICAS display is presented on the MFD. The lower part of the controller is dedicated primarily to operation of the optional checklist installation.

DC-840 DISPLAY CONTROLLER

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Figure 3-20

NAVIGATION PRESENTATION

PFD/HSI Button - Pressing the PFD/HSI button toggles the PFD display between the full and partial compass display. The full compass display shows the entire compass rose; the partial display shows a segment 120 degrees wide, with the airplane heading in the middle. The default display at power up is full compass. The MFD range knob controls the MFD range selections unless weather radar is being displayed, in which case the range markers are controlled by the weather radar controller.

PFD/WX Button - Pressing the PFD/WX button displays weather on the arc display. Range control reverts to the radar weather controller.

ET Button - Alternately pressing the ET button selects or removes the elapsed time (ET) clock display from the MFD. The same button also starts, stops, and resets the timer. The power-up default is with the clock not displayed. When the timer, if displayed, experiences no activity for 10 minutes, or if the ET button is pressed for 2 seconds, the timer will disappear from the display. The timer can count from zero forward or from a preset value back to zero. Counting from zero is started by pressing the ET button. Counting from a preset value back to zero is started by the ET button after the preset value has been entered in the display. The MAIN 1 menu select key is used to enter the mode for setting preset values.

TCAS Button (Optional) - Pressing the TCAS button displays TCAS information in the MFD zoom window. If the TCAS button is pressed when the MFD is in the map mode, the map mode remains. The MFD window can be toggled between the checklist, systems, or TCAS displays. If TCAS is displayed in the MFD window, and if TCAS traffic is selected for display on the MFD map the TCAS traffic is removed from the map display.

ACFT/SYS Button - Pressing the ACFT SYS button displays the system status in the system pages section of the center display. If the EICAS SYS menu is selected the system is shown boxed on the display. Pressing the ACFT SYS button will sequence through the EICAS system displays, starting at the last display selected. If no displays were selected since start-up, the sequence starts with the normal checklist. The EICAS menu select keys can be used to select an EICAS display in any sequence. Using the ACFT SYS button, the toggling sequence for EICAS systems displays is as follows: NORM, FUEL/HYD, ELEC, CTRL POS, ENG (standard), DCLT, NORM.

MFD/MAP Button - Pressing the MFD/MAP button toggles the MFD between the heading-up (MAP) and north-up (PLAN) displays. The default power-up display is MAP. If weather is selected in MAP function, the display will include it. When weather is displayed the radar control will control the range markers. If TCAS is selected for display and PLAN display is selected, TCAS will be removed from the display. If TCAS is selected in the MFD "zoom" window it will not be displayed on the MAP display.

MFD/WX Button - Pressing the MFD/WX button displays weather in conjunction with the MAP mode. Range control is by the radar weather controller. When weather is selected it replaces the plan display, TCAS and checklist displays are not affected by selection of weather.

The lower section of the DC-840 display controller is used in conjunction with the flight management system (FMS), or with the optional electronic checklist. The below following discussions concern these functions. When used with the FMS, the lower pushbuttons and the "joystick" control the position designator and are referred to as designator controls. When used with the checklist, they become checklist controls.

DESIGNATOR CONTROL

SKP Button - Pressing the skip button skips the designator's home position to the next displayed waypoint. When pressed with the designator at the last displayed waypoint, the designator returns to the present position.

RCL Button - In the map mode, when the designator is not at its referenced waypoint, pressing the RCL (recall) button moves the designator to the referenced waypoint. If the referenced waypoint was the aircraft, pressing RCL moves the designator to the aircraft's present position. If the system is in the plan mode, pressing RCL returns the designator to the referenced waypoint.

ENT Button - When the designator is offset from its home position or a waypoint, pressing the ENT button transmits the LAT/LON of the designator to the FMS scratchpad as a requested waypoint.

Joystick - The joystick is used for four-direction control of the designator: up, down, left, and right on the map display. The course and distance to the designator from its home position is displayed in the lower right corner of the display. When the plan display is being used, the joystick moves the north-up viewing circle so the pilot can see the desired track line. Changing display formats resets the designator to its home position on the map format. When the checklist is selected in the MFD zoom window, the joystick on the selected side is the only control that can be used to operate the checklist. The cross-side joystick can, however, be used to control the map designator on the cross-side MFD.

CHECKLIST PRESENTATION

Checklists can only be displayed one at a time on the MFD. When one pilot selects a checklist for display using the display controller, the cross-side controller checklist selections are ignored by the system. When the pilot who selected the checklist deselects the checklist, the cross-side controller becomes operable.

NOTE

- if a partially completed checklist is deselected by one pilot and then reselected using the other side controller, the reselected checklist displayed will indicate that none of the checklist steps have been completed. Partially completed checklists are not retained in memory.
- If either pilot has SG REV selected, and if either pilot then selects a checklist function, the system places the checklist on both MFDs. The system recognizes an SG (symbol generator) failure has occurred and presents identical displays on both display units.

The SKP, RCL, PAG, and ENT buttons, and the joystick can be used to control the checklist designator. Selecting another checklist button, airplane systems display, or TCAS overrides the existing checklist display. The descriptions below describe how checklist control functions are used to operate the checklist.

NORM (Normal) Button - When the NORM button is pressed, the system displays the MFD's normal checklist display. The normal checklist is arranged in the order of standard flight operations. Pressing the button displays the normal checklist index page.

ABN (Abnormal) Button - When the ABN button is pressed, the system displays the MFD’s abnormal checklist. Pressing the ABN button displays the abnormal procedures index from which a selection can be made.

EMER (Emergency) Button - When the EMER button is pressed, the system displays the MFD’s abnormal and emergency checklist displays. Pressing the EMER button displays the index from which a procedure cand be selected.

SKP (Skip) Button - When the SKP button is pressed the active selection skips to the next item. If the item skipped is the last item on the checklist, the active selection is the lowest order skipped item on the checklist.

RCL (Recall) Button - Pressing the RCL button displays the page that contains the lowest order skipped item with the active selection being at that item.

PAG (Page) Button - Pressing the PAG button advances the checklist to its next page. The active selection is the lowest order incomplete item on the new page. If there are no incomplete items on the new page, the active selection is the first item on the page.

ENT (Enter) Button - Operation of the ENT button is dependent upon the following two criteria:

Index Page - When the ENT button is pressed on an index page, the checklist which corresponds to the active index line selection is displayed. The checklist is displayed at the page that contains the lowest order incomplete item with the active selection at that item. If the checklist has been completed, the system forces all items on the checklist to be incomplete and displays the first page of the checklist with the active selection at the first item.

Checklist Page - On a checklist page, the ENT button is pressed when an item has been completed. When the ENT button is pressed, the system designates the active item as completed, and advances to the next incomplete item. If ENT is pressed with the active selection at the last item in a checklist, the operation depends on whether the checklist is completed or not. If the checklist is not complete (one or more items skipped), the system displays the page that contains the lowest order incomplete item with the active selection at that item.

Joystick - The joystick is used to control paging and the cursor. Control is dependent on the direction the joystick is moved; up arrow moves the active selection to the lower order item, down arrow moves the active selection to the next higher order item (identical to the SKP button), left arrow displays the previous page, right arrow displays the next page (identical to PAG button). When the joystick is displayed in the MFD window, the joystick on the displayed side is the only one that can be used to control the checklist.

SC-840 SOURCE CONTROLLER

The SC-840 source controller is used to select the bearing pointer display, and the navigation sources used by the system. Some navigation sources can be previewed when they are selected with the source controller. The source controller transmits data to its on-side DC-840 display controller. The PFD and the MFD can each display two independent bearing pointers, O and ◇ , which are selected by the respective bearing (BRG) knobs; BRG O and BRG ◇ . The selectable bearing sources for each pointer are as follows: BRG O selects OFF, VOR 1, ADF 1, and FMS 1. BRG ◇ selects OFF, VOR 2, ADF 2, and FMS 2. Selections are annunciated in appropriate colors (matching the pointer colors) in the lower left side of the PFD display. Push button switch functions on the source controller are described below.

SC-840 SOURCE CONTROLLER

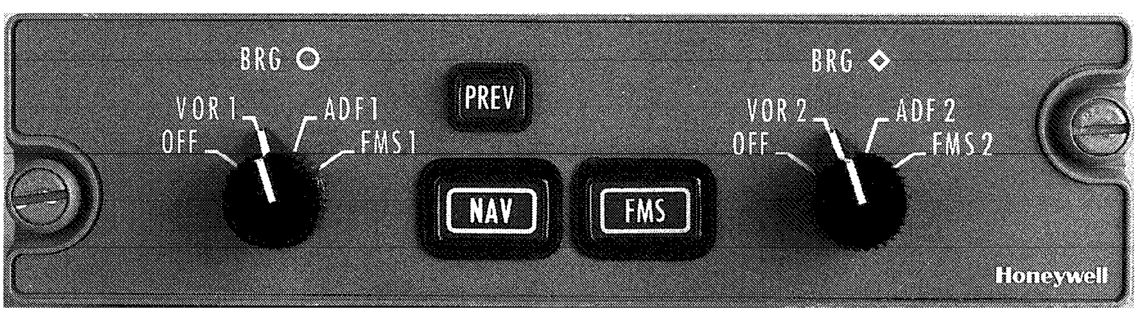

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Figure 3-21

NAV Button - Pressing the NAV button toggles between the on-side and cross-side VOR/ILS navigation source. Default power-up selection is the on-side VOR/ILS source.

FMS Button - Pressing the FMS button toggles between FMS number one and FMS number two. At power-up there is no FMS selection by the system.

PRE Button - When the FMS (one or two) is selected for display, pressing the PRE button displays the respective navigation source (VOR or LOC) in the preview format, i.e., the tuned VOR (on-side) station or ILS will be shown as a white course deviation indicator (CDI), in addition to the FMS course guidance. Pressing the button again will remove the additional display. Toggling the PRE button alternates between the on-side and the cross-side navigation sources.

RI-871 INSTRUMENT REMOTE CONTROLLER

Using the RI-871 instrument remote controllers the pilot and copilot can independently select course and heading data for display and for flight director use. The copilot can, in addition, on the right-side controller input the selected altitude for the altitude select (ALT SEL) feature of the flight guidance system. The two controllers are identical except that the pilot's controller does not have the ALT SEL knob in the center of the panel.

RI-871 INSTRUMENT REMOTE CONTROLLER

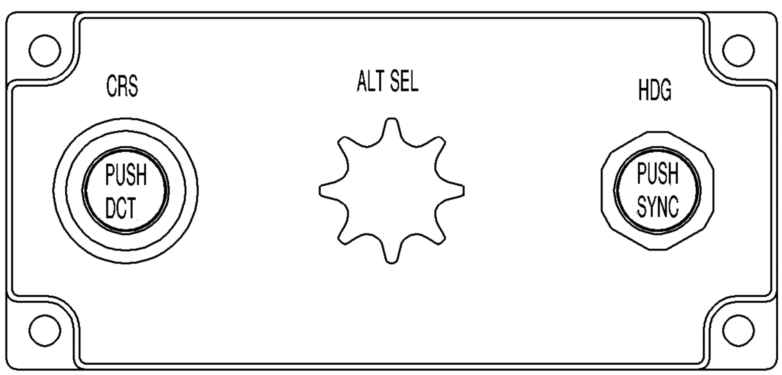

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Figure 3-22

CRS Button - The CRS button is used to select the desired course when in VOR/ILS navigation mode. When in FMS or the optional MLS modes the navigation sources automatically select the proper course. When navigation using a VOR source, pressing the PUSH DCT button centers the course pointer for a direct course to the active VOR station.

HDG Button - Depending on the position of the HDG selector on the GC-810 flight guidance controller this button displays and selects the position of either the heading bug or the optional inertial reference system (IRS) track bug. Pressing the PUSH SYNC button synchronizes either the heading or track bug (as selected) to either the current aircraft heading or IRS track.

ALT SEL Knob (Copilot only) - The ALT SEL (altitude select) knob is used to set the altitude preselect on both primary flight displays (PFDs). When turned at a rate of one click at a time, each click adds or subtracts value. When the knob is turned quickly, the altitude preselect data changes in larger increments. Clockwise rotation increases the preselect value; counterclockwise rotation decreases it.

FLIGHT GUIDANCE

GC-810 FLIGHT GUIDANCE CONTROLLER

The GC-810 flight guidance controller is used to engage or disengage the autopilot and yaw damper and to select the flight director modes of operation. It also selects whether the left or right air data computer (ADC) and left or right horizontal situation indicator (HSI) displayed data are used for supplying information to the flight guidance system. A pitch trim wheel is located on the controller; it can be used to control the airplane pitch attitude through the autopilot, when an automatic pitch mode is not selected. There is also a redundant pitch trim wheel, which is more convenient to the pilot, located near the throttles on the left side of the center pedestal.

When the autopilot and yaw damper are selected they are annunciated on the controller and on the PFD. If only the yaw damper (YD) is engaged, the YD is annunciated on the controller but there is no primary flight display (PFD) annunciation. The yaw damper is normally engaged at all times, to provide yaw stability augmentation. It senses rudder pedal inputs and does not "feed back" against them; it cannot be intentionally disengaged but may, in case of momentary disengagement caused by system malfunction, be re-engaged by the YD switch on the GC-810 controller if the malfunction is cleared. Flight director modes and the HSI source for the flight guidance system are also annunciated on the controller and the PFD. The function of each switch on the controller is discussed in the below paragraphs. All references to the automatic flight control system (AFCS) are references to the flight guidance system (FGS) as well.

GC-810 FLIGHT GUIDANCE CONTROLLER

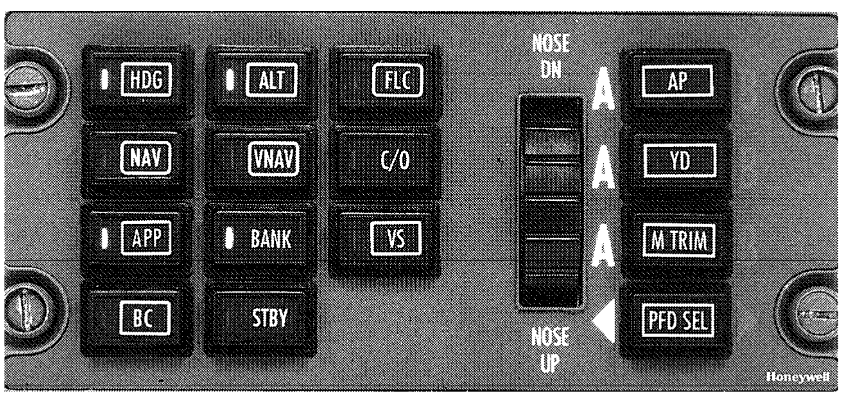

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Figure 3-23

FLIGHT DIRECTOR FUNCTIONS

HDG (Heading) - The HDG button commands the flight guidance computer (FGC) to follow the inputs from the heading bug on the selected HSI. Pressing HDG causes the command bars on the primary flight display (PFD) to follow the position of the heading bug. A lower bank limit can be selected, while in heading mode, by pressing the BANK button on the controller.

NAV (Navigation) - Pressing the NAV button causes the flight guidance computer to arm, capture, and track the selected navigation signal sources; VOR (VHF omni-range), LOC (ILS localizer), AZ (MLS azimuth) (optional), or LNAV (long range navigation).

APP (Approach) - Pressing the APP button generates the proper system gains to meet approach criteria in order to enable the system to arm and capture the lateral deviation signals for VOR, LOC, and AZ, and to arm and capture both lateral and vertical navigation signals for the ILS and the optional MLS systems.

BC (Back Course) - Pressing the BC button commands the flight director computer to track the localizer back course. For a back course approach, the published front course should be set into the horizontal situation indicator (HSI) so that the flight director computer will compute properly.

ALT (Altitude Hold) - When the ALT button is pressed, it commands the system to hold the present altitude.

VNAV (Vertical Navigation) - Pressing the VNAV button causes the system to follow the vertical path guidance from the selected FMS.

BANK - Pressing the BANK button causes the guidance computer to reduce the bank angle to 17° when in HDG mode. An automatic bank angle change occurs at 34,275 feet mean sea level (MSL). During a climb the bank angle is reduced; during descent it returns to the full bank value.

STBY (Standby) - Pressing the STBY button cancels all of the flight director modes. If engaged, the autopilot will remain engaged in the basic pitch and roll hold modes.

FLC (Flight Level Change) - When the FLC button is pressed, the system maintains the current indicated airspeed or permits a new indicated airspeed to be selected and maintained, using either of the two autopilot PITCH wheels, or the touch control steering (TCS) button on the control wheels. The indicated airspeed target is displayed on the PFD. FLC is also used with the flight management system (FMS) VNAV to maintain an FMS supplied speed target.

C/O (Changeover) - The guidance controller C/O button is an indicated airspeed (IAS)/Mach changeover button. Pressing the button toggles selection between IAS and Mach.

VS (Vertical Speed) - Pressing the VS button causes the system to maintain the current vertical speed, or a new vertical speed can be selected and maintained by using either pitch wheel or by pressing and holding the TCS button. The vertical speed target will be displayed on the PFD.

AUTOPILOT FUNCTIONS

AP (Autopilot) - Pressing the AP button simultaneously engages the autopilot and yaw damper; it disengages only the autopilot.

YD (Yaw Damper) - The YD button engages the yaw damper only. It will not disengage the yaw damper.

The active FGS is annunciated by the illuminated A or B indicators located on either side of the AP and YD buttons. When the autopilot and yaw damper are in a normal no-failure condition, the number one (A) flight guidance system (FGS) is automatically selected as active and the A annunciator is illuminated. The pilot may select the right FGS system as active by selecting it by means of the bezel controller on the multifunction display, through the MAIN 2 menu. Engagement of the number two FGS is indicated by illumination of the B annunciator by the AP and YD buttons.

M TRIM (Mach Trim) - Pressing the M TRIM button engages the horizontal stabilizer automatic trim, when the autopilot is not engaged. Upon power-up the Mach trim automatically engages. Turning M TRIM off has no effect on the yaw damper or the autopilot. The illuminated A or B annunciates which FGS is supplying the M TRIM function.

HSI SEL (PFD Select) - Pressing the HSI SEL button alternately selects data from either the pilot's or copilot's HSI and micro-air data computer (MADC) for lateral and vertical guidance to the active FGS. Upon power-up, data from the pilot's micro-air data computer and HSI are automatically selected. When a cross-side system is selected all flight director modes will cancel, and will have to be reselected, if desired. The pointer on the right or left side of the HSI SEL button lights to annunciate which HSI and MADC have been selected. The status of the flight director modes (ARM or CAP [CAPTURE]) is annunciated only on the PFD. A green arrow at the top of attitude director indicator (ADI) display in the PFD points to the left or right in order to indicate which flight guidance computer (FGC) is in control.

PITCH Wheel - The AUTOPILOT TRIM (NOSE UP/NOSE DOWN) pitch wheel is used primarily to set an airspeed or a vertical speed target on the PFD; then when the FLC (flight level change) or VS (vertical speed) modes are selected, the command bars will command a path to capture and hold the selected values. The PITCH wheel can also be used to control the airplane in pitch, with only the basic autopilot modes (pitch and roll hold) engaged. When both pitch wheels are moved at the same time, the inputs are cancelled.

Autopilot Disengage - The autopilot is normally disengaged by pressing the AP disconnect button on the outboard side of each control wheel. It can also be disengaged by any of the following methods: Pressing the AP or YD button on the GC-810 flight guidance controller, pressing the go-around button located on the throttle levers, selecting AOA (angle-of-attack) or FLAP (flap test) on the cockpit rotary TEST switch, or operating the pilot's or copilot's elevator trim switch.

The airplane primary elevator trim system is monitored and engaged by the automatic flight control system (AFCS); if the trim system becomes invalid the autopilot will disengage. When the integrated avionics computer (IAC) 1 or SERVO 1 circuit breakers are pulled, the system transfers to flight guidance computer (FGC) number two if FGC number one was the system in control. The autopilot will remain engaged.

The yaw damper can be disengaged by either pressing the YD button on the GC-810 flight guidance controller or by pressing the AP button on the outboard side of each control wheel.

For normal operations the autopilot cannot be engaged on the ground.

FLIGHT GUIDANCE SYSTEM CAUTION/ADVISORY/STATUS MESSAGES

Flight guidance system related messages are displayed by the engine indicating and crew alerting (EICAS) system. Flight guidance system associated messages are listed below. CAUTION messages are amber, ADVISORY messages are cyan and STATUS messages are WHITE. The flight guidance system has no red messages.

MESSAGE	DESCRIPTION
AP STAB TRIM INOP (AMBER) *****	The AP is engaged and the FGC has detected an AP trim failure. The pilot should disengage the AP manually with his hands on the control column.
FGC A-B FAIL (AMBER) *****	This message is displayed when there is a failure of AP, manual or Mach trim on the annunciated FGC, or loss of lower yaw damper.
FLIGHT CONTROL FAULT (AMBER) *****	PCU-PCU force fight or any control switch depressed. Do not unload hydraulic system.
RAT PROBE FAIL L-R (AMBER) *****	If both RAT probes unavailable there will be no TAS, therefore AP will disengage due to miscompare. ******
FGC-ADC MISCMP (CYAN)	This message is displayed when ADC 1 and 2 data to the FGC do not agree. FD/AP mode drops or will not engage.
FGC- ATT MISCMP (CYAN)	This message is displayed for 5 seconds if the crew's attempt to engage the AP is unsuccessful due to an AHRS split or split of the optional IRS.
RAT PROBE FAIL L-R (CYAN)	If RAT is unavailable there will be no TAS, therefore AP will disengage due to miscompare. ******
FGC A-B MASTER (WHITE)	Annuciates which FGC is drIvIng the servos in response to manual or auto transfer. Will clear after five seconds.

***** Audible warning chime will sound.
****** A unique autopilot off tone will sound.

FLIGHT GUIDANCE SYSTEM POWER-UP TEST

When the flight guidance is powered-up it accomplishes a system self-test, which takes approximately 30 seconds to complete. When the test is completed, the white FGC A MASTER status message will be displayed for five seconds. If failure is detected in either FGC, the blue advisory message FGC A-B FAIL will be displayed. A failure in the flight guidance computer that prevents operation of the flight director function will be annunciated with a red FD FAIL on the PFD.

MODES OF OPERATION

System operation is explained below in a series of steps. Explanation of the terms used is found in the preceding sections in which operation of the various control panels, through which control of the modes is effected, is discussed and in this section where operation of the modes is discussed. Operation of the system is discussed in greater detail in the PRIMUS 2000 Integrated Avionics Flight Control system for the Citation X, Pilot's Manual, which is provided with the airplane.

AUTOPILOT BASIC MODES

Heading Hold Mode

The basic lateral mode of the autopilot is heading hold. It is not annunciated. The autopilot is considered to be in heading hold mode when the autopilot is engaged, no lateral flight director mode is selected, and the bank angle is less than 6 degrees. When the preceding conditions are satisfied and the autopilot is engaged, it will roll the airplane wings level and hold that attitude. When the bank angle is less than three degrees plus ten seconds, the heading hold mode is automatically engaged.

Pitch Hold Mode

The pitch hold mode is the basic autopilot (AP) and flight director (FD) vertical mode. There is no PFD annunciation of pitch hold. The mode is best described by discussing its operation with autopilot engaged and without autopilot engaged. The below discussion assumers that the single cue operation has been selected. If the cross pointer command cue is selected and only a vertical mode is selected, the pitch command cue can be in view without the roll command cue being in view.

Pitch Hold Mode with Autopilot Engaged

If no vertical modes are active, the autopilot holds the pitch attitude that exists when the AP is engaged. The FD pitch command bar is in view on the coupled PFD only if a lateral FD mode is active. Also, if no vertical modes are active, the pitch attitude reference can be changed by pushing and holding the touch control steering button on the control wheel and changing the aircraft's pitch attitude using the control column. The AP will retain the pitch attitude that exists when the TCS button is released. If only a lateral FD mode is active, the FD pitch command bar is in view on the coupled PFD.

An easy way to change the pitch attitude is by using the PITCH wheel located on either the GC-810 flight guidance controller, or the remote one on the center pedestal. Use of the pitch wheel is inhibited in the modes of flight level change (FLC), vertical flight level change (VFLC), vertical path (VPTH), vertical altitude hold (VALT), and approach (APP) modes. It can be used when no FD vertical modes are active or in the altitude hold (ALT) mode; movement of the pitch wheel will cancel the ALT mode.

Pitch Hold Mode with Autopilot Not Engaged.

When a FD lateral mode with no active FD vertical mode is selected, the command bar will be displayed (assuming the single cue command bar is being used). This command represents the airplane pitch attitude when the FD lateral mode is selected. The reference can be changed by pushing the TCS button to synchronize the pitch command to the current aircraft attitude.

The pitch hold mode is automatically cancelled by selecting an FD vertical mode.

Roll Hold Mode

The roll hold mode can be engaged and the maneuvered bank angle held under the following conditions: (1) no lateral FD mode is selected, (2) the bank angle is greater than 6° but less than 45°, and (3) the touch control steering (TCS) was used to initiate the roll maneuver, with the autopilot engaged.

When the TCS button is released at bank angles greater than 45°, the autopilot will roll the airplane to a bank of 45° and maintain it. Any time the TCS button is used, the AP engage annunciation on the GC-810 flight guidance controller extinguishes and the PFD annunciates TCS. There is no roll hold annunciation.

Heading Select Mode

The heading select mode is used to intercept and maintain a selected heading. Selecting heading select mode resets all previously selected lateral modes. When the heading bug is set, the flight guidance computer (FGC) receives an error signal that amounts to the difference in the selected and current heading. The FGC then generates a roll command to intercept and maintain the selected heading.

To select the mode: (1) select the primary flight display (PFD) for display, by pressing the HSI SEL button on the GC-810 guidance controller (this also selects the same flight director side for guidance), (2) position the heading bug on the on-side HSI using the HDG knob on the respective RI-871 instrument remote controller, and (3) press the HDG button on the GC-810 flight guidance controller. The PFD will annunciate HDG in green and will display flight director steering commands to intercept and hold the selected heading.

Heading select mode can be cancelled by any of the following: (1) by pressing the HDG button on the GC-810 flight guidance controller, (2) by selecting go-around mode, (3) by the automatic capture of any other selected lateral mode, (4) by selecting symbol generator (SG) reversionary status (if it is on the active side), or (5) by coupling to the cross-side HSI with the flight guidance controller HSI SEL button.

VOR (NAV) Mode

The VOR mode uses the navigation source displayed on the coupled side PFD to intercept, capture, and track a selected VOR radial. To set up and capture a VOR radial using the VOR mode, accomplish the following: (1) press the HSI SEL button on the GC-810 guidance controller to select the desired side (< or >) for guidance, (2) select NAV 1 or NAV 2 by pressing the left or right NAV button on the on-side SC-840 source controller, (3) tune the NAV receiver to the correct VOR frequency, (4) set the desired course on the on-side RI-871 instrument remote controller and set the heading bug to intercept the course, and (5) press the NAV button on the GC-810 guidance controller to engage the mode. VOR armed and heading select modes will be automatically selected to intercept the beam; VOR will be annunciated in white and HDG in green on the PFD to indicate this.

When the course pointer on the PFD is set, a course select error signal is established which represents the difference between the present airplane heading and the desired course. This error signal is sent from the electronic flight instrument system (EFIS) to the flight guidance system (FGC) in the IC-800 integrated avionics computer (IAC). An intercept of 45° or less will result in a faster intercept; otherwise the system may make up to two heading changes to accomplish course intercept.

When the airplane reaches the lateral beam sensor trip point, heading select will be cancelled and the VOR radial will be captured. This is annunciated by the HDG message disappearing and the white VOR message changing to green, being asterisked, and flashing for five seconds. The flight guidance computer will roll the airplane onto the radial and track it to the station. As the airplane approaches the station it enters a zone of confusion, or unstable radio signals, caused by the shape of the radiated signal from the station. When the signals are sensed to be erratic an over station monitor system (OSS) removes the radio deviation from the roll command until the signal becomes stable again on the other side of the station. When the OSS system is controlling the roll function, the mode annunciation will be *VOR. After station passage there is an after over station sensor (AOSS) which commands the roll mode until a clear signal is received. During this time the annunciation is also *VOR.

Performing any of the following actions will cancel the VOR mode: (1) Pressing the NAV button on the GC-810 flight guidance controller, (2) selecting the heading select (HDG) mode, (3) changing NAV sources on the SC-840 source controller, (4) selecting go-around mode, (5) pressing the HSI SEL button to couple to the cross-side HSI, and (6) deselecting an SG reversionary selection.

VOR Approach Mode

The VOR approach mode uses the navigation source displayed on the coupled side PFD to intercept, capture, and track a selected VOR radial, when using the VOR for an instrument approach procedure. VOR APP mode is similar to the VOR mode above, except it changes selected gains in the flight guidance system to improve system performance in the approach mode. To set up and capture a VOR radial using the VOR approach (VOR APP) mode, accomplish the following: (1) press the HSI SEL button on the GC-810 guidance controller to select the desired side (< or >) for guidance, (2) select NAV 1 or NAV 2 by pressing the NAV button on the on-side SC-840 source controller (NAV 1, NAV 2, NAV 1 progression, etc.), (3) tune the NAV receiver to the correct VOR frequency, (4) set the desired course on the on-side RI-871 instrument remote controller and set the heading bug to intercept the course, (5) and press the APP button on the GC-810 guidance controller to engage the mode. VOR armed and heading select modes will be automatically selected to intercept the beam; VOR APP mode will be annunciated by a white VOR and HDG in green on the PFD to indicate this. The VOR annunciation will turn green when capture occurs. The minimum descent altitude (MDA) should be set on the bug on the PFD altitude tape, and the radio altitude bug may be set as desired.

The VOR APP mode can be cancelled by pressing the APP button on the GC-810 flight guidance controller, or by making any of the selections under VOR Mode above, which result in the cancelling of that mode.

Long Range Navigation

To fly the airplane guided by course(s) programmed into the flight management system (FMS), the following sequence is followed: (1) press the HSI SEL button on the GC-810 flight guidance controller (in order to select which flight director will follow the FMS guidance - the on-side PFD will display the commands), (2) press the FMS button on the SC-840 source controller, (3) verify that the FMS flight plan active leg is correct by displaying it on the MFD (use the MFD MAP button for ARC or Plan views), (3) set the heading bug to the proper intercept angle, and (4) press the NAV button on the GC-810 flight guidance panel to engage the mode. If the airplane position is outside the capture window when the NAV button is pressed, the PFD will display a white FMS annunciation, indicating that the FMS is armed; heading select mode will be automatically selected to accomplish course interception.

When the NAV button on the mode selector is pressed, LNAV is annunciated on the PFD. Depending on the position of the airplane in relation to the desired course, the FGS may first arm and then capture the long range nav mode (LNAV). Annunciation of LNAV in white on the PFD indicates the mode is armed, when the annunciation changes to green, it indicates that capture has occurred. Once capture has occurred the system will compute a desired track to intercept.

The LNAV mode is cancelled by any of the following actions: (1) pressing the NAV button on the GC-810 flight guidance controller, (2) selecting go-around mode, (3) selecting another navigation source on the SC-840 source controller, (4) selecting the heading select mode, (5) coupling to the cross-side HSI with the HSI SEL button, (6) deselecting an SG reversionary selection.

Localizer (NAV) Mode

The localizer mode will automatically intercept, capture, and track a front course localizer beam, lining up the airplane with the center line of the runway in preparation for landing.

To accomplish the automatic interception and tracking of the ILS localizer, accomplish the following: (1) press the HSI SEL button on the GC-810 flight guidance controller to couple the flight guidance computer to the desired side. An arrow (< >) will illuminate indicating which side has control. (2) Select NAV 1 or NAV 2 on the DC-840 source controller NAV button on the selected side, (3) tune the selected NAV receiver to the proper localizer frequency, (4) set the localizer in-bound course on the on-side PFD by rotating the course knob on the respective RI-871 instrument remote controller, (5) set the heading bug to the beam intercept angle, (6) set the radio altitude MDA and the barometric minimum descent altitude using the PFD RA/BARO button and the minimums knob, (7) press the NAV button on the GC-810 flight guidance controller to engage the mode. LOC armed and HDG select modes will be automatically selected if the beam deviation is outside the LOC capture range (which is approximately more than one dot deviation). The PFD will display LOC in white to indicate that the mode is armed; HDG in green will be indicated in the PFD until capture occurs. At capture the green HDG and white LOC will extinguish and a green LOC message will appear and flash for five seconds.

The localizer mode will be cancelled by any of the following actions: (1) pressing the NAV button on the GC-810 flight guidance controller, (2) selecting go-around mode, (3) selecting heading select mode, (4) selecting back course mode, (5) changing NAV sources, (6) deselecting an SG reversionary selection.

Back Course Mode

The back course mode will automatically intercept, capture, and track a back course localizer beam, lining up the airplane with the center line of the runway in preparation for landing.

To accomplish the automatic interception and tracking of the ILS localizer back course, accomplish the following: (1) press the HSI SEL button on the GC-810 flight guidance controller to couple the flight guidance computer to the desired side. An arrow (< >) will illuminate indicating which side has control. (2) Select NAV 1 or NAV 2 on the DC-840 source controller NAV button on the selected side, (3) tune the selected NAV receiver to the proper localizer frequency, (4) set the localizer in-bound course (that corresponds to the front course) on the on-side PFD by rotating the course knob on the respective RI-871 instrument remote controller, (5) set the heading bug to the beam intercept angle, (6) set the radio altitude MDA and the barometric minimum descent altitude using the PFD RA/BARO button and the minimums knob, (7) press the BC button on the GC-810 flight guidance controller to engage the mode. BC armed and HDG select modes will be automatically selected if the beam deviation is outside the capture range (which is more than approximately one dot deviation). The PFD will display BC in white to indicate that the back course mode is armed; HDG in green will be indicated in the PFD until capture occurs. At capture the green HDG and white BC will extinguish and a green BC message will appear and flash for five seconds.

When the back course mode is selected on the flight guidance controller, logic in the flight guidance system is established to internally reverse the polarity of the course error and localizer signals, and a gain is introduced to account for the fact that the localizer antenna is closer to the airplane by the length of the runway plus 1000 feet.

The back course mode will be cancelled by any of the following actions: (1) pressing the BC button on the GC-810 flight guidance controller, (2) selecting heading select or go-around mode, (3) selecting APP mode, (4) changing NAV sources, (5) deselecting an SG reversionary selection, (6) coupling to the cross-side HSI with the flight guidance controller HSI SEL button.

Preview and Transition

Preview is a feature that can be displayed after capture of FMS mode has been accomplished on the SC-840 source controller. Pressing the PRE button activates an additional white course deviation indicator in order to preview the position of the airplane in regard to a potential approach course. When the PRE button is pressed, activating the preview function, the flight guidance system will automatically transition to the previewed mode when the capture parameters are met. Procedures to preview and accomplish capture of the previewed mode are as follows: (1) verify the navigation source to be previewed is operative and press the PRE button, (2) set the applicable approach course into the EHSI with the RI-871 remote instrument controller, (3) press the APP button on the GC-810 flight guidance controller; the next steps will automatically occur in the following stages: (1) the PFD will annunciate the FD arm modes that apply to the previewed source, and transition will arm, (2) the FGS will track the FMS until the previewed source lateral deviation reaches its capture value, resulting in capture of the preview mode, (3) at capture the FGS will automatically replace the FMS with the previewed NAV source (VOR or ILS) and will capture and track the lateral signal, (4) the FGS will capture the ILS or MLS glideslope at its intercept point, and the approach will be completed in accordance with regular procedures for the particular approach.

If FMS VNAV (either vertical flight level change [VFLC] or vertical flight path [VPTH]) was in use before the transition capture, the FGC will transition to the pitch hold mode, and no vertical mode will be captured. If FMS VALT was being used before the transition capture, the FGC will transition to the ALT mode.

Instrument Landing System (ILS) Approach Mode

The ILS mode will automatically intercept, capture, and track a front course localizer beam and glideslope beam, lining up the airplane with the center line of the runway, on the glideslope, in preparation for landing. With this system the pilot can fly a fully coupled ILS approach to minimums. The glideslope will not capture until localizer capture has been effected.

To accomplish the automatic interception and tracking of the ILS localizer and glideslope, accomplish the following: (1) press the HSI SEL button on the GC-810 flight guidance controller to couple the flight guidance computer to the desired side. An arrow (< >) will illuminate indicating which side has control. (2) Select NAV 1 or NAV 2 on the SC-840 source controller NAV button on the selected side, (3) tune the selected NAV receiver to the proper localizer frequency, (4) set the localizer inbound course on the on-side PFD by rotating the course knob on the respective RI-871 instrument remote controller, (5) set the heading bug to the beam intercept angle, (6) set the radio altitude MDA and the barometric minimum descent altitude using the PFD RA/BARO button and the minimums knob, (7) press the APP button on the GC-810 flight guidance controller to engage the mode. LOC armed and HDG select modes will be automatically selected if the beam deviation is outside the LOC capture range (which is approximately more than one dot deviation). The PFD will display LOC in white to indicate that the mode is armed; HDG in green will be indicated in the PFD until capture occurs. At capture the green HDG and white LOC will extinguish and a green LOC message will appear and flash for five seconds. When the glideslope captures, any other vertical mode in use will be dropped, and GS will be annunciated in green (upon capture it will flash for five seconds).

The ILS approach mode will be cancelled by any of the following actions: (1) pressing the NAV or APP buttons on the GC-810 flight guidance controller, (2) selecting go-around mode, (3) selecting any other lateral or vertical mode on the GC-810 flight guidance controller, (4) changing NAV sources, (5) coupling to the cross-side HSI by pressing the HSI SEL button on the GC-810 flight guidance controller, (6) deselecting an SG reversionary selection.

Microwave Landing System (MLS) Approach Mode

An MLS approach is performed in a similar manner to an ILS approach. The MLS mode will automatically intercept, capture, and track the azimuth and glide path beams of a microwave landing system, lining up the airplane with the center line of the runway, on the glide path, in preparation for landing. With this system the pilot can fly a fully coupled MLS approach to minimums. The glide path will not capture until azimuth capture has been effected.

To accomplish the automatic interception and tracking of the MLS azimuth and glide path, accomplish the following: (1) tune the MLS receiver to the correct channel, (2) verify the correct inbound course on the MLS controller. The MLS receiver automatically slews the HSI course pointer or the pilot can set the course manually, (3) press the NAV button on the SC-840 source controller to select MLS for navigation, (4) verify that the PFD displays the correct course, (5) set the heading bug on the PFD to perform the intercept, (6) press the APP button on the GC-810 flight guidance controller to engage the mode. AZ/GP (azimuth/glide path) function will be armed and heading select mode is selected to accomplish interception if the airplane is outside the AZ capture parameters. The PFD will display AZ/GP armed by showing a white AZ and GP.

The MLS approach mode will be cancelled by any of the following actions: (1) pressing the NAV or APP buttons on the GC-810 flight guidance controller, (2) selecting go-around mode, (3) selecting any other lateral or vertical mode on the GC-810 flight guidance controller, (5) changing NAV sources, (6) coupling to the cross-side HSI by pressing the HSI SEL button on the GC-810 flight guidance controller, (7) deselecting an SG reversionary selection.

Azimuth must be captured before the glide path can be captured. With an MLS system, azimuth only approaches can be flown just as localizer only approaches can be flown on an ILS.

Dual Couple Approach Mode

When both NAV receivers are tuned to the same ILS approach frequency, the system uses the landing flight path information from both left and right PFDs. The dual phase uses fail-operational sensor performance with sensor redundancy management for the safety critical segment of the approach. This flight segment is initiated automatically by the system. To set up a dual coupled approach perform the following: (1) tune both receivers to the ILS frequency for the approach runway, (2) set the selected course on both PFDs. When both the localizer and the glideslope signals are on track, the radio altitude is below 1200 feet, and both NAV receivers are valid, the system transitions to the dual HSI mode of operation. When this mode is active, both HSI SEL arrows on the GC-810 flight guidance controller will automatically light. The HSI SEL button is inhibited in dual channel operation.

In dual channel operation, both flight guidance computers use information from both NAV receivers so the approach can continue in the event of failure of one receiver. In dual channel mode, both flight guidance computers use averaged ILS data to perform the same computations, thereby sending identical flight director commands to their respective PFD sides. In case of a receiver failure, the arrow associated with that receiver side will extinguish, and the approach mode will remain active on the remaining receiver.

Automatic cancellation can occur whenever invalid data from one ILS receiver is detected: the flight guidance system will select the remaining side ILS data for guidance. Automatic cancellation also occurs whenever an unflagged ILS data mismatch occurs. The flight guidance system then performs an automatic sensor voting and selection. In both of the above cases the system automatically reverts to single HSI SEL on the side voted by the flight guidance computer.

If the dual channel mode of operation is cancelled manually, the flight director will couple to the side to which it was coupled before the dual channel operation was initiated.

Vertical Speed Hold Mode

The vertical speed hold mode maintains the airplane at a pilot selected vertical speed. The mode is initiated by the following procedures: (1) maneuver the airplane, manually or with autopilot, to the desired climb or descent attitude, (2) establish the vertical speed reference, and engage the mode by pressing the VS button on the GC-810 flight guidance controller. The reference can be changed at any time by using the remotely mounted pitch wheel on the pedestal or the one on the GC-810. A change can also be made by pressing and holding the touch control steering (TCS) button on either control wheel. Press the button, hold it, maneuver the airplane to a new vertical speed reference, and release the button.

When the VS mode is engaged, the annunciations in the PFD will be as follows: VS will be shown in green and the vertical speed target value will be seen in a blue box above the vertical speed scale, in feet per minute.

When the reference vertical speed is changed by either the pitch wheel or the TCS button, the vertical speed reference bug will be repositioned and the boxed target value will be changed.

The VS mode can be cancelled by any of the following: (1) pressing the VS button, (2) selecting any other vertical mode, (3) selecting go-around or standby (STBY), (4) coupling to the cross-side HSI by pressing the HSI SEL button.

The airplane will not exceed the maximum allowable airspeed in the vertical speed mode. If given a vertical speed that will result in exceeding the maximum allowable airspeed or Mach, the flight guidance computer will maneuver the airplane to remain with the allowable maximum speed and MAX SPD will be annunciated in amber in the upper left corner of the PFD.

Flight Level Change Mode

The flight level change mode (FLC) is engaged by pressing the FLC button on the GC-810 flight guidance controller. Pressing FLC overrides all other active pitch flight director modes except VNAV. When VNAV is engaged, pressing the FLC button selects the VNAV submode VFLC. The IAS/Mach indicated when FLC is engaged becomes the IAS/Mach reference. The reference can be changed by using either pitch wheel to establish a new reference. The system will fly either airspeed reference or Mach reference, as it is controlled on the C/O button on the GC-810 flight guidance controller. Switching from IAS to Mach, or vice versa, does not change the reference but changes the nature of the digital readout on the PFD. Switching references will not change the attitude of the airplane.

The FLC mode is basically an airspeed mode, however, it differs from a regular IAS or Mach mode in the following ways: (1) vertical speed excursions are minimized due to air disturbances or large airspeed changes, since the mode primarily tracks airspeed with only short term emphasis on vertical speed. Actual airspeed can temporarily vary from the target airspeed by up to 20 knots.

The FLC mode attempts to change the flight level, at the selected airspeed, from the present altitude to the preselected altitude. The mode therefore tries to prevent the airplane from flying away from the preselected altitude target. In FLC mode, if the throttle is retarded during a climb, for instance, the system will try to maintain a positive vertical speed and will opt to decelerate rather than descend, even after the vertical speed reaches zero.

The pilot can maneuver the airplane while the mode is engaged, as with the other modes, by pressing and holding the TCS button and maneuvering the airplane and releasing the button. The airspeed target will be the speed at the time the button is released. The FLC mode is annunciated by a green FLC on the PFD.

To climb the airplane from present altitude to a preselected altitude, follow this procedure: (1) use the altitude preset knob on the remote instrument controller to set the alert altitude higher than the current altitude, (2) press the FLC button on the GC-810 flight guidance controller; the airspeed current when FLC is pressed will be the target airspeed, (3) advance the throttles to establish climb power. The system will climb the airplane to the preselected altitude, and will maintain the speed reference. The amount of throttle applied will vary the rate of climb achieved. The capture of any armed pitch mode will override the selected FLC mode.

The C/O button on the GC-810 flight guidance controller can override the reference which was selected when the FLC mode was engaged, i.e., pressing the button will change the reference to Mach from IAS and vice versa. In a climb, the FLC reference automatically switches from IAS to Mach when actual Mach exceeds 0.70 M. In a normal descent, the FLC automatically switches from Mach to IAS when the actual IAS exceeds 300 knots.

At FLC engagement above an altitude of 34,275 feet a Mach target airspeed will be selected; below that altitude an IAS reference will be selected.

The flight guidance cannot fly to an airspeed reference outside the normal airplane flight envelope. The system will limit the commanded airspeed to the maximum speed of the airplane (V_{MO} /M_{MO}). This fact is annunciated by an amber MAX SPD in the upper left corner of the PFD.

The target speed range of the system on the Citation X is from 80 knots to 340 knots IAS, or 0.40 to 0.85 Mach.

The FLC mode can be cancelled by any one of the following conditions: (1) pressing the FLC button on the GC-810 flight guidance controller, (2) by the system capturing any other armed pitch mode, or selecting any other vertical mode, (3) selecting go-around mode, or by (4) coupling to the cross-side HSI.

Altitude Preselect Mode

The altitude preselect mode (ASEL) is used in conjunction with another vertical mode to automatically capture, level off, and hold an altitude set with the altitude select knob on the copilot's RI-871 instrument remote controller. The mode will be displayed on each PFD. The mode selected to fly to the new altitude will control the airplane to the point where the altitude preselect mode captures and levels the airplane on the preselected altitude. To make an altitude change by using the altitude preselect mode accomplish the following steps: (1) set the altitude in the PFD's altitude preselect window using the altitude select knob on the copilot's instrument remote controller, (2) adjust the throttle to initiate a climb or descent to the preselected altitude, (3) engage another vertical mode (i.e., VS or FLC) on the GC-810 flight guidance controller; altitude preselect (ASEL) will arm and be annunciated in white on the PFDs and the mode selected to effect the altitude change will capture and be annunciated in green. The selected altitude will capture, the other mode will cancel, and the airplane will be leveled. When the ASEL mode has captured, the altitude error is less than 25 feet, and the altitude rate is less than 5 feet-per-second the system will switch to altitude hold. ALT will be annunciated in green.

It is possible to engage the ASEL mode late if the airplane is still within 250 feet of the selected altitude. If the airplane has gone through the selected altitude and is still within 250 feet of it and the ASEL mode is engaged, the mode will capture immediately and the airplane will level off on the altitude.

Altitude Hold

The altitude hold mode is a vertical mode. When engaged, the flight director uses the vertical axis to maintain a barometric altitude. Pressing the ALT button on the GC-810 flight guidance controller selects the altitude hold mode; it is annunciated by a green ALT in the PFD display. The reference altitude can be changed by pressing the TCS button on either control wheel, maneuvering the airplane to a new altitude, and releasing the TCS button. The altitude at the release of the button will be the new reference altitude. Selecting the altitude hold (ALT) mode cancels any other vertical mode.

Altitude hold can be canceled by any of the following actions: (1) moving the pitch wheel, either on the GC-810 or on the pedestal, (2) pushing the ALT button on the GC-810 flight guidance controller, (3) selecting any other vertical mode, (4) selecting go-around mode, (5) coupling to the cross-side HSI.

Vertical Navigation Mode

The vertical navigation (VNAV) mode is selected by pressing the VNAV button on the GC-810 flight guidance controller. This overrides all other flight director pitch modes. In the VNAV mode the flight guidance system will track the vertical flight profile of the flight management system (FMS). An altitude set into the altitude select window of the PFDs has precedence in case of an altitude conflict in the FMS selected altitude and the PFD selected altitude. The flight management system will not cause the flight guidance system to pass any altitude which has been set into the altitude window (in the upper right side of the PFDs), by the altitude select knob on the copilot's RI-851 remote instrument controller.

Vertical flight level change (VFLC), vertical altitude select (VASEL), vertical altitude hold (VALT), and vertical path (VPTH) modes are possible submodes that can be used with the VNAV mode. The vertical navigation mode and the submodes are all modes which are used in conjunction with the flight management system.

Vertical Flight Level Change (VFLC)

VFLC operates the same way as FLC mode except that the target speed and altitude from the FMS flight plan are used for climb or descent. VFLC engages if VALT is engaged, the target altitude is more than 150 feet from the airplane's current altitude, and the FMS initiates a climb or descent. A third method of using VFLC mode is when VALT or VPTH arm is engaged and the FLC button on the GC-810 flight guidance controller is pressed. The mode is annunciated on the PFD by a green VFLC.

Vertical Altitude Select (VASEL)

VASEL operates the same way as ALT SEL. ALT SEL arms when either VFLC or VPTH is engaged. When the mode captures, VASEL is annunciated in green on the PFDs.

Vertical Altitude Hold (VALT)

VALT operates the same was as ALT. VALT engages automatically after VASEL captures the target altitude. VALT also engages whenever the VNAV button on the GC-810 flight guidance controller is pressed and the airplane is within 250 feet of the FMS selected target altitude. The FMS ALT mode is annunciated on the PFD with a green VALT.

Vertical Path Mode

VPTH mode is used to fly a fixed flight path angle to a vertical waypoint during a descent. The VPTH mode engages whenever the FMS initiates a path descent which can occur while in VFLC or VALT modes. When the mode captures, a green VPTH is displayed on the PFD.

To select the VPTH mode: (1) use the FMS CD-810 control display unit (CDU) to enter the altitude required at the waypoint, and (2) use the CD-810 to enter an angle of descent if a particular flight path angle is required.

For a complete description of VNAV operation, refer to Honeywell FMZ-Series Flight Management System Operating Manual, Publication No. A28-1146-43.

Emergency Descent Mode

The emergency descent mode (EDM) is automatically used by the flight guidance system to automatically descend the airplane in the event of loss of cabin pressurization. The following conditions are required for this mode to engage: (1) the autopilot must be engaged, (2) the cabin altitude must exceed 13,500 feet and airplane pressure altitude must be at or above 34,500 feet. When the mode is engaged, the following events occur: (1) all flight director modes are cancelled and inhibited, (2) ALT preselect is automatically set to 15,000 feet, (3) HDG bug is automatically set to 90° left of the existing heading, (4) the airplane enters a 30° bank for approximately 90° of turn and then rolls wings level, and (5) the airspeed target continuously synchronizes to V_{MO}.

The pilot must adjust the power to idle and set the speed brakes, or the descent rate will be reduced. Once the airplane levels at 15,000 feet, the system remains in emergency descent mode until the autopilot is disengaged. Once the autopilot is disengaged, normal flight director and autopilot operation can be resumed.

Go-Around Mode (Wings Level)

The purpose of the go-around mode is to transition from a approach condition to a climb out after a missed approach. The pilot selects go-around mode by pressing the GA button located on either outboard throttle handle. All flight director modes will be cancelled and the autopilot will disengage. A wings level command and a thirteen degree climb angle will be displayed on the PFD.

The go-around mode is cancelled by any of the following actions: (1) selecting another pitch mode, (2) pressing the TCS button, and (3) engaging the autopilot.

Takeoff Mode

Takeoff mode is initiated only on the ground. It operates the same as the go-around (GA) mode. The PFD mode annunciation for this mode is a green TO. If the go-around (GA) button is pressed before rotation at takeoff, the flight director command bars will command a 13° nose up wings level attitude. The mode is cancelled as in Go-Around Mode, above.

guidance controller, (3) selecting any other vertical mode, (4) selecting go-around mode, (5) coupling to the cross-side HSI.

Vertical Navigation Mode

The vertical navigation (VNAV) mode is selected by pressing the VNAV button on the GC-810 flight guidance controller. This overrides all other flight director pitch modes. In the VNAV mode the flight guidance system will track the vertical flight profile of the flight management system (FMS). An altitude set into the altitude select window of the PFDs has precedence in case of an altitude conflict in the FMS selected altitude and the PFD selected altitude. The flight management system will not cause the flight guidance system to pass any altitude which has been set into the altitude window (in the upper right side of the PFDs), by the altitude select knob on the copilot's RI-851 remote instrument controller.

Vertical flight level change (VFLC), vertical altitude select (VASEL), vertical altitude hold (VALT), and vertical path (VPTH) modes are possible submodes that can be used with the VNAV mode. The vertical navigation mode and the submodes are all modes which are used in conjunction with the flight management system.

Vertical Flight Level Change (VFLC)

VFLC operates the same way as FLC mode except that the target speed and altitude from the FMS flight plan are used for climb or descent. VFLC engages if VALT is engaged, the target altitude is more than 150 feet from the airplane's current altitude, and the FMS initiates a climb or descent. A third method of using VFLC mode is when VALT or VPTH arm is engaged and the FLC button on the GC-810 flight guidance controller is pressed. The mode is annunciated on the PFD by a green VFLC.

Vertical Altitude Select (VASEL)

VASEL operates the same way as ALT SEL. ALT SEL arms when either VFLC or VPTH is engaged. When the mode captures, VASEL is annunciated in green on the PFDs.

Vertical Altitude Hold (VALT)

VALT operates the same was as ALT. VALT engages automatically after VASEL captures the target altitude. VALT also engages whenever the VNAV button on the GC-810 flight guidance controller is pressed and the airplane is within 250 feet of the FMS selected target altitude. The FMS ALT mode is annunciated on the PFD with a green VALT.

Vertical Path Mode

VPTH mode is used to fly a fixed flight path angle to a vertical waypoint during a descent. The VPTH mode engages whenever the FMS initiates a path descent which can occur while in VFLC or VALT modes. When the mode captures, a green VPTH is displayed on the PFD.

To select the VPTH mode: (1) use the FMS CD-810 control display unit (CDU) to enter the altitude required at the waypoint, and (2) use the CD-810 to enter an angle of descent if a particular flight path angle is required.

For a complete description of VNAV operation, refer to Honeywell FMZ-Series Flight Management System Operating Manual, Publication No. A28-1146-43.

Emergency Descent Mode

The emergency descent mode (EDM) is automatically used by the flight guidance system to automatically descend the airplane in the event of loss of cabin pressurization. The following conditions are required for this mode to engage: (1) the autopilot must be engaged, (2) the cabin altitude must exceed 13,500 feet and airplane pressure altitude must be at or above 34,500 feet. When the mode is engaged, the following events occur: (1) all flight director modes are cancelled and inhibited, (2) ALT preselect is automatically set to 15,000 feet, (3) HDG bug is automatically set to 90° left of the existing heading, (4) the airplane enters a 30° bank for approximately 90° of turn and then rolls wings level, and (5) the airspeed target continuously synchronizes to V_{MO}.

The pilot must adjust the power to idle and set the speed brakes, or the descent rate will be reduced. Once the airplane levels at 15,000 feet, the system remains in emergency descent mode until the autopilot is disengaged. Once the autopilot is disengaged, normal flight director and autopilot operation can be resumed.

Go-Around Mode (Wings Level)

The purpose of the go-around mode is to transition from a approach condition to a climb out after a missed approach. The pilot selects go-around mode by pressing the GA button located on either outboard throttle handle. All flight director modes will be cancelled and the autopilot will disengage. A wings level command and a ten degree climb angle will be displayed on the PFD.

The go-around mode is cancelled by any of the following actions: (1) selecting another pitch mode, (2) pressing the TCS button, and (3) engaging the autopilot.

Takeoff Mode

Takeoff mode is initiated only on the ground. It operates the same as the go-around (GA) mode. The PFD mode annunciation for this mode is a green TO. If the go-around (GA) button is pressed before rotation at takeoff, the flight director command bars will command a 10° nose up wings level attitude. The mode is cancelled as in Go-Around Mode, above.

SYSTEM LIMITS

The following table lists the roll, pitch, course intercept, and track limits of the Primus 2000 Flight Control System.

MODE	CONTROL OR SENSOR	PARAMETER	VALUE
AP ENGAGE	-	Engage Limit	Roll: Up to ±45° Pitch: Up to ±20°
BASIC AUTOPILOT	TCS	Roll Control Limit Pitch Control Limit	Roll: Up to ±45° Pitch: Up to ±20°
	Pitch Wheel	Pitch Angle Limit Pitch "G" Command Limit	Pitch: ±20° Preset
HEADING SELECT	Heading SEL Knob	Roll Angle Limit	±27° ±17° Low Bank switched on GC-810 Flt. Guidance Controller
		Roll Rate Limit	4° per second
VOR, VOR APP, LNAV	Course Knob and NAV Receiver	**<u>Capture:</u>** Beam Intercept Angle (HDG SEL)	Up to ±90°
		Capture Point	Function of beam, beam closure rate, and course error. Min. trip point ±20 mV DC; max. trip point ±180 mV DC
		Roll Angle Limit	±27° VOR, VOR APP ±30° LNAV
		Roll Rate Limit	7.0°/sec VOR APP 4.0°/sec VOR 5.5°/sec LNAV
		Course Cut Limit at Capture	±45° course
		<u>Track:</u> Roll Angle Limit Roll Rate Limit	±27° 4.0°/sec VOR APP 4.0°/sec VOR
		Crosswind Correction	Up to ±17° course error
		<u>Over Station</u> Course Change	Up to 90° VOR ±30° (VOR APP)
		Roll Angle Limit	±27°

Table 3-1 (Sheet 1 of 3)

Table 3-1 (Continued)

MODE	CONTROL OR SENSOR	PARAMETER	VALUE
APP (LOC or AZ) or BC	Course Knob and NAV Receiver	**Lateral Capture**: Beam Intercept Roll Angle Limit Roll Rate Limit Capture Point	 Up to ±90° ±30° ±7°/second Function of beam rate and course error Max. trip point is 180 mA for LOC and 230 mA for AZ. Min. trip point is 35 mA.
		Lateral Track: Roll Angle Limit Roll Rate Limit Crosswind Correction Limit Gain Programming	 ±27° of roll ±5.5°/second ±45° of course error Starts at 1500 feet radio altitude or 17 NM DME (MLS)
	GS or GP Receiver and Air Data Computer	**GS or GP Capture:** Beam Capture Pitch Command Limit Pitch Rate Limit Gain Programming	 Variable with intercept +10° to -15° 2.0°/sec (minimum) Starts at 1500 feet radio altitude or 6 NM DME (MLS)
GO AROUND (GA)	Control Switches on Throttles (Disengage A/P)	Fixed Flight Director Pitch Up Command: Wings Level in Roll	10° nose up
PITCH HOLD	TCS Switch depressed	Pitch Attitude Command	±20° Maximum
ALT HOLD	Air Data Computer	Alt Hold Engage Range Altitude Hold Engage Error Pitch Limit Pitch Rate Limit	0 to 65,536 feet ±20 feet ±20° Preset
VS HOLD	Air Data Computer	VERT Speed Engage VERT Speed Hold Engage Error Pitch limit Pitch Rate Limit	0 to +6000 ft/min to -8000 ft/min. +30 ft/min ±20° $\frac{300}{TAS}$ (±2°/sec max)

Table 3-1 (Sheet 2 of 3)

SYSTEM LIMITS

The following table lists the roll, pitch, course intercept, and track limits of the Primus 2000 Flight Control System.

MODE	CONTROL OR SENSOR	PARAMETER	VALUE
AP ENGAGE	-	Engage Limit	Roll: Up to ±45° Pitch: Up to ±20°
BASIC AUTOPILOT	TCS	Roll Control Limit Pitch Control Limit	Roll: Up to ±45° Pitch: Up to ±20°
	Pitch Wheel	Pitch Angle Limit Pitch "G" Command Limit	Pitch: ±20° Preset
HEADING SELECT	Heading SEL Knob	Roll Angle Limit	±27° ±17° Low Bank switched on GC-810 Flt. Guidance Controller
		Roll Rate Limit	4° per second
VOR, VOR APP, LNAV	Course Knob and NAV Receiver	**<u>Capture:</u>** Beam Intercept Angle (HDG SEL)	Up to ±90°
		Capture Point	Function of beam, beam closure rate, and course error. Min. trip point ±20 mV DC; max. trip point ±180 mV DC
		Roll Angle Limit	±27° VOR, VOR APP ±30° LNAV
		Roll Rate Limit	7.0°/sec VOR APP 4.0°/sec VOR 5.5°/sec LNAV
		Course Cut Limit at Capture	±45° course
		<u>Track:</u> Roll Angle Limit Roll Rate Limit	±27° 4.0°/sec VOR APP 4.0°/sec VOR
		Crosswind Correction	Up to ±17° course error
		<u>Over Station</u> Course Change	Up to 90° VOR ±30° (VOR APP)
		Roll Angle Limit	±27°

Table 3-1 (Sheet 1 of 3)

Table 3-1 (Continued)

MODE	CONTROL OR SENSOR	PARAMETER	VALUE
APP (LOC or AZ) or BC	Course Knob and NAV Receiver GS or GP Receiver and Air Data Computer	**Lateral Capture**: Beam Intercept Roll Angle Limit Roll Rate Limit Capture Point **Lateral Track:** Roll Angle Limit Roll Rate Limit Crosswind Correction Limit Gain Programming **GS or GP Capture:** Beam Capture Pitch Command Limit Pitch Rate Limit Gain Programming	Up to ±90° ±30° ±7°/second Function of beam rate and course error Max. trip point is 180 mA for LOC and 230 mA for AZ. Min. trip point is 35 mA. ±27° of roll ±5.5°/second ±45° of course error Starts at 1500 feet radio altitude or 17 NM DME (MLS) Variable with intercept +10° to -15° 2.0°/sec (minimum) Starts at 1500 feet radio altitude or 6 NM DME (MLS)
GO AROUND (GA)	Control Switches on Throttles (Disengage A/P)	Fixed Flight Director Pitch Up Command: Wings Level in Roll	13.0° nose up
PITCH HOLD	TCS Switch depressed	Pitch Attitude Command	±20° Maximum
ALT HOLD	Air Data Computer	Alt Hold Engage Range Altitude Hold Engage Error Pitch Limit Pitch Rate Limit	0 to 65,536 feet ±20 feet ±20° Preset
VS HOLD	Air Data Computer	VERT Speed Engage VERT Speed Hold Engage Error Pitch limit Pitch Rate Limit	0 to +6000 ft/min to -8000 ft/min. +30 ft/min ±20° $\frac{300}{TAS}$ (±2°/sec max)

Table 3-1 (Sheet 2 of 3)

Table 3-1 (Continued)

MODE	CONTROL OR SENSOR	PARAMETER	VALUE
FLC	Air Data Computer	Engage Range Pitch Limit Pitch Rate Limit	80 to 350 knots and 0.4 to 0.85 Mach ±20° 2.0°/sec (minimum)
VFLC	FMS	Mach Engage Range Mach Hold Error Pitch Limit Pitch Rate Limit IAS Engage range IAS Hold Engage error	0.4 to 0.8 Mach ±0.01 Mach ±20 0.3 G maximum 80 to 335 knots ±5 knot
VPTH	FMS	Altitude Range Angle Range Bias Range Pitch Limit Pitch Rate Limit	0 to 60,000 feet 0° to -6° (FMS waypoint) ±20° 0.3 G maximum
ALT PRESELECT	Air Data Computer and Instrument Remote controller	Preselect Capture Range Maximum Vertical Speed for Capture Capture Maneuver Damping Pitch Limit Pitch Rate Limit Limiter Synchronized at Bracket Maximum Altitude Capture Error	0 to 65,536 feet ±16,384 ft/min Complemented VERT acceleration ±20° Preset ±25 feet

Table 3-1 (Sheet 3 of 3)

ELECTRONIC FLIGHT INSTRUMENT SYSTEM (EFIS)

The Electronic Display System (EDS) and the Electronic Flight Instrument System (EFIS) are both parts of the comprehensive Primus 2000 Integrated Avionics System (IAS). The EFIS is the part of the integrated system that displays flight altitude, airspeed, vertical speed, airplane attitude, heading, course orientation, flightpath commands, weather and mapping presentations, as well as system source annunciations. The Electronic Flight Instrument System is a sister subsystem of the Electronic Display System in the Primus 2000 Integrated Avionics and Flight Control System, therefore, many of the system controllers and switches have been covered under the discussion of the Electronic Display System, above. Those controls having a more direct bearing on flight guidance have been discussed under Flight Guidance, also above, as have the primary flight displays (PFDs), which were covered only where required for the interface discussion of the various controllers. The remaining units of the display system, which bear on the subjects of airplane attitude, heading, and display and control, (i.e., flight instrument system) are discussed here. This includes the RC-840 reversionary and dimming controllers, the primary flight displays (PFDs) (in more detail), the multifunction displays (MFDs), the BL-870 bezel controllers, the BL-871 bezel controllers, and the display system symbol generators. The electronic presentation of the airspeed indicators, altimeters, and vertical speed indicators are covered under Instrumentation, at the beginning of this section, following the discussion of the pitot/static system.

BL-870 PRIMARY FLIGHT DISPLAY (PFD) BEZEL CONTROLLER

The PFD bezel controller, which is mounted below the PFD, has two push buttons and two knobs. The RA/BARO push button is used to select control of radio altitude (RA), or barometric altitude (BARO) for display on the PFD. If RA is selected, the MINIMUMS knob will control the cyan digital radio altitude display at the lower left of the PFD altitude display. A radio altitude for minimum descent reference, or other warning altitude, may be set as desired. If BARO is selected, the MINIMUMS knob controls a cyan bug which can be set along the barometric altitude display; it may be used to set minimum descent altitude, decision height, or other altitude as desired. When the altitude bug is set, a digital readout of the selected altitude is presented in the same place as the radar altitude selection, above, is shown; both BARO and RA selections are not possible at the same time. As the airplane descends the altitude bug will come closer to the center readout line of the altitude presentation. The altitude bug works only in conjunction with the barometric altitude selection.

The MINIMUMS knob may be used to set height values between 20 to 2500 feet R, or barometric MDA or DH altitudes between 20 to 16,000 feet. Clockwise rotation increases the value and counterclockwise rotation decreases the value. The power-up default value is a radio altitude of 200 feet. When the display controller fails, the DH/MDA select becomes inoperative and the RA/BARO display will blank.

The BARO SET knob is used to select the barometric altimeter setting in either inches of mercury (inHG) or in hectopascals (HP). Clockwise rotation increases the value and counterclockwise rotation decreases the value. Selecting the barometric altimeter correction in either inHG or HP is a function that is selected from the PFD setup menu which is controlled by the BL-871 MFD bezel controller, discussed below. The BARO set function of the PFDs is independent of the display controller (DC) and the barometric value can be set even if the DC does not work. However, when cross-side digital air data computer (DADC) is being displayed on the PFD, the pilots will not have control over the displayed BARO setting from their own display controller (DC).

A conventional inclinometer is attached to the center of the bezel controller.

Pressing the standard (STD) button on the bezel sets the barometric altimeter setting to the standard value of 29.92 HG or 1013 HP.

BL-870 PFD BEZEL CONTROLLER

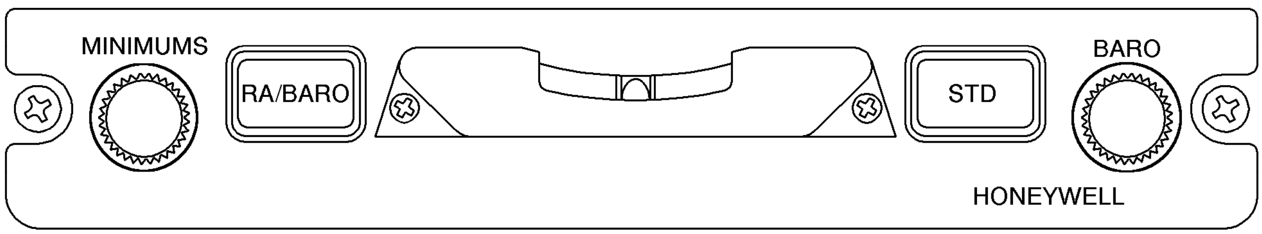

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Figure 3-24

BL-871 MULTIFUNCTION DISPLAY (MFD) BEZEL CONTROLLER

The MFD bezel controller has one rotary control knob and six push buttons. The knob is used to control the range of the map or plan display in preset increments. Some of the menu select buttons can be used to change the knob function so it can set flight parameters. When weather is selected for display, the WC-870 weather radar controller is used to set the range. There are two main menus, and several submenus, available for selections of functions on the multifunction displays (MFD), and some for the primary flight displays (PFDs). The arrow push button(<) always selects one of the two main menus, in rotation. Upon power up MAIN MENU 1 is displayed.

BL-871 MFD BEZEL CONTROLLER

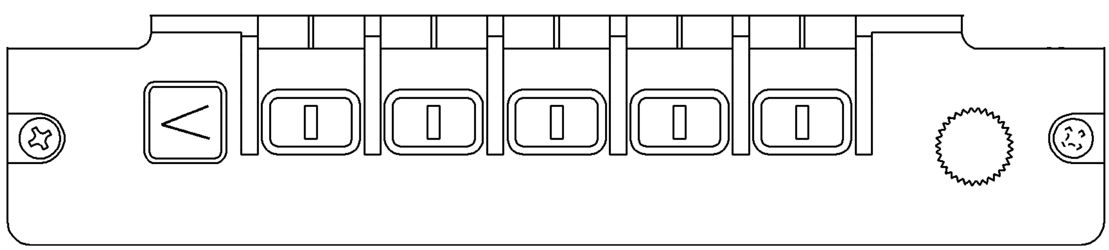

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Figure 3-25

When a PFD is selected in the reversionary mode, the menu item keys on the selected PFD will be inoperative. When the EICAS is selected in reversionary mode the reversionary MFD displays EICAS data and the MFD bezel controller controls the EICAS menu.

ELECTRONIC FLIGHT INSTRUMENT SYSTEM BLOCK DIAGRAM

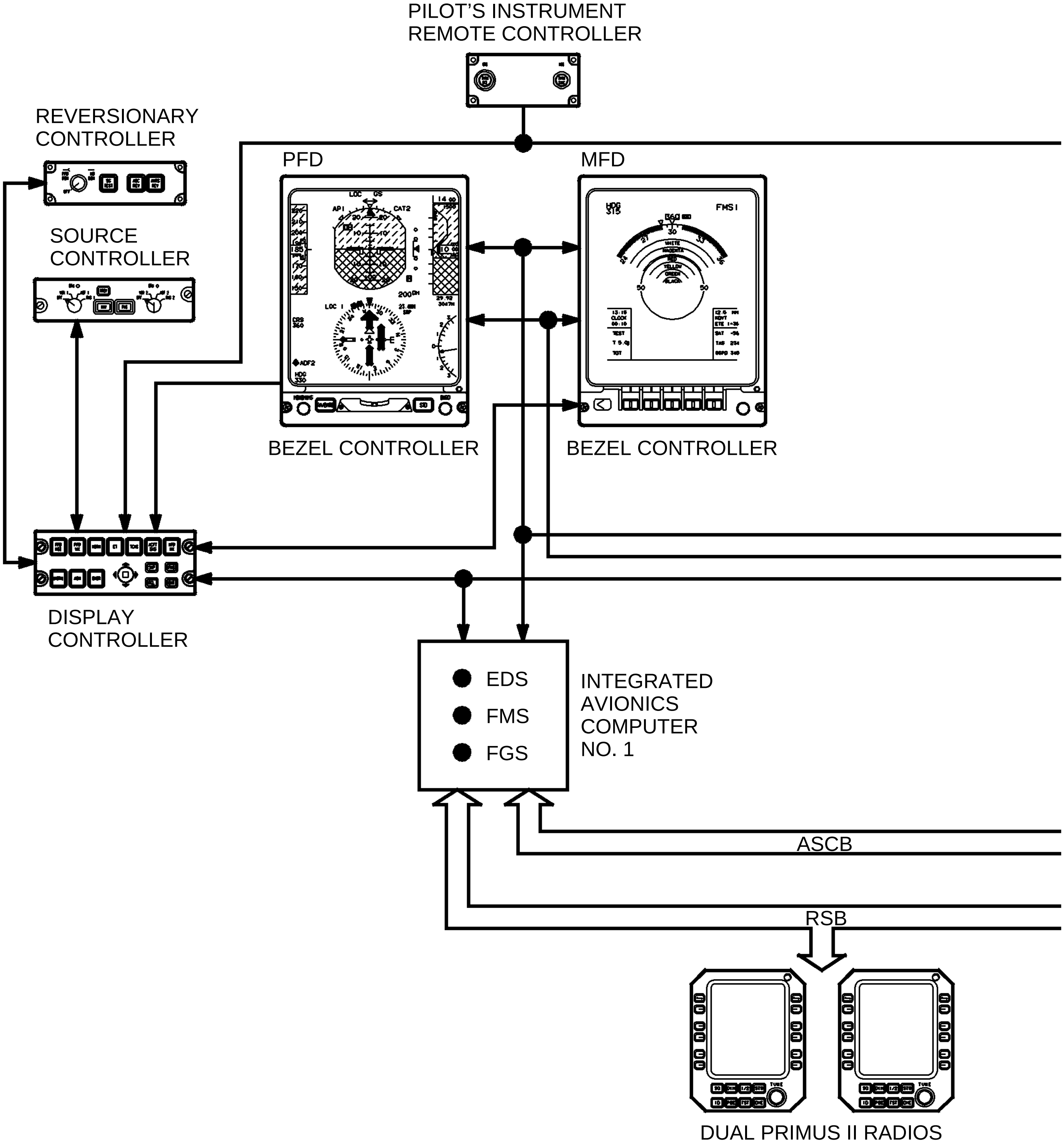

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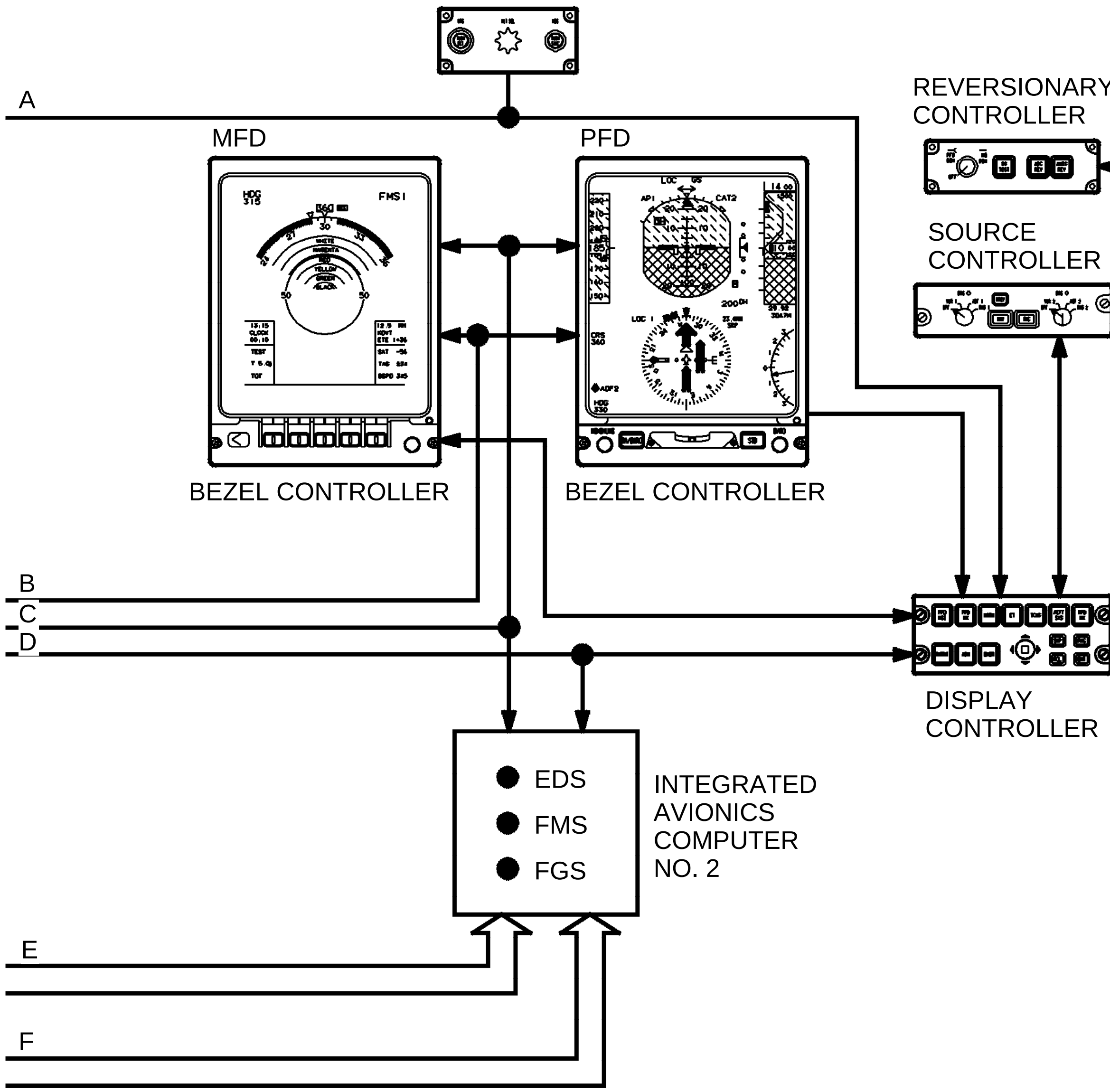
Figure 3-26 (Sheet 1 of 2)

ELECTRONIC FLIGHT INSTRUMENT SYSTEM BLOCK DIAGRAM



ASCB - AVIONICS STANDARD COMMUNICATIONS BUS
RSB - RADIO SYSTEMS BUS
EDS - ELECTRONIC DISPLAY SYSTEM
FMS - FLIGHT MANAGEMENT SYSTEM
FGS - FLIGHT GUIDANCE SYSTEM
PFD - PRIMARY FLIGHT DISPLAY
MFD - MULTIFUNCTION DISPLAY

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Figure 3-26 (Sheet 2 of 2)

MFD Main 1/2 Menu

Procedures for operating the main 1/2 menu are described below. Operation may at first seem complex, but with practice operation becomes easy, because the menu prompts easily lead the operator to the desired control level. More detailed operating instructions, with illustrations, are found in the Primus 2000 Integrated Avionics Flight Control System for the Citation X Pilot's Manual, Pub. No. A28-1146-104-00, which must be available to the flight crew when operating the Primus 2000 system.

The left button (<) on the bezel is used to select Main Menus 1/2 and 2/2, in rotation. Once a submenu is selected, the same button becomes the button (RTN) which returns the operator to the main menu. The default main menu is Main Menu 1/2 which is automatically selected at power-up. The selections on this menu are PFD SETUP, MFD SETUP, ET SET/FT TIMER, EICAS SYS, And V SPEEDS. Selection of any of these items results in the appearance of a submenu. An explanation of the menu and submenu selections follows:

PFD SETUP - Submenu items are: FMD CUE, BARO, and METRIC ALT.

FMD CUE - The flight director command cue can be cycled on and off, and the selection between single cue and cross pointer can be made. A box will enclose the selections made.
BARO - Pressing the key identified BARO toggles between barometric altimeter settings and hectopascals. A box in the display will enclose the selection made.
METRIC ALT - Pressing this menu key toggles between selecting and deselecting the metric altitude presentation. A box around the selection indicates metric altitude is selected. When METRIC ALT is selected, the indication is a green digital presentation of metric altitude located just below the regular altitude display.

MFD SETUP - Submenu items are:

VORS, APTS, TRAFF, V PROF, and WIND XY VEC.
VORS - Selects VOR stations to be displayed on the multifunction display. Up to 10 VORs can be shown.
APTS - Selects airports for display on the multifunction display; up to 9 airports can be shown.

TRAFF - Selects traffic and collision avoidance system (TCAS) for display on the multifunction display (MFD). Control of TCAS modes is by radio management unit (RMU) or radio tuning unit (RTU), depending upon installation.
V PROF (Vertical Profile) - Toggles between selecting (Boxed) and deselecting (unboxed) vertical profile for display on the MFD.
WIND - Toggles between XY (wind components) display and VEC (single wind vector) display on the MFD. This button is inactive in the PLAN mode, which always displays the XY wind components.

ET SET/ FT TIMER - Sets up the clock for elapsed time countdown.

Pressing the button changes identification of the left most button to ET and the next one to it to FIGHT TIMER. To select ET, press the ET button; the initial value of ET is zeros (no time set); and the dashes are boxed in cyan. The label ET will appear above the rotary knob. Rotate the knob clockwise to increase the ET value, and counterclockwise to decrease the value. When the desired ET is set, press the menu button below ET SET. The ET SET title and the data will be boxed. When the button is pressed, the ET value will be displayed on the MFD and the ET SET plus

MULTIFUNCTIONAL DISPLAY (TYPICAL)

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Figure 3-27

The countdown will start and when it gets to zero the color will change to a amber and it will continue to count; from zero, however, it will count upwards and the display will flash, indicating that the time has expired. If the clock already contained a value and a new ET was set, the new value replaces the old one. Timing from zero upwards can be started by simply pressing the ET button on the DC-840 display controller. Progression is: one press; timing starts, second press; timing stops, third press; time zeros. Another press restarts it to repeat the process. FLIGHT TIMER selects elapsed time from the time the landing gear squat switches indicate in flight condition until they compress again upon landing.

EICAS SYS - Submenu items are: FUEL HYD, ELEC, APU, and ENG. When the applicable button is pressed the selection is boxed and the selected parameter is presented on the EICAS display. Pressing RTN (<) returns to the MENU 1/2. The RNG over the rotary knob indicates that the range can be adjusted on the MFD display. (These menu items are separate from selections, which can be made on the center EICAS display. Except for the APU selection, they are mostly identical to the EICAS display items, however, they select the window display on the MFD only.)

FUEL HYD - When selected, shows the fuel temperature in the tanks and at the engine and shows the hydraulic system situation with respect to pressure in system A and system B, as well as the quantity of fluid in each system, presented in percent of a full service.
ELEC - When selected, shows DC voltage and amperage of both generators, battery temperature in degrees Celsius of both batteries, and the battery voltage of both batteries.
APU - When selected, indicates APU RPM in percent and exhaust gas temperature (EGT) in degrees Celsius.
ENG - When selected, indicates which full authority digital engine control (FADEC) is controlling each engine, and the oil service status of each engine. The APU start pressure and the status of the bleed air valve (open or closed) is also indicated.

V SPEEDS - Submenu items are: V_1, V_R, V_2, V_{REF}, V_{APP}. To set a V_{SPEED} press the button below the applicable speed; the V_{SPEED} selected will box and its designator will also appear over the rotary knob. The rotary knob may then be used to set the speed. When the speed is set press the menu button below it; the speed will appear boxed in white below its identifying designator on the MFD. The corresponding speed bug will be displayed on both PFD airspeed tapes.

The takeoff V_{SPEEDS} are set with the following criteria: In terms of magnitude the order of V_1, V_R, and V_2 is maintained; V_1 set starts at 100 knots; $V_1 \geq V_R$ and $V_R > V_R+3$. Subsequent takeoff V_{SPEEDS} (V_1, V_R, V_2) start at the last V_{SPEED} set value. When the V1 menu button is pressed on either MFD, V_{ENR} is displayed at the fixed value of 200 Knots. V_1, V_R, V_2, and V_{ENR} values and the corresponding PFD speed bugs are removed when the actual airspeed exceeds 230 knots.

Landing V_{SPEEDS} are set with the following criteria: In terms of magnitude the order of V_{REF}, V_{APP}, is always maintained. $V_{APP} > V_{REF}+3$, and V_{REF} start at 100 knots.

If the airplane configuration changes (affecting V_{SPEEDS}), V_{REF} must be changed first, so that the landing speeds criteria do not inhibit the setting of the new V_{REF} and V_{APP} values. Landing V_{SPEEDS} automatically deselect when the actual airspeed equals the bug value and deviates by more than ±50 knots.

MFD Main 2/2 Menu

Procedures for operating the main 2/2 menu are described below. The left button (<) on the bezel is used to select Main Menus 1/2 and 2/2, in rotation. Once a submenu is selected, the same button becomes the button (RTN) which returns the operator to the main menu. The default main menu is Main Menu 1/2 which is automatically selected at power-up. The selections on the 2/2 menu are MFD SRC/1 FMS 2, LRU TEST, and FGC SRC/A B. Selection of any of these items results in the appearance of a submenu. An explanation of the menu and submenu selections follows:

MFD SRC/1 FMS 2 (Multifunction Display Navigation Source [1 or 2]) - There are no submenu items for this selection.

MFD SRC/1 FMS 2 - Pressing the button below the navigation source selection annunciation toggles between the two sources. When one source is selected it is boxed, which indicates that it is the active source. The power-up selection is the on-side source. The FMS source will be annunciated at the top of the MFD in purple; if both sources are the same it will be annunciated in amber.

LRU TEST - Submenu items are: RAD ALT, ADC1, ADC2, TCAS, and MAINT.

RAD ALT - Pressing and holding this menu key initiates a test of the radio altimeter system. The radio altimeter will indicate approximately 100 feet while the button is held down. At the end of the test, it will indicate the radio altitude. The radio altitude (RADALT) test is inhibited once a glideslope (ILS) or glide path (MLS) has been captured.

ADC 1 or ADC 2 - Pressing ADC 1 or ADC 2 tests the respective air data computer while the button is held down. The test Indication occurs on the respective PFD. Mach indication is 0.790 in red in the EADI. The trend indicators for the altitude and airspeed will go to the top of the respective displays and the vertical speed indication will go to 5000 feet up. ADC TEST will be annunciated at the top of the EADI while the test is in progress. The air data computer tests are inhibited in flight.

TCAS - Pressing the TCAS key activates a test of the TCAS system. TEST will be displayed in large letters while the test is active. The TCAS traffic displays show test pattern traffic symbols, red and green resolution advisories, and TCAS TEST during the test. The test routine takes approximately ten seconds to complete. After successful completion, the system returns to the set operating modes and aurally annunciates TCAS SYSTEM TEST OK on the cockpit audio system. If the system fails the test, TCAS FAIL will be displayed in amber on the TCAS display(s) and the audio system will annunciate TCAS SYSTEM TEST FAIL. If the airplane is equipped with Honeywell radios, the same test can be initiated by positioning the tuning window in the TCAS area and pressing the TST button on the radio management unit (RMU). For airplanes equipped with Collins RTU-4210 radio systems, the TCAS test can also be initiated by pressing the TEST key on the TCAS page of the radio tuning unit (RTU).

MAINT - Pressing the MAINT key will access the built in maintenance test functions of the avionics system, and the various submenus. Refer to Chapter 45 of the Airplane Maintenance Manual and the applicable Honeywell maintenance manuals.

REVERSIONARY CONTROLS

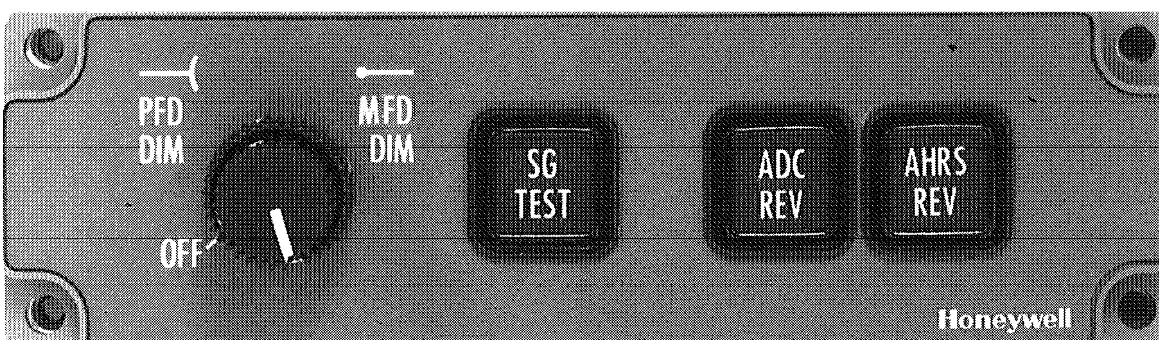
The Primus 2000 system uses reversionary controllers to replace failed sensors, displays, or symbol generators with operating units. The operating unit of one side can be used as a backup unit to operate both sides, providing flexibility and redundancy to the system. The panels of the reversionary controllers also provide control space for the dimming controllers.

RC-840 Reversionary and Dimming Controller

The RC-840 reversionary and dimming controller is used to dim the primary flight displays (PFDs) (outer knob) and the multifunction displays (MFDs) (inner knob). Turning the PFD dimming control to OFF position turns off the PFD. If the PFD is turned off, the adjacent MFD display becomes the PFD. Buttons are provided for symbol generator test (SG TEST), air data computer reversion (ADC REV), and attitude and heading reference system (AHRS) reversion. If an inertial reference system is installed the AHRS REV button is labeled IRS REV.

The dimming control sets a reference value. Once set, the light sensors on the display units adjust the display brightness for varying light conditions.

RC-840 REVERSIONARY AND DIMMING CONTROLLER



7016609-905

Figure 3-28

When the SG TEST button is pressed, and the airplane is on the ground, the symbol generator goes through a test cycle. TEST is displayed in red and the various caution indications (amber boxed) of HDG, LOC, EICAS, VSPD and IAS are presented on the PFD. PFD/MFD/EICAS failure annunciations (red Xs) are displayed. ATT FAIL and HDG FAIL will be displayed in red, and FD FAIL in amber. The EICAS display will also show the specific test elements, which may be selected.

Pressing ADC REV toggles between the on-side and the off-side micro air data computers (ADCs). If the on-side ADC is selected there is no PFD indication; if the cross-side ADC is selected, an amber ADC 1 or ADC 2 (depending upon which system is serving both sides) will appear in the PFD.

Pressing the AHRS REV buttom toggles between the on-side and the off-side AHRS systems. There will be no indication in the PFD of the active system if the on-side system is selected; if the cross-side system is selected in reversion, there will be an amber annunciation ATT 1 and HDG 1 or ATT 2 and HDG 2 (depending upon which system is serving both sides) in the PFD.

RC-841 Reversionary and Dimming Controller

The RC-841 reversionary and dimming controller is a single unit which is used to dim the EICAS display unit and to control reversionary functions. The controller has two knobs (EICAS DSPLY/NORM and SG REV/NORM) and two pushbuttons (DAU 1 REV and DAU 2 REV). The EICAS DSPLY/NORM has two concentric knobs; the inner knob is used to dim the engine instrument and crew alerting system (EICAS) (center) display unit. Once the dimming control is adjusted, sensors on the display adjust the brightness for the varying light conditions. The inner knob (EICAS DSPLY/NORM) is used to select display units for the EICAS display. In the NORM position, the EICAS display is in its normal position on the center display unit. In the L (left) position, the EICAS display is moved to the pilot's multifunction display and the center display unit is blanked. In the R (right) position the EICAS display is moved to the copilot's multifunction display and the center display unit is blanked.

The right knob (SG REV/NORM) is used to select either the normal (NORM) or back-up (SG1 or SG2) symbol generators which are a part of their respective integrated avionics computers.

RC-841 REVERSIONARY AND DIMMING CONTROLLER

7016882-915

Figure 3-29

In NORM position, SG1 drives the pilot's PFD, MFD, and the EICAS, and SG2 drives the copilot's PFD and MFD. In SG1 position, SG1 drives all five display units; in SG2 position, SG2 drives all five displays. Whenever a single symbol generator (SG) is driving all five of the display units, the condition is annunciated in the PFD by an amber boxed SG1 or SG2, according to which SG is active.

When reversion is selected, both multifunction displays display the same data, so either display controller can be used to select the display. It must be kept in mind that when operating in reversionary mode, the same symbol generator is driving the pilot's and copilot's display units. Either pilot can control the MFD display in reversion. The reversionary symbol generator will also be annunciated in amber between the fan RPM indicator and the ITT indicator on the EICAS display.

Each data acquisition unit (DAU) has two completely independent channels. Normally DAU1 channel A is used for the left engine display, and DAU2 channel A is used for the right engine display on the engine indicating and crew alerting system (EICAS) display. The two pushbuttons (DAU 1 REV and DAU 2 REV) will select channel B of the respective DAU, when pressed, to become the active engine display source. The reversion annunciation (DAU1B or DAU2B, or both) is annunciated in amber, in the EICAS display, between the engine fan RPM and ITT indications. In the unlikely event that both data acquisition units, with their backup channels, should fail, the standby engine instruments provide an additional backup capability.

The data acquisition units and the DAU reversion buttons are more closely associated with the EICAS system, which is discussed below in this section. The EICAS system is a component part of the Primus 2000 system, but is so comprehensive that it is covered separately in detail.

AHZ-800 ATTITUDE AND HEADING REFERENCE SYSTEM

The AHZ-800 dual attitude and heading reference system is a new generation system design based on a fiber optic gyro. The gyro is referred to as an interferometric fiber optic gyro (IFOG). Each basic system (of the dual system) is comprised of the following line replaceable units (LRUs): an AH-800 attitude heading reference unit (AHRU), a memory module, and an FX-600 flux valve. The fiber optic gyros are within the AHRU; they sense angular motion around all three axes. Accelerometers, also within the AHRU, sense linear motion along all three axes.

The AHRU is the major component of the system. It contains the necessary power supplies, sensors, and electronics to compute airplane attitude, magnetic heading, rate-of-change, and acceleration forces. From these sensors it obtains airplane attitude and physical motion, and gets long term magnetic heading information from the flux valve. After performing the necessary computations, the AHRU computes the following outputs and transmits them to the using systems via avionics standard communications bus (ACSB) and ARINC (Aeronautical Radio Incorporated) 429 bus:

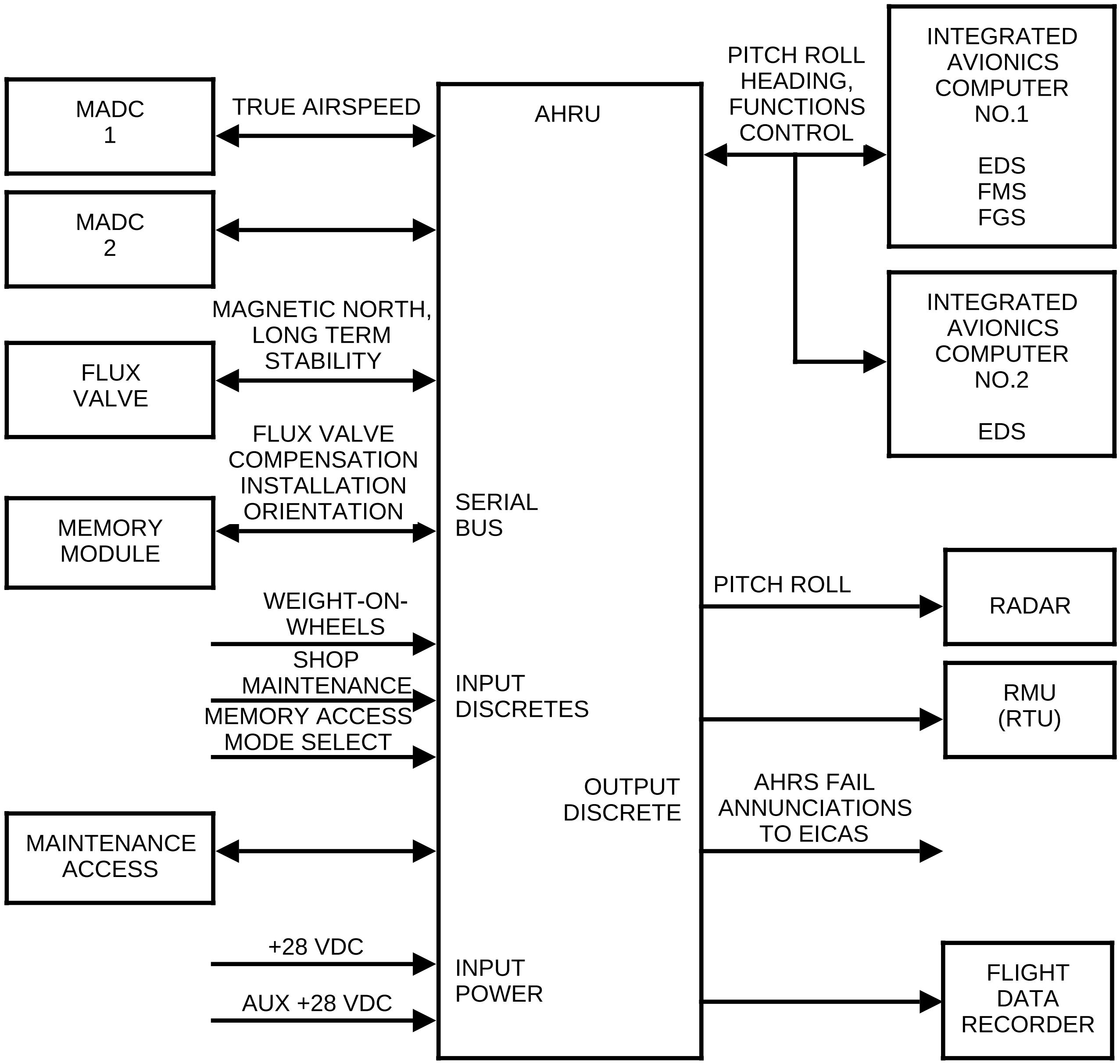
- Attitude (pitch and roll)
- Magnetic heading
- Angular rate-of-change (pitch, roll, and yaw)
- Linear acceleration (longitudinal, lateral, and normal)
- Operating mode status

The AHRU outputs digital data for the electronic display system (EDS), flight guidance system (FGS), flight management system (FMS), weather radar antenna, and other airplane systems as required.

The AHRS has six operating modes:

- Initialization
- Full Performance
- Directional Gyro (DG)
- Basic
- Test
- Maintenance

ATTITUDE AND HEADING REFERENCE SYSTEM AHRU INTERFACE DIAGRAM



AHRU = ATTITUDE AND HEADING REFERENCE UNIT
EDS = ELECTRONIC DISPLAY SYSTEM
FMS = FLIGHT MANAGEMENT SYSTEM
FGS = FLIGHT GUIDANCE SYSTEM
RMU = RADIO MANAGEMENT UNIT
RTU = RADIO TUNING UNIT
EICAS= ENGINE INDICATOR AND CREW ALERTING SYSTEM

Figure 3-30

Initialization Mode - Normal system initialization is performed on the ground. At power application the AH-800 performs self test functions to determine the condition of its sensors, central processing unit (CPU), power supply, and the input/output (I/O) subsystems. The outputs are brought into alignment with the true local vertical (level) and magnetic heading. This procedure takes two minutes on the ground, and 15 seconds in the air. When the initialization process is completed, all outputs are within their stated accuracies and the system will be in the full performance mode of operation, unless a system input or crew command has placed the system in one of its reversionary modes of operation. The AH-800 withstands very short power interruptions without the loss of data, however longer power interruptions will require a restart during flight. Should this occur, all data will be flagged until the system is reinitialized. This will take approximately 15 seconds in flight. Normally, if airplane normal system power is lost, the AHRS will go onto auxiliary (battery) power and a cyan EICAS message (AHRS 1-2 AUX POWER) will be annunciated by the EICAS system.

To initialize the airplane on the ground the airplane must remain stationary until the flags for attitude and heading are pulled out of view. Normal passenger loading, cargo loading, wind gusts, engine start, and engine runup procedures can be performed during initialization. Taxiing or towing the airplane during initialization is prohibited and may result in initialization not being completed. If the airplane is moved during initialization, the AHRS restarts the alignment process. For a complete re-initialization of both systems, by the pilot, all four circuit breakers (2 AHRS PWR and 2 AHRS AUX PWR) must be pulled out (not serially) and reset. Resetting each circuit breaker individually will not reinitialize the system. To verify all power has been removed check that the AHRS AUX POWER message is not being displayed on the EICAS.

Full Performance Mode - This is the normal system operating configuration. In this mode, true airspeed is used in the computation of pitch and roll attitude to produce a long term heading reference. In normal operation the "dot/cross" (•\+) indicator in the EHSI portion of the PFD will drift back and forth slowly between the two symbols. This indicates normal operation; in DG mode this indicator will not appear. Operation in full performance mode is not possible if the true airspeed function is not available.

AHRS CONTROLS

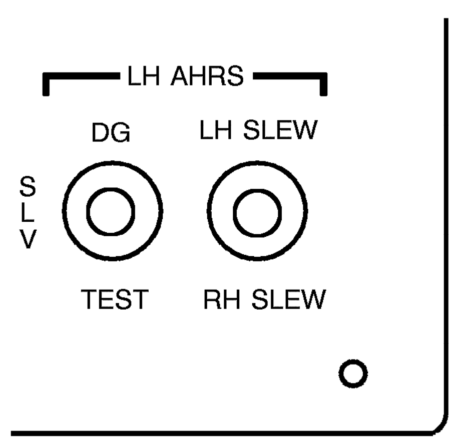


Figure 3-31

Directional Gyro (DG) Mode - In this mode the heading channel of the AHRU operates as a free non-slaved directional gyro, which is without reference to the flux valve. This mode is entered by pilot command through the LH (or RH) AHRS DG/SLV/TEST switch on the respective pilot's or copilot's instrument panel. It is used when operating in charted areas of unreliable magnetic heading, in far north latitudes (where true heading may be desired), or when flux valve failure has occurred. In DG operation the heading is slewed by reference to the magnetic compass or other reliable heading indicator. When switching from DG to slaved operation, the system will automatically synchronize to the flux valve magnetic heading.

The above automatic slaving feature of the system can be used if a heading error develops while in the slaved mode. The error can be removed by momentarily entering the DG mode (selecting DG) and then returning to the slaved (SLV) mode.

When the system is in DG operation the heading may be slewed clockwise (RH SLEW) or counterclockwise (LH SLEW) by the slew switch (LH [or RH]/LH SLEW/RH SLEW) at the right side of the applicable AHRS control panel. The HDG flag will come into view on the EHSI when a slew command is initiated and will clear when the compass card reaches the desired heading. In slave (SLV) mode, the slew switch is inactive.

There is no fast erection mode available to the pilot for the AHRS system. The system constantly updates the vertical calculations.

Basic Mode - If the AHRS system loses its true airspeed (TAS) input, it will enter the basic mode. There are no pitch and roll computations in this mode for acceleration induced errors. The AHRS system in this mode will have approximately the same accuracy as a conventional vertical gyro, with no pitch and roll erection cut-offs. It is susceptible to drift and acceleration errors, and therefore is subject to reduced attitude accuracy. After basic mode is entered the pilot must avoid sustained shallow banked turns of less than 6 degrees (i.e., a constant turn to hold a arc). Making sure the airplane is correctly trimmed assists system accuracy during basic mode operation. If an attitude error develops during basic mode operation, it cannot be removed by the pilot. The system will try to maintain the error within bounds. If the system enters the basic mode, a white EICAS message (AHRS 1-2 BASIC) will be annunciated.

Test Mode - Upon power-up the AHRS tests itself. This test lasts for two minutes, and during that time the annunciations ATT FAIL and HDG FAIL will appear in the PFD attitude sphere and the MFD, respectively. The test will time itself out by setting approximately 120 degrees (2 minutes) on the heading card, finishing at 360 degrees. The pilot can initiate a system test any time the AHRS self-test has been accomplished and is valid, and circuits of the weight on wheels switches are made. During a pilot initiated self-test the EADI will indicate five degrees of pitch-up, 45 degrees of right wing down roll attitude, and a heading of 15 degrees. During the test, ATT TEST will be indicated in the PFD attitude sphere, HDG TEST in the PFD heading circle, and HDG TEST will appear on the MFD. The test sequence takes five seconds, although it can be prolonged by holding the switch to the TEST position. When the test is completed, if it was valid the TEST annunciation will clear. System modes will not be affected by the TEST sequence. The AHRS cannot be tested once the airplane is airborne.

In case of an apparent abnormal indication on the EADI or EHSI, correct operation of the AHRS system may be confirmed by momentarily selecting TEST position on the AHRS control panel. The autopilot may disengage when the AHRS TEST function is activated.

Maintenance Mode - This mode is used for the installation and maintenance of the AHRS system. A special compass swing feature is installed in the system which allows compass swings without additional test equipment. The maintenance mode is discussed in detail in the airplane maintenance manual, and in the related Honeywell documents.

There is a built in test (BITE) which permits fault detection with a 90 percent minimum probability of success. The 200 most recent BITE faults are stored in BITE memory, designated for flight faults, which is accessed through the maintenance mode. If the AHRS determines that it is being operated on the ground and that the aircraft engines are inactive, then BITE detected faults will be stored in an area of BITE memory separate from flight fault storage. The ground fault storage can hold the last 24 detected BITE failures.

REVERSIONARY SWITCHING

System reversion is controlled by the RC-840 reversionary controller, one of which is installed for each (left and right) system. The RC-840 controller is also discussed under EFIS system, above in this section, since its operation also has bearing on the EFIS system. At power up, the on-side AHRS provides the display data for the respective side of the cockpit. Pressing the respective ARHS REV button causes the PFD to display the cross-side AHRS data. When this condition is selected, the same AHRS data is being displayed on both sides of the cockpit. This condition is annunciated by an amber message on both PFDs. The on- side AHRS can be selected by pressing the AHRS REV button again. When the on-side AHRS is selected, there is no indication on the PFDs of which system is active.

When the system goes onto auxiliary power, it is being powered by the airplane battery. Tolerance of a 200 millisecond delay is built into the system to allow for system switching, such as may occur if airplane main system power should be lost, resulting in the AHRS being switched to the auxiliary power. If power is completely lost, on the ground or in flight, the system must be reinitialized. This procedure takes two minutes on the ground and fifteen seconds in flight. At the end of a successful re-initialization sequence, all outputs are within their stated accuracies and the system is in the full performance mode of operation.

In-flight initialization is not recommended. If it should become necessary to perform an in-flight initialization, the airplane should be maintained in wings level unaccelerated flight during the alignment. Both power source circuit breakers (AHRS PWR and AHRS AUX PWR) must be pulled to restart the system. The AHRS continuously tries to realign itself, therefore, when it cannot realign itself, pulling the circuit breakers to force a realignment may not be successful.

RADIO ALTIMETER

The Citation X radio altimeter installation displays the absolute altitude in a digital readout on each primary flight display (PFD). The radio altimeter system is a high resolution, short pulse system which provides continuous operation in a wide variety of conditions. It operates on a frequency of 4300 MHz. The radio altimeter system interfaces with the data acquisition units (DAUs) and the optional ground proximity warning system. The DAUs provide information to the integrated avionics computers (IACs) which, in turn, provide the digital absolute altitude display In the PFDs, in the lower part of both attitude director (ADI) displays. The digital altitude readout is green until the airplane descends below a set decision height altitude, at which time the display becomes amber. The radio altimeter is in operation during the entire flight, however, there is no altitude indication above an absolute altitude of 2500 feet. If the radio altimeter is invalid, a red box with RA inside will appear instead of the digital read-out of altitude.

The radio altimeter also has an effect on the altitude tape in the PFD. A solid brown raster band will appear on the altitude tape on the primary flight displays as the radio altitude drops below 550 feet. The brown band will cover the lower half of the altitude tape when the airplane is on the ground. A yellow line will be drawn at the intersection of the brown raster and the grey band of the latitude tape. There is no written information displayed in the brown band.

There is also a radio altimeter decision height indication, which is a digital display located in the PFDs in the lower right corner of the ADI display. The decision height is set to a predetermined altitude by rotating the MINIMUMS knob located in the lower left corner of the PFD bezel controller. The decision height is displayed in a window on the lower right side of the attitude director indicator display. When the airplane descends below the selected altitude, an amber DH, enclosed in a white box, will appear in the upper left side of the attitude director indicator display. The copilot's decision height is independent of the pilot's, even though only one radio altimeter is installed. The decision height warning horn will sound only when the airplane descends below the altitude selected in the decision height window on the pilot's attitude director indicator (ADI) display.

The decision height (DH) display is located on each ADI. A different decision height can be set on each indicator, which will control the DH annunciator on that indicator only. The different radio altitude indicators operate independently of each other, even though they are driven by the same radio altimeter transceiver.

The radio altimeter can be functionally tested by selecting the Main 2/2 Menu on the applicable multifunction display, which will show LRU TEST as a selection option. Press LRU TEST and RAD ALT will appear as a submenu option; press RAD ALT and a box will appear around RAD ALT while it is being held down, and the radio altimeter will test. On airplanes equipped with the standard Honeywell AA300 system, the display will indicate 100 feet and the DH annunciator shall not be displayed. On airplanes having the Collins ALT-55 radio altimeter installation the display will indicate 50 feet. After the button is released the actual altitude will be shown. If a decision height is set below the radio altimeter test altitude, a chime will sound as the altitude comes back down through 100 feet (or 50 feet on Collins radio altimeter installations) when the button is released and the amber DH will be annunciated in a box in the upper left side of the altitude sphere.

The radio altimeter test function is disabled after glideslope capture during an ILS or MLS approach in which the autopilot or flight director is being used. Taxiing over accumulations of ice and snow may cause radio altimeter fluctuations.

The system may be used in flight to monitor absolute altitude at any altitude within the range of the altimeter. The MINIMUMS control on the PFD can be set to alert the pilot automatically whenever the airplane reaches a preset altitude. The system may be used to display ground separation and climb conditions during night or instrument takeoffs, as well as to indicate ground clearance during approaches. The DH read-out may be extinguished by turning the MINIMUMS fully counterclockwise.

LASEREF III INERTIAL REFERENCE SYSTEM

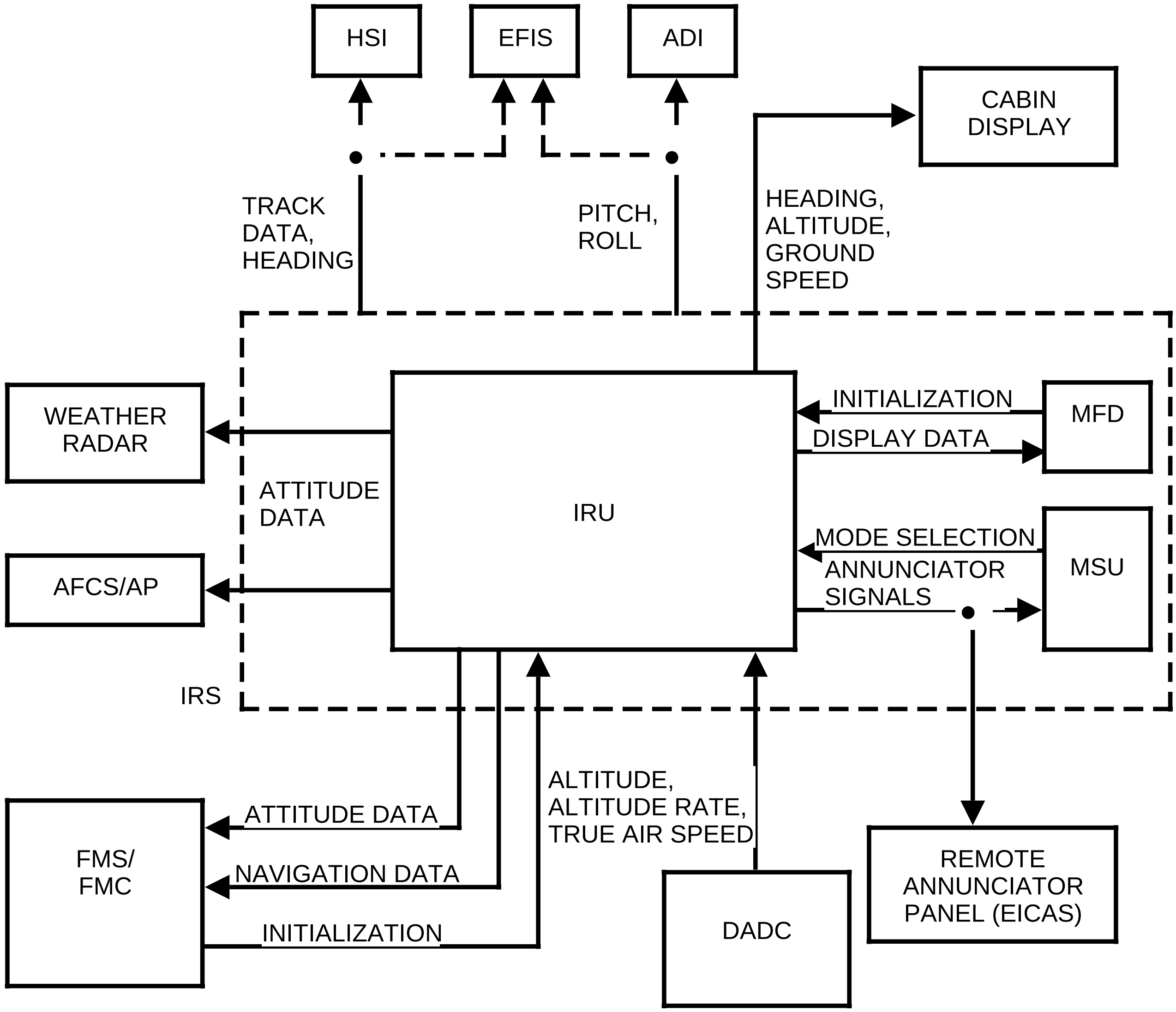
The optional dual LASEREF III inertial reference system (IRS) is a strapdown, Shuler-tuned navigation system. It contains three laser gyros and three accelerometers mounted on each of three axes inside the inertial reference unit (IRU). This combination of sensors integrates all inertial sensors in the airplane, eliminating duplication of systems. The gyros and accelerometers sense accelerations along and rotation about each axis. A microprocessor within the IRU performs the calculations necessary to provide present position, velocity, heading and attitude data to the airplane flight management system by using positional changes detected on each axis. The IRS then outputs this information digitally to the flight management system (FMS) and the electronic flight instrument system (EFIS). The IRS outputs include primary attitude, body linear accelerations, body angular rates, inertial velocity vectors, magnetic and true north reference heading, navigation position data, wind data, and inertial altitude.

The dual system consists of two inertial reference units (IRUs), and two mode select units (MSUs). The Primus 2000 avionics standard communications bus (ASCB) provides the interface medium for system control. When the LASEREF III system is installed, a slightly different RC-840 reversionary and dimming controller is installed (for operation see Electronic Flight Instrument System, above in this section). The AHRS REV button is replaced with a button with the nomenclature IRS REV. Pressing the IRS REV button will select the cross-side IRS to provide the required outputs to the electronic flight instrument system (EFIS). Since both sides will then be supplied by the same IRS system, that fact will be annunciated in amber in both primary flight displays. Since one IRS is supplying both displays, the selections on either RC-840 will affect both displays (left and right). If the button is pressed again, the system will revert back to on-side selection. Power-up default selection is the on-side selection. Since the on-side selection is the normal configuration, it is not annunciated.

The IRS installation interfaces with the automatic flight control system/autopilot (AFCS/AP), the flight management system (FMS), the digital air data computers (DADC), the electronic flight instrument system (EFIS), the weather radar, and the engine and crew alerting system (EICAS).

A white EICAS message (IRS HI LAT ALN 1-2) will illuminate in cases where the inertial reference system is taking extra time to align itself due to a high latitude location. This is a status message to remind the pilot that the system is taking longer than usual to align. It is due to a normal situation caused by a high north or south latitude location.

LASEREF III INERTIAL REFERENCE SYSTEM INTERFACE DIAGRAM



ADI - ATTITUDE DIRECTOR INDICATOR
AFSC/AP - AUTOMATIC FLIGHT CONTROL SYSTEM/AUTOPILOT
DADC - DIGITAL AIR DATA COMPUTER
EFIS - ELECTRONIC FLIGHT INSTRUMENT SYSTEM
FMS/FMC - FLIGHT MANAGEMENT SYSTEM/FLIGHT MANAGEMENT COMPUTER
HSI - HORIZONTAL SITUATION INDICATOR
IRS - INERTIAL REFERENCE SYSTEM
IRU - INERTIAL REFERENCE UNIT
MFD - MULTIFUNCTION DISPLAY
MSU - MODE SELECT UNIT

Figure 3-32

INERTIAL REFERENCE SYSTEM MODE SELECT UNIT

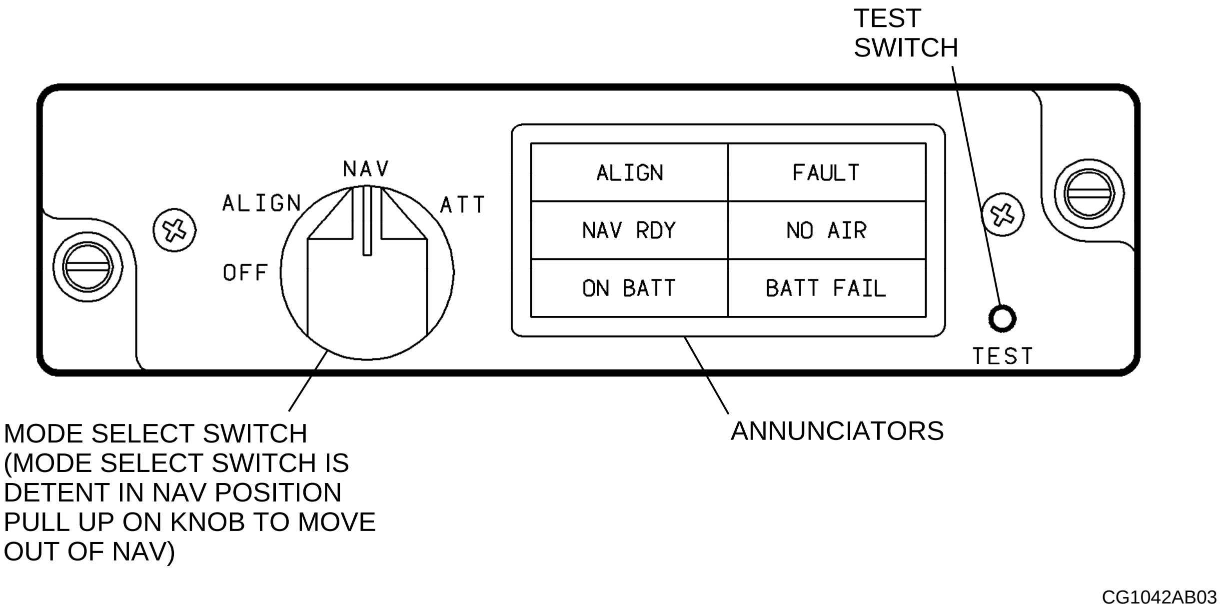


Figure 3-33

INERTIAL MODES OF OPERATION

The IRU operates in four basic inertial modes, three transitional modes, and a test mode. The basic inertial modes are: OFF, ALIGN, NAV, and ATTITUDE. The basic inertial and transitional modes are selected with the four-position rotary mode select switch (OFF, ALIGN, NAV, and ATT) on the mode select control panel. Six annunciators on the panel convey information and warnings concerning status and/or malfunctions of the IRS systems. The mode select panel is discussed below. The mode select switch is detented in the NAV position. It requires four pounds of force to pull the switch out before it can be set to another position. This is primarily to prevent mispositioning of the switch, which could shut down the system in the course of its operation, and which could deprive the airplane of attitude and heading reference as well as required navigation functions. In OFF, system power is removed and the system is deactivated. The operating modes are discussed below.

ALIGN Mode (ALIGN) - In the ALIGN mode the inertial reference unit (IRU) aligns its reference axes to the local vertical and computes heading and latitude by measuring the horizontal earth rate components. At the equator the IRU will complete its alignment in a minimum of 2.5 minutes. As the latitudes are increased either north or south from the equator, the alignment times increase to the point where at latitudes of greater than 70 degrees, alignment will take a minimum of fifteen minutes. In this case a white CAS message IRS HI LAT ALN 1-2 will be annunciated. During the alignment the ALIGN annunciator will be illuminated. Alignment is not certified at latitudes higher than 78.25° north or south. When performing alignment at latitudes greater than 78.25°, normal system tolerances may cause the system performance test to fail, which will prevent the IRU from entering the NAV mode. If alignment at these latitudes is successful, navigation performance accuracies may be degraded.

To complete the alignment the pilot must enter the present position (latitude and longitude) of the airplane in the control display unit (CDU) of the flight management system (FMS). If the position is not entered, the MSU ALIGN annunciator will flash and the inertial reference unit (IRU) will not enter the NAV mode until it receives a valid present position input. The current latitude and longitude may be updated any number of times without delaying alignment, as long as the IRU has not entered the NAV mode. Each successive entry writes over the last one; only the last entry is used for navigation.

The IRU conducts a reasonableness test and a system performance test on the position that the pilot enters; it conducts the reasonableness test immediately after each value has been entered. The system compares the entered latitude and longitude with the latitude and longitude stored at the end of the last NAV mode operation. If the entered position is not within one degree of the stored position, the entered position fails the reasonableness test, which will cause the ALIGN annunciator to flash.

Although the IRU accepts each new entry, it must also pass or override the reasonableness test. If latitude and longitude are entered twice in identical values, the reasonableness test will be overridden. This procedure may be required if the airplane has been moved to a different location without operating the IRU or if a new IRU has been installed. If the new entry passes the reasonableness test the ALIGN annunciator will stop flashing.

When the system completes its alignment test, it will immediately enter a performance test mode. At this stage the longitude is not tested, but the performance test still requires that the latitude entered by the pilot must be within a given limit of the latitude computed by the IRU during alignment. The new latitude must still pass the reasonableness test. If the entered latitude and the system passes both tests, the alignment is completed.

If two consecutive, identical latitudes are entered and the system performance test fails, the flashing ALIGN annunciator will go steady and the FAULT annunciator light will illuminate. If the FAULT annunciator illuminates because of disagreement between the latitude determined to be reasonable by the system and that entered by the pilot, one entry of correct latitude will pass the performance test, turn off the FAULT and ALIGN annunciators, and allow entry into the NAV mode.

NAV MODE (NAV) - In NAV mode the IRU supplies inertial position reference for the airplane and provides outputs of airplane attitude, body rates and accelerations, true and magnetic heading, velocity vectors, wind data, and latitude and longitude. The latitude and longitude entered during alignment are used by the system as a starting point for computations. The inertial present position is computed by the IRU from that starting point. Once in the NAV mode the system will not permit updates of latitude and longitude.

In high latitude navigation, alignment is not certified above 78.25°, but after alignment at other latitudes system accuracy will be normal upon entering latitudes above 78.25°. However, digital magnetic heading is invalidated during flight at latitudes greater than 73 degrees north or sixty degrees south. The pilot must be aware of the effects of no magnetic heading on associated airplane equipment that use magnetic heading supplied by the inertial reference system. For flights at latitudes greater than seventy-three degrees north or sixty degrees south, true heading should always be selected. True heading selection is a function of the FMZ Flight Management System; refer to the FMZ Series Flight Management System Pilot's Operating Manual.

ATTITUDE MODE (ATT) - When ATT mode is selected, the mode select switch must be left in the ATT position for a minimum of two seconds. The delay is to allow the pilot to reset the switch to the desired position if it was inadvertently set to ATT. There are two conditions in which ATT mode should be selected in flight:

1. The MSU FAULT annunciator lights. This indicates that the IRS has had a critical fault occur, which invalidates all outputs. Entry of the ATT mode clears intermittent critical faults in the IRU. If the FAULT annunciator remains lit after selection of the ATT mode, all outputs remain invalid.

2. All power to the IRS has been temporarily lost. This includes battery backup power.

When entering ATT mode, the IRU enters an erect attitude submode (rapid leveling) for the first twenty seconds. The MSU ALIGN annunciator illuminates and the IRU computes a set of new level axes. The airplane must be held straight and level on a constant heading during this time.

The outputs which are provided by the IRU (attitude rates and angles, vertical velocity, and inertial altitude) will again be provided by the system once rapid leveling has been completed. The attitude outputs are not as accurate as those which are provided in the NAV mode, and navigation outputs such as positions, velocities, and wind data are not provided.

In the ATT mode the IRU must be initialized with magnetic heading; if magnetic heading is not entered, the heading at which the airplane was flying when the attitude mode was selected becomes the zero-degree reference. A heading drift rate of up to fifteen degrees per hour can occur in the ATT mode, so the magnetic heading must be updated frequently from the magnetic compass or other reliable heading reference.

Transitional Modes - There are two transitional submodes: POWER ON/BITE and ALIGN DOWNMODE. In the power on BITE (built-in test equipment) submode, the IRU powers on and performs BITE and system tests. In this mode it checks functions that cannot be tested in flight without interfering with normal operations. In the ALIGN DOWNMODE the IRU accepts optional inputs of latitude and longitude to improve accuracy. The inputs must pass a reasonableness test similar to that of the align mode. Failure of the test causes the ALIGN annunciator to flash immediately after the data entry is completed. A successful test of the position entry will allow the IRU to enter the NAV mode. The align downmode requires only thirty seconds; after the thirty seconds refinement of the heading continues until NAV mode is selected or automatically entered.

Power Off - When OFF is selected, the IRU provides a three-second delay before the power-off process begins. The delay permits reselection of the desired position if OFF were to be inadvertently selected. The power then continues for approximately seven seconds to transfer BITE information, last calculated latitude and longitude (if the IRU was in NAV mode), and other IRS parameters to nonvolatile memory.

TEST MODE - TEST mode is selected by pressing the MSU TEST switch. TEST mode is inhibited in ATT mode and when the airplane ground speed exceeds twenty knots. In this mode the IRU outputs preprogrammed signals to airplane instruments. It is a three-phase test, each phase being of eight seconds duration. Phase one exercises all flags and annunciators. During the second and third phases, the IRU outputs fixed signals for display on cockpit instruments. At the end of the test all outputs return to normal.

MODE SELECT UNIT

The mode select units (MSUs) are mounted on the aft pedestal, on the respective system pedestal side. The four basic inertial system modes of operation are indicated by the MSU mode select switch positions: OFF, ALIGN, NAV, and ATT. The MSU also has six annunciators which signal fault warnings or system status. They are: ALIGN, NAV RDY, ON BATT, FAULT, NO AIR, and BATT FAIL.

The MSU fault indications functions and some operating information are discussed below:

ALIGN - The ALIGN annunciator illuminates when the IRU is in ALIGN mode. To complete alignment the pilot must enter the present position (latitude and longitude) of the airplane into the flight management (FMS) system. The ALIGN annunciator illuminates in a flashing mode when an incorrect latitude/longitude entry has been made in the FMS system, or when excessive airplane movement has occurred during alignment. If the airplane has been moved while IRS Power was off, or some other reason that the information that it contains is erroneous, the position information can be written over by entering it (identical values) twice into the system. The IRS conducts a reasonableness test and a system performance test on the latitude and longitude that the pilot has entered.

FAULT - The FAULT annunciator illuminates when the MSU mode switch remains set to ALIGN after a successful alignment has been completed. It will also illuminate when the system has detected a critical fault, which invalidates all IRS outputs. In flight, select the backup IRS system. All of the cockpit instruments which interface with the IRS will display failure warning flags and invalid signal annunciations, etc. If a non-critical fault occurs the fault light will not come on until after the airplane has landed. There are some faults which are classified as "maintenance faults"; these are faults which have a low probability of affecting the IRS performance. These faults will not be apparent to the pilot but a record will be stored in the BITE memory for the information of maintenance technicians.

NAV RDY - The NAV RDY annunciator illuminates when the MSU mode switch remains set to the ALIGN position after successful alignment has been completed. The mode select switch should be set to NAV when the annunciator comes on. The FMS CDU should also indicate that time to "NAV READY" is 0. The timing out of the compass card should have also have been completed when the NAV RDY annunciator illuminates.

NO AIR - The NO AIR annunciator illuminates to indicate no cooling air is being detected from the IRU MT-800 mounting tray fan or an overtemperature condition exists. Operate the IRU until completion of the flight. If the fault annunciator is on or inertial data ceases to be transmitted by the IRU, select the backup reference system, and set the mode selector switch for the affected IRU to OFF. If the IRU is off, the flight is near its destination, and/or additional attitude reference is needed, set the MSU mode select switch from OFF to ATT and operate the IRU in attitude mode for the remainder of the flight. Visually inspect the air filter at the end of the flight; replace a clogged filter.

ON BATT - The ON BATT annunciator illuminates when the IRU is operating on backup battery power. Normal airplane power to the IRS unit has failed or been removed. Check the IRS primary power circuit breaker.

BATT FAIL - The BATT FAIL annunciator will illuminate when the battery voltage from the battery which is used for backup power for the IRS system has fallen below 21 volts and is inadequate to sustain IRS operation if the need should occur.

A test of the IRS system may be performed by pressing the TEST button on the MSU control panel. The test is a three phase test; to accomplish it, place the mode selector switch in the ALIGN or NAV position and press the MSU TEST button. If the mode selector switch is already in ALIGN or NAV, simply press the TEST button. All of the annunciator lights will illuminate for the first phase of the test, and will then return to their original state for the completion of the test, and at the test completion will remain in that state.

GROUND PROXIMITY WARNING SYSTEM WITH WIND SHEAR WARNING

The optional ground proximity warning system with wind shear warning (with MK V warning computer) monitors the airplane's flight path with respect to the terrain at radio altitudes from 50 to 2450 feet. If projected flight paths could result in impact with the terrain, unique aural and visual warnings are issued to the flight crew. The system is powered whenever power is applied to the airplane and it operates automatically in any one of five flight modes. The warning for the first four flight modes consists of a tone warning WHOOP-WHOOP followed by a voice warning "PULL UP". The warning continues over the earphones and speakers until it is cleared by a positive pull up out of the danger area.

The MK V warning computer utilizes airspeed, altitude, and vertical speed signals from the micro air data computers as well as signals from the radio altimeter, glideslope indicators, landing gear position, flap position, angle-of-attack system, and the selected decision height to output the various aural and visual warnings.

There are two switch-annunciators in the system, (GPWS FLAP NORM/GPWS FLAP OVRD and BELOW G/S//G/S CANCELLED). The normal selection for the flap norm/override switch is GPWS FLAP NORM. If it is desired to make approaches or landings with no flaps, nuisance warnings may be avoided by placing the switch to the GPWS FLAP OVRD position. If the pilot desires to purposely descend below the glideslope, the mode can be inhibited if the BELOW G/S switch/annunciator switch is pressed below 1000 feet above ground level.

The wind shear warning is triggered by a sensor which is extremely sensitive to the body angle of the airplane in comparison with rate-of-change of altitude. The first indication of the onset of a wind shear problem is usually the rapid settling of the airplane, with a minimum change of airplane body angle. The crew warning that this set of circumstances has occurred is the sounding of a siren effect, followed by the words WINDSHEAR WINDSHEAR WINDSHEAR. An immediate go-around should be initiated.

The warnings for the different system flight modes are listed and described below:

Mode 1 - Excessive Sink Rate (SINK RATE Envelope)

The sink rate is measured barometrically and registers in a flight envelope beginning at approximately 5000 feet-per-minute at 2450 feet above ground level, decreasing to approximately 1350 feet-per-minute at fifty feet. If this flight envelope is entered, an aural warning SINK RATE will be announced.

Mode 1 - Excessive Sink Rate (PULL UP Envelope)

A flight envelope beginning at a rate-of-descent of approximately 7125 feet-per-minute at 2450 feet above ground level ranging down to approximately 1500 feet-per-minute at slightly below 200 feet above ground level, will produce a tone warning WHOOP WHOOP followed by a voice warning PULL UP. The PULL UP warning will continue until it is cleared by a positive pull up out of the danger area.

Mode 2 - Excessive Terrain Closure Rate

Terrain closure rate during cruise operation (flaps up) is sensed by the radio altimeter. The upper limit is established at approximately 5000 feet-per-minute at 2450 feet above ground level at a moderate Mach indication. The speed and closure rate decrease linearly to near approach speed at a descent rate of approximately 2000 feet-per-minute. The aural message is TERRAIN, TERRAIN switched to PULL UP every 3/4 seconds if the airplane remains in the mode envelope. To avoid false warnings during landing approaches, the mode dynamics are altered by lowering the flaps.

Mode 3 - Descent after Takeoff

After takeoff, a negative rate-of-climb for a specific altitude loss will trigger an aural warning of DON'T SINK. The amount of altitude loss varies from -15 feet at 100 feet altitude to -70 feet at 700 feet altitude.

Mode 4 - Inadvertent Proximity to Terrain and Airplane Not in Landing Configuration

There are three conditions and messages in this mode. If the airplane descends below 500 feet above ground level at approximately approach speed with the landing gear not down, an aural warning of TOO LOW - GEAR will be repeated every 3/4 seconds until the situation is corrected or the airplane is flown out of the envelope. If the same set of circumstances occurs with the landing gear down but the flaps not down, a warning of TOO LOW - FLAPS will be heard (if the flaps are not in the landing position). If the airplane is in a predetermined speed envelope at an altitude of between 50 feet and 1000 feet, a warning of TOO LOW - TERRAIN will be heard. In each of these cases a WHOOP WHOOP, PULL UP warning will be announced if the parameters are within the mode 1 (PULL UP) limits. The flap feature can be deactivated by pressing the GPWS FLAP OVRD switch/annunciator to prevent nuisance warnings when landing with less than full flaps.

Mode 5 - Inadvertent Descent Below Glideslope

Repeated aural warnings of GLIDESLOPE and illumination of the amber BELOW G/S switch/annunciator are initiated if the airplane descends below more than approximately one dot below the instrument landing system glideslope. This area is considered the "soft" warning and can be silenced by returning to the glideslope. When the airplane is more than two dots below the glideslope and is between 300 and 150 feet above ground level, the warning becomes "hard" as evidenced by the voice warning GLIDESLOPE being repeated louder and faster. The "hard" warning can only be silenced by a positive pull up. Mode 5 can be inhibited by pressing the BELOW G/S switch/annunciator while in the "soft" warning areas. Climbing to a radio altitude of above 1000 feet or descending below fifty feet will reset mode 5 if it has been cancelled. If the pilot desires to purposely descend below the glideslope, mode 5 can be inhibited if the BELOW G/S switch/annunciator is pressed below 100 feet above ground level.

Mode 6 - Minimums

An audible message of MINIMUMS is repeated twice when the airplane is below 1000 feet above ground level and the radio altitude passes through the altitude set in the radio altitude decision height window or the barometric decision height (DH) (or minimum descent altitude, [MDA]) in the pilot's PFD.

Mode 7 - Wind Shear Warning

A siren and the voice announcement WINDSHEAR WINDSHEAR WINDSHEAR will occur when a combination of airplane body angle and vertical displacement occurs which is indicative of a windshear situation. An immediate go-around should be accomplished.

Since there are ten different messages and the possibility exists that more than one warning situation could occur at one time, a message priority system has been established. A list of the messages is presented below by priority, along with the associated mode(s):

PRIORITY	MESSAGE	MODE
1	(SIREN) WINDSHEAR (3 TIMES)	7
2	WHOOP WHOOP - PULL UP	1 and 2
3	TERRAIN	2
4	TOO LOW - TERRAIN	4
5	TOO LOW - GEAR	4
6	TOO LOW - FLAPS	4
7	MINIMUMS	6
8	SINK RATE	1
9	DON’T SINK	3
10	GLIDESLOPE	5

The message with the highest priority will always be provided. If a message is being presented and a higher priority occurs, the message will immediately switch to the higher priority one. If a situation requiring a higher priority message is terminated, the higher priority message will complete before switching to a lower priority one.

The system is self tested by placing the rotary test switch on the center pedestal to the ANNUN position. During system self-test MK V warnings will be evidenced by engine instrument and crew alerting system (EICAS) amber digital annunciations of WINDSHEAR FAIL and GPWS FAIL illuminating, as well as the below listed voice announcements. Traffic and collision avoidance system (TCAS) annunciation is inhibited when voices are annunciated.

When the rotary test switch is placed to the ANNUN position the following GPWS annunciations will occur:

1. Amber EICAS digital annunciations of WINDSHEAR FAIL and GPWS FAIL illuminate immediately
2. The BELOW GLIDESLOPE annunciator will come on
3 One GLIDESLOPE message is annunciated
4. The BELOW GLIDESLOPE annunciators go OFF
5. One WHOOP WHOOP PULL UP message is annunciated
6. SIREN, WINDSHEAR WINDSHEAR WINDSHEAR is annunciated
7. Amber EICAS digital annunciations of WINDSHEAR FAIL and GPWS FAIL extinguish

WEATHER RADAR

PRIMUS 870 COLORADAR

WARNING

THE AREA WITHIN THE SCAN AREA AND WITHIN 15 FEET OF AN OPERATING WEATHER RADAR SYSTEM CONSTITUTES A HAZARDOUS AREA. DO NOT OPERATE THE RADAR SYSTEM WITHIN 15 FEET OF PERSONNEL OR FLAMMABLE OR EXPLOSIVE MATERIAL OR DURING FUELING OPERATIONS. FOR GROUND OPERATION OF A RADAR SYSTEM, POSITION THE AIRPLANE FACING AWAY FROM BUILDINGS OR LARGE METAL STRUCTURES THAT ARE LIKELY TO REFLECT RADAR ENERGY BACK TO THE AIRPLANE.

The Primus 870 digital weather radar system is an advanced multicolor radar that provides the pilot with all the traditional weather displays plus the additional function of turbulence detection. The radar is designed primarily to detect thunderstorms along the airplane flight path, but can be used also for ground mapping. The system gives the pilot a visual indication in color of rainfall intensity and turbulence content. A technique of pulse-pair processing is used. The system senses targets of varying rainfall intensity, as well as senses the random motion of raindrops which is caused by the presence of turbulent air currents. After proper evaluation, the pilot can chart a course to avoid the storm areas.

The 870 Weather Radar System employs a flat plate antenna which is integrated into a single-unit receiver-transmitter-antenna (RTA) assembly which has the receiver-transmitter unit mounted on the rear of the antenna, with the remaining circuitry mounted in the RTA assembly base. The multifunction display (MFD) replaces the conventional radar indicator and serves as the radar indicator, along with its other functions. The radar is controlled by a WC-870 weather radar controller mounted on the center pedestal. A dual WC-870 installation is also available.

The color radar indicator enables the pilot, through the color coded display, to receive current information on cloud formation, thunderstorms, rainfall rate and turbulence. The radar system cannot, however, detect clear air turbulence.

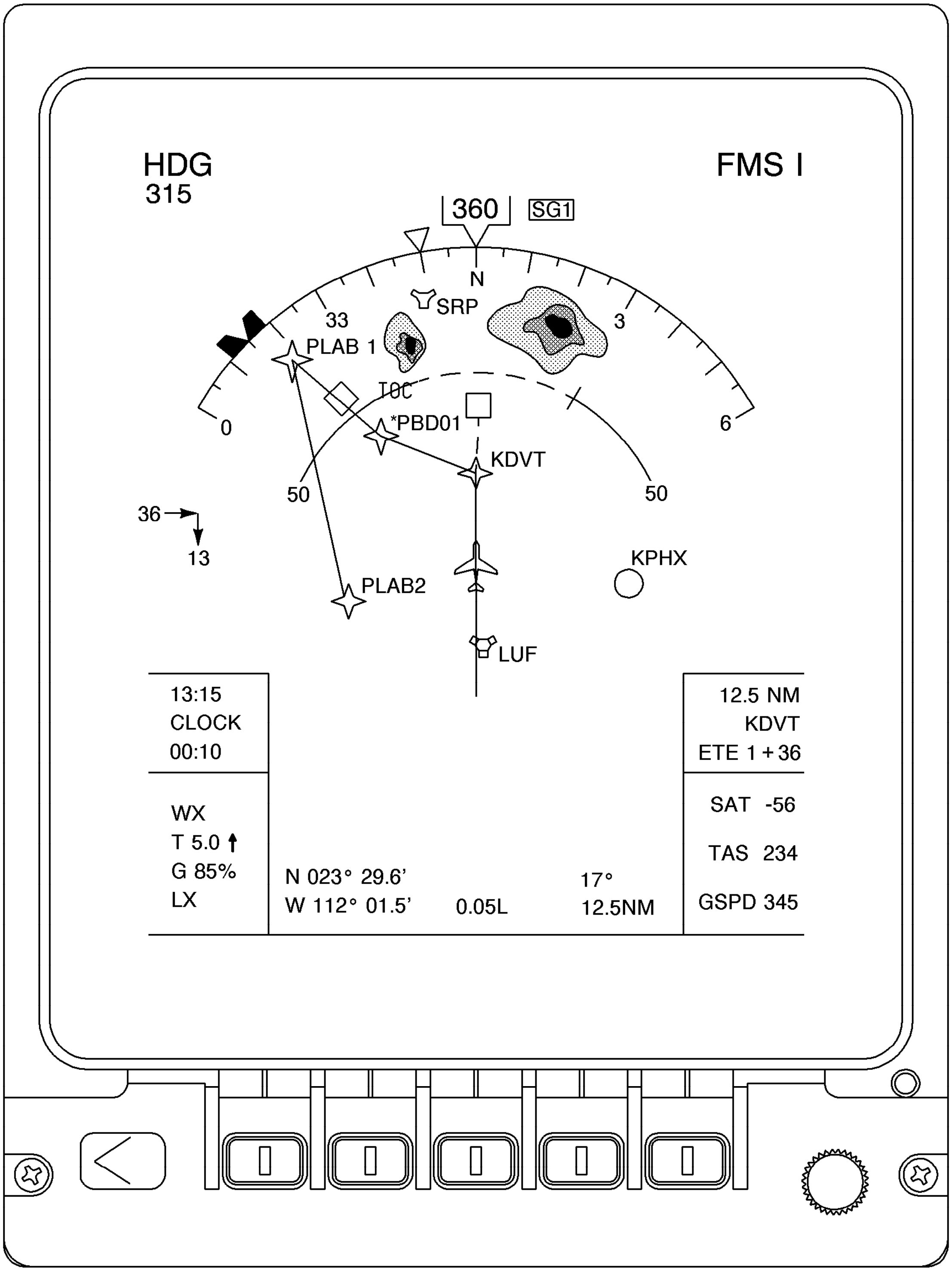
In weather detection mode, target returns are displayed at one of five video levels (0, 1, 2, 3, 4), with 0 being represented by a black screen because of weak or no returns, and levels 1, 2, 3 and 4 being represented by green, yellow, red, and magenta, respectively, to show progressively stronger returns. Areas of high turbulence are shown in soft white (grey-white). In ground-mapping mode, video levels of increasing reflectivity are displayed as black, cyan (sky blue), yellow, and magenta.

The ground-mapping mode (GMAP) permits display of prominent topographical features such as lakes, bays, islands, shorelines, high ground, cities, etc.

WARNING

THE SYSTEM PERFORMS ONLY THE FUNCTIONS OF WEATHER DETECTION AND GROUND MAPPING. IT SHOULD NOT BE USED OR RELIED UPON FOR PROXIMITY WARNING, ANTI-COLLISION OR TERRAIN AVOIDANCE.

PRIMUS 870 COLORADAR DISPLAY

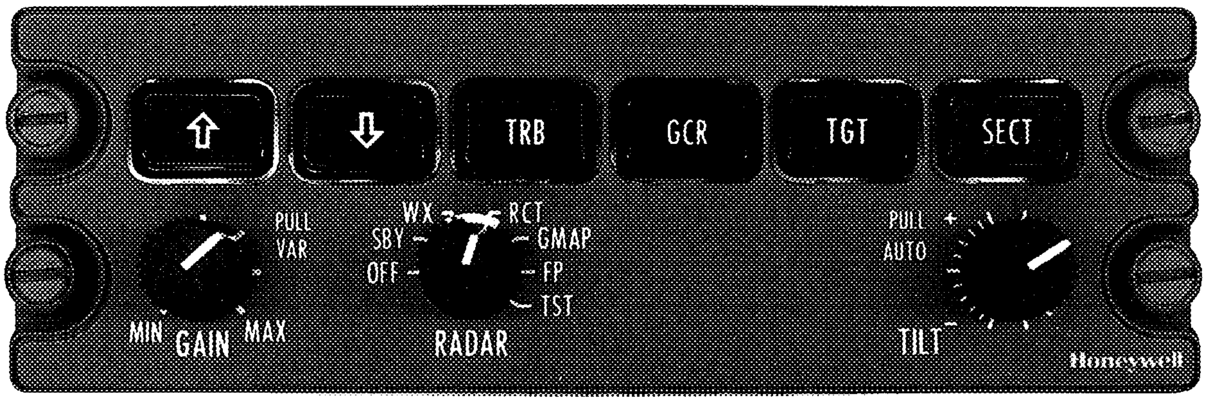


MAP MODE WITH WEATHER DISPLAY AND CLOCK

6785C1024

Figure 3-34

PRIMUS 870 COLORADAR CONTROLLER



5685P6063

Figure 3-35

The COLORADAR controller is used to control the Primus 870 COLORADAR system. All of the controls that are required to operate the system are located on the controller. Brightness for all of the legends and controls are controlled by the dimming control for the aircraft panel. A description of controller operation and switch functions follows below.

CONTROLS

TILT — Rotary control used to select the tilt angle of antenna beam in relation to the earth plane. Tilt range is between 15 degrees upward (clockwise rotation) and 15 degrees downward (counterclockwise rotation). A digital readout of the antenna angle is displayed on the EFIS.

AUTO TILT (PULL) — Pulling out the tilt control knob places the system into AUTO TILT mode. In this mode the antenna automatically adjusts, based upon inputs received from barometric altitude and selected range. Changes in altitude and range selection will result in antenna tilt changes. The tilt setting can still be controlled to a maximum of plus two or minus two degrees with the tilt control. In autotilt mode an A will be suffixed to the tilt readout.

RADAR — The RADAR function switch controls selection of the primary radar modes of operation.

OFF — Removes power from the system. An amber WX id displayed in the mode field.

SBY — Places system in Standby. Antenna scan is stopped, the transmitter is inhibited and the display memory erased. A blue "STBY" is displayed in the mode field of the display. When warm-up is completed the system automatically switches to the standby mode. If SBY is selected before the R/T/A warmup period is over (approximately 45 seconds) the blue WAIT legend is displayed in the mode field.

WX — Select Weather mode for enroute weather detection. "WX" is displayed in the mode field of the display.

CONTROLS (Continued)

RCT Selects REACT (Rain Echo Attenuation Compensation Technique) circuits. REACT compensates for attenuation of the radar signal when it passes through precipitation. When the signal cannot be compensated a cyan (sky blue) field indicates a dangerous area. Any target detected within the cyan field cannot be calibrated and should be considered very dangerous. RCT is available in WX mode only. RCT forces the system to preset gain. "RCT" is displayed in the REACT field of the display, which is located above the mode field.

GMAP Selects Ground Mapping Mode. Returns from ground targets are enhanced in this mode. As a constant reminder that GMAP is being displayed, the blue GMAP legend is displayed and the color scheme is changed to cyan, yellow, and magenta. Cyan represents the least reflective return, yellow is a moderate return, and magenta is a strong return.

WARNING

WEATHER TYPE TARGETS ARE NOT CALIBRATED WHEN THE RADAR IS IN GMAP MODE. BECAUSE OF THIS, THE PILOT SHOULD NOT USE THE GMAP MODE FOR WEATHER DETECTION.

FP Selects Flight Plan Mode. The indicator screen is cleared of radar data and navigation displays may be presented from the flight management system (FMS). Target alert may be used in this mode in order to maintain an alert for potentially dangerous weather. A green "TGT" will be displayed. If a target is detected from five to fifty-five NM and within 7.5 degrees of dead ahead the TGT annunciator will change to amber. "FLT PLN" is displayed in the mode field. The target alert advises the pilot that a hazardous target is in the flightpath and the WX mode must be selected to view the target.

TST Selects Radar Test Mode. Displays a test pattern to allow verification of system operation. "TEST" is displayed in blue in the mode field.

WARNING

- **THE TRANSMITTER IS ON AND RADIATING IN TEST MODE.**
- **THE SYSTEM PERFORMS ONLY THE FUNCTIONS OF WEATHER DETECTION OR GROUND MAPPING. IT SHOULD NOT BE RELIED UPON FOR PROXIMITY WARNING OR ANTI-COLLISION PROTECTION.**

FSBY (Not on Control) FSBY is an automatically selected radar mode which operates when the Weight-on-Wheels squat switch is activated. Antenna scan and transmitter are inhibited. Simultaneously pressing both range buttons will restore normal operation.

CONTROLS (Continued)

SLV In dual controller installation an SLV annunciator on the lower edge of a controller will illuminate when that controller is turned OFF with the RADAR knob. This annunciation means the controller that is turned OFF is slaved to the controller that remains ON. The annunciator is "dead front" and is not otherwise in evidence. Both controllers must be off before the radar system turns off.

GAIN When the control is pushed in, the receiver gain is preset and calibrated. When pulled out the control manually varies the RTA receiver gain. Minimum gain is set with the control at its fully counterclockwise position. Gain increases as the control is rotated in a clockwise direction from full counterclockwise to the 12:00 o'clock position. At the 12:00 o'clock position both the gain and the sensitivity time control (STC) are at their maximum values. Additional clockwise rotation removes STC. At the fully clockwise position, the gain is at maximum and the STC is at minimum. The full clockwise position produces maximum gain. Selection of RCT (Rain Echo Attenuation Compensation Technique), on the RADAR function switch, overrides the variable gain setting, causing the receiver gain to be fixed and calibrated at a preset value. Selection of low gain settings on the variable gain may eliminate hazardous targets from the display.

RANGE Two momentary-contact switches permit range selection of one of six ranges (10, 25, 50, 100, 200, and 300 NM) for the optional lightning sensor system (LSS) and radar. In the FPLN mode, additional ranges of 500 to 1000 miles are added. Activation of the UP arrow increases the range and activation of the DOWN arrow decreases the range. If the system is in forced standby mode (FSBY), pressing both range buttons will restore operation. Power-up range is 100 nautical miles. One-half of the selected range is annunciated at the one-half range mark on the EHSI. When switching from WX mode to FP mode and back, the system will remember the WX mode range selection.

TRB Momentary alternate-action push button which enables and disables the Turbulence Detection mode of operation. TRB mode can only be selected when WX mode is selected and the selected range is 50 nautical miles or less. Areas of moderate or greater turbulence are shown in soft white (grey-white). WX/T is annunciated in the mode field. The radar cannot detect clear air turbulence. Undetected turbulence may exist within any storm cell. Selecting the 100, 200, or 300-mile range turns off the turbulence detection. The“/T” is deleted from the mode annunciation and variable gain is engaged if it was previously selected. Subsequent selection of ranges of 50 miles or less will re-engage the turbulence detection.

WARNING

UNDETECTED TURBULENCE MAY EXIST WITHIN ANY STORM CELL. TURBULENCE CAN ONLY BE DETECTED WITHIN AREAS OF RAINFALL.

CONTROLS (Continued)

GCR Momentary alternate-action push button which enables and disables the Ground Clutter Reduction mode. Selectable only when WX mode selected and the range selection is 50 nautical miles or less. Ground clutter returns are reduced, making it easier to discern the remaining targets which are more likely to be weather. "GCR" is annunciated above the mode field.

The GCR feature has the following limitations: it does not remove all of the ground but it does remove some of the weather. It is most effective dead ahead, and its effectivity is reduced as the antenna scans away from dead ahead. The circuit logic assumes reasonable tilt settings for proper operation.

Selecting the 100, 200 or 300-mile range, or the TRB mode turns off ground clutter reduction (GCR). The GCR legend is deleted from the mode annunciation and variable gain is engaged, if previously selected. Subsequent selection of ranges of 50 miles or less re-engages GCR. If not already selected, GCR forces the radar into preset gain.

WARNING

- **DO NOT LEAVE THE RADAR IN THE GCR MODE.**
- **GCR REMOVES MOST OF THE GROUND TARGETS FROM THE DISPLAY. BUT AT THE SAME TIME IT REMOVES SOME OF THE WEATHER TARGETS.**

TGT Momentary alternate-action push button which enables and disables the Target Alert function. Target Alert monitors the area beyond the range selection within 7.5 degrees of dead ahead. It is selectable in all but the 300 mile range. If a return with certain characteristics is detected in the monitored area, the target alert changes from the blue armed condition to an amber "T" warning condition. When this amber warning is displayed, the pilot should select a longer range to view the questionable target. Target alert is inactive within the selected range.

SECT Momentary alternate-action push button which selects either the normal full azimuth scan of 120 degrees of fourteen looks per minute, or the faster 60 degree sector scan with 28 looks per minute.

LSZ-850 LIGHTNING SENSOR SYSTEM (OPTIONAL)

The lightning sensor system (LSS) is an optional system used to detect and locate areas of lightning activity. It is effective for approximately a 100 nautical mile radius of the airplane. The system gives the operator a visual display of the average position and rate-of-occurrence of both visible and invisible-type (high energy electromagnetic and electrostatic discharges) lightning activity. After evaluating the LSS display and its relation to precipitation, as indicated by the weather radar display, the operator can effectively plan the proper course to avoid hazardous weather.

The occurrence of a single lightning strike is of little significance as an indicator of turbulence, and is displayed as a lightning alert for five seconds. However, if multiple strikes occur in a given area, this indicates significant and potentially dangerous weather activity. All lightning signals received are denoted with a magenta lightning alert symbol placed at the correct bearing and at the maximum selected range. Lightning alert symbols are removed from the display after five seconds. In the case of severe thunderstorms, the alert symbol may appear to be present all the time in the direction of the storm, indicating a high level of lightning activity.

LSS information is displayed on both the primary flight display (PFD) and the multifunction display (MFD). Precipitation data from the weather radar and the lightning information from the LSS can be displayed simultaneously, on one or the other displays or on both.

Since the system is a passive device in that it does not transmit, it is safe to operate on the ground, even in a congested area. The system scans three hundred sixty degrees of azimuth.

The LSZ-850 system components are the LP-850 Receiver/Processor, the AT-855 antenna, the EFIS display system, and a four-position lightning sensor system switch (LSS) on the WC-870 remote weather radar controller. The rotary switch has the functions: OFF, STBY, LX, and CLR/TST. The following is an explanation of the LSS switch functions:

LSS Control Switch — The LSS control is a four-position rotary switch that controls the optional separate lightning sensor system (LSS). The operating modes are defined below:

OFF - In this position power is removed from the lightning sensor system.

STBY (Standby) - In this position the LSS display data is not displayed but the system continues to accumulate data.

LX - In this position the LSS is fully operational. It collects, processes, and displays data on the multifunction display (MFD) or the primary flight display (PFD), depending upon the selection of the weather display.

LSS Control Switch (Cont.)

CLR/TST (Clear/Test) - When CLR/TST is selected, all memory of past strikes and symbols are erased. After three seconds the equipment enters the test mode. In the test mode, simulated lightning signals are fed to the antenna and a lightning strike is simulated at a bearing of 45° at 25 nautical miles. The simulated strike progresses in severity to lightning rate three within fifteen seconds of the start of the test. A lightning alert is also generated along the outermost range ring at a bearing of 45°. If the system is left in the CLR/TST mode, the ALERT and STRIKE reduce in severity and disappear. After approximately two minutes the lightning strike rate symbol is removed. During the test the antenna is in use, and any real activity that is occurring may also be displayed.

CAUTION

- THE LIGHTNING SENSOR SYSTEM IS A WEATHER AVOIDANCE DEVICE. IT IS NOT A WEATHER PENETRATION DEVICE. WEATHER RADAR IS THE PRIMARY WEATHER AVOIDANCE SYSTEM. THE LIGHTNING SENSOR DATA IS SUPPLEMENTARY INFORMATION.
- USE THE WEATHER RADAR TO DETERMINE STORM CLEARANCE DISTANCES AND AVOID ALL LIGHTNING BY 20 MILES.

LSZ-850 LIGHTNING SENSOR SYSTEM CONTROL

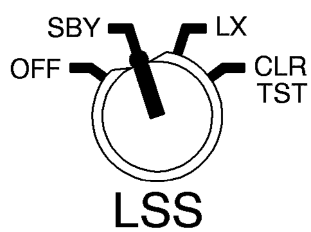


Figure 3-36

Three different symbols representing lightning rates are shown below. These symbols appear on the PFD and/or the MFD. They represent the rate-of-occurrence of lightning flashes for the last two minutes. The symbol location represents the average position of lightning which has occurred in the last two minutes inside an 18 mile diameter area. The lightning is not necessarily occurring at the location represented by the center of the symbol.

RATE OF OCCURRENCE SYMBOLS

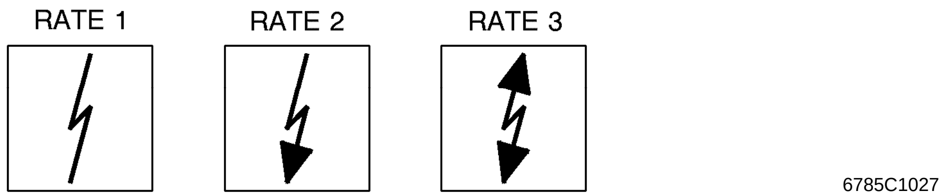


Figure 3-37

In the following graph, the methods by which rate 1, 2, and 3 occurrences are computed is shown. The number of lightning strokes required for each rate symbol is adjusted for distance to the storm, since it is easier for the lightning sensor system to detect lightning close to the aircraft rather than at far distances. The graph plots the number of strokes required for each symbol against range.

STROKES PER SYMBOL VERSUS DISTANCE

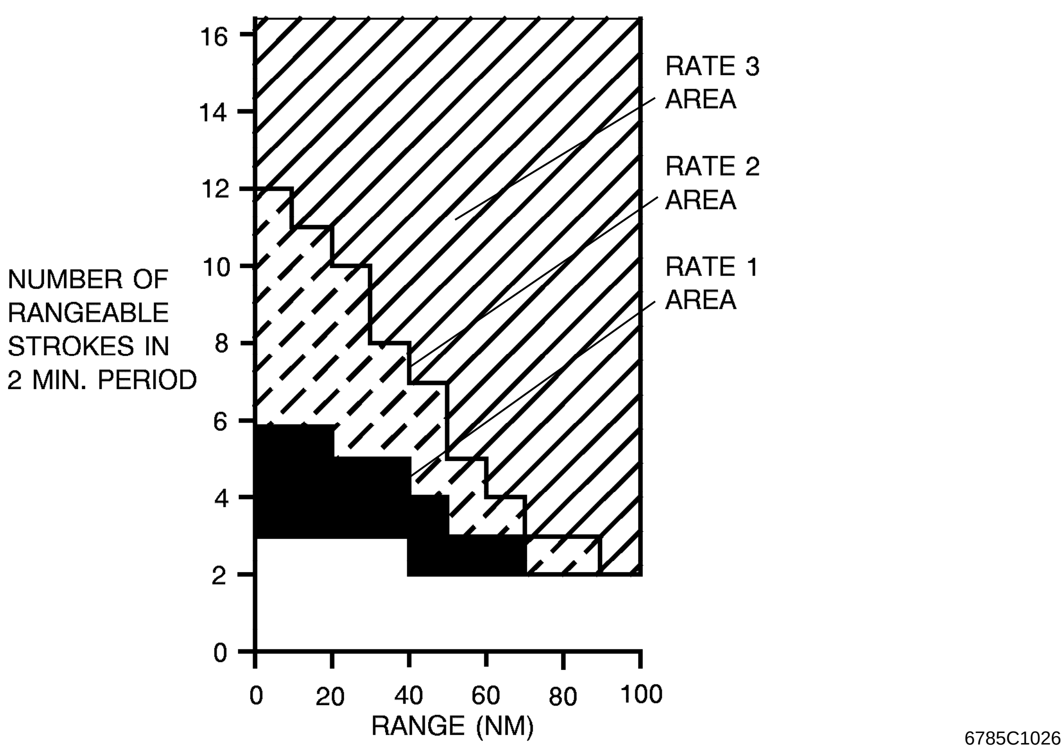


Figure 3-38

MODE ANNUNCIATIONS

Mode annunciation concerning the lightning detector system are displayed on the left side at the bottom of the PFD display in the weather section. The following annunciations may occur, with the meanings defined below.

ANNUNCIATION	DEFINITION
LX/F	Self-test has detected a fault.
LX/S	The system is in the standby mode.
LX/CL	The system is in the CLR mode. This occurs for approximately three seconds after the CLR/TST mode has been selected. After this time the mode annunciation switches to LX/T.
LX/T	The system is in the TST mode. This annunciator may be replaced with a display in the form LXmn. Refer to the Pilot Activated Self-Test, for further details.
LX/I	The receiver is inhibited by XMIT INH input during transmission by communications transmitters. No lightning signals are received during this condition.
LX/H	This annunciation indicates that heading input has been deselected, either by the operator or by the HDG VALID input.
LX/C	The system is in the self-calibration mode. This annunciation reverts to the selected mode approximately 10 seconds after power is applied.
LX/L	The number of computed lightning rate symbols exceeds the capability of the display system.
LX	The system is in the normal operating mode.
LX/OFF	The lightning detector system has been selected off.

PILOT ACTIVATED SELF-TEST

Following the below procedure will verify the operation of the LSZ-850 system. The system generates a known signal in the antenna to accomplish a complete verification of the system operation. It displays the end result on the indicator display.

ANNUNCIATION	DEFINITION
1	Select 50 NM or greater display range.
2	Select CLR/TST on the LU-850 controller.
3	Verify that all lightning rate symbols are erased from the display. After three to four seconds, simulated lightning test pulses are sent to the antenna.

(Continued Next Page)

PILOT ACTIVATED SELF-TEST (Continued)

ANNUNCIATION	DEFINITION
4	Verify that a rate 3 symbol is displayed at 25 nautical miles, at a 45° right azimuth. The symbol will take approximately five to seven seconds to build up. The time will be extended to approximately fifteen seconds if TST is selected immediately from the OFF position, due to initialization of the lightning processor. If strong local interference is present the symbol's range may vary by up to five miles.
5	Verify that a magenta lightning alert symbol is displayed at maximum selected range, at 45° right azimuth. It must remain on for three to seven seconds.
6	To restart the test, switch to LX mode and back to CLR/TST mode.

A failure code for hardware/firmware failure is included in Honeywell Publication Number 28-1146-54. This publication is provided with Citation X airplanes equipped with the LSZ-850 Lightning Sensor System. It contains a complete system description and full operating procedures for the LSZ-850 Lightning Sensor System. For detailed information concerning system composition and operation refer to that publication.

ENGINE INDICATING AND CREW ALERTING SYSTEM (EICAS)

The engine indicating and crew alerting system (EICAS) makes possible modern comprehensive engine and aircraft systems monitoring. It combines several instruments into one display system. EICAS replaces the conventional annunciator panel and many electromechanical instruments with a digital electronic display, which minimizes maintenance and saves scarce instrument panel space. The displays are composed of textual messages or of symbology which lends itself to immediate interpretation. EICAS is the center display of the five electronic display units on the Citation X instrument panel. It is located between the two multifunction displays (MFDs).

EICAS provides the flight crew with instantly available primary engine parameters, control surface position reporting, and major aircraft system monitoring. It receives analog and digital input signals from many sensors located throughout the airplane. The assembly point for many inputs is the data acquisition unit (DAU). The Citation X has two DAUs for collection and dissemination of data. Data is transmitted from the DAUs to dual integrated avionics computers (IAC) through two digital data buses that process the data for display. The IACs contain symbol generators (SG) that subsequently transmit the data to the DU-870 display units (DU).

EICAS provides aural messages as well as textual, and the message text and symbology are colored in order to immediately alert the flight crew to the degree of seriousness of any situation. Textual messages are provided in the colors of white, cyan (dark blue), amber, and red in ascending order of seriousness.

White messages indicate operational or aircraft systems status information. They require no acknowledgment, neither do they trigger any external annunciator systems. These messages are steadily illuminated on the EICAS screen.

Cyan messages are of a more important nature, indicating that crew awareness is required and subsequent crew action may be required. They neither require acknowledgment nor trigger any external annunciator systems. These messages will flash for five seconds when first appearing on the EICAS screen.

Amber messages indicate a need for immediate crew awareness for future correction or compensatory action due to abnormal system conditions; they are preceded by an attention chime, or in some particular cases a unique warning device (horn). They will flash on the EICAS screen until acknowledged, and then remain steady. They will also cause the MASTER CAUTION to illuminate in steady mode until it is acknowledged. Amber messages can be scrolled off the crew alerting system (CAS) display, once acknowledged. If there is insufficient space, newer messages will replace older ones which will then scroll off the display screen. Messages may also be scrolled out of view by the crew in order to read other CAS messages which are not being shown because of lack of space.

Red EICAS messages indicate conditions that require immediate recognition and corrective or compensatory action. Red messages are annunciated four ways: they will flash on the EICAS screen until acknowledged and then remain steady; they will appear on the multifunction display (MFD) until acknowledged and will then be removed; the MASTER WARNING will flash until acknowledged; and there will be a double chime audio tone. Red messages are not allowed to scroll off the EICAS display. Almost all messages of the various levels (colors) will stay on the EICAS display (space permitting) until the condition causing the message is corrected.

GENERAL DISPLAY INFORMATION

This section will discuss the various displays, as illustrated here and on the next page. The center display unit (DU) on the instrument panel is the primary display unit of the EICAS system; the two display units on either side of it are the multifunction displays (MFDs) for the pilot and copilot, respectively. The MFDs present navigation, weather, and other data which is optionally selectable. When a red message appears on the EICAS, it will also be displayed on the cross-side MFD. The two end displays are the primary flight displays (PFDs) for the pilot and copilot. The PFDs present heading, airspeed, altitude, vertical speed, airplane attitude, and navigation data. In this section discussion is limited primarily to the EICAS displays except where, due to reversion or the appearance of red EICAS message, the multifunction displays are involved.

The EICAS displays of the critical systems, of which the crew requires constant information, such as fan speed (N_1), turbine speed (N_2), inter-turbine temperature (ITT), ram air temperature (RAT), oil temperature and pressure, and fuel quantity and flow, are present on the display at all times. Stabilizer trim setting, flap setting, and the synoptic wing view will be displaced by the declutter mode when it is selected. The various "Systems Pages" are crew selectable, since crew alerting system (CAS) messages will warn of any system abnormalities or exceedances. When an exceedance does occur the system produces EICAS textual messages, aural messages, and symbology color change to help alert the flight crew to the situation. The crew can then also immediately select the appropriate system and receive detailed information. These pages will be discussed further on in this section.

EICAS DISPLAY MAP

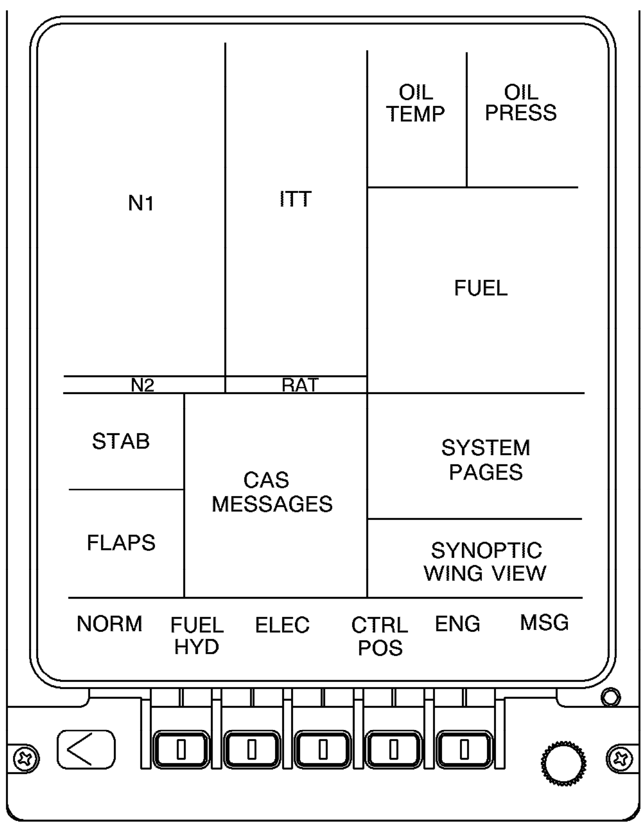
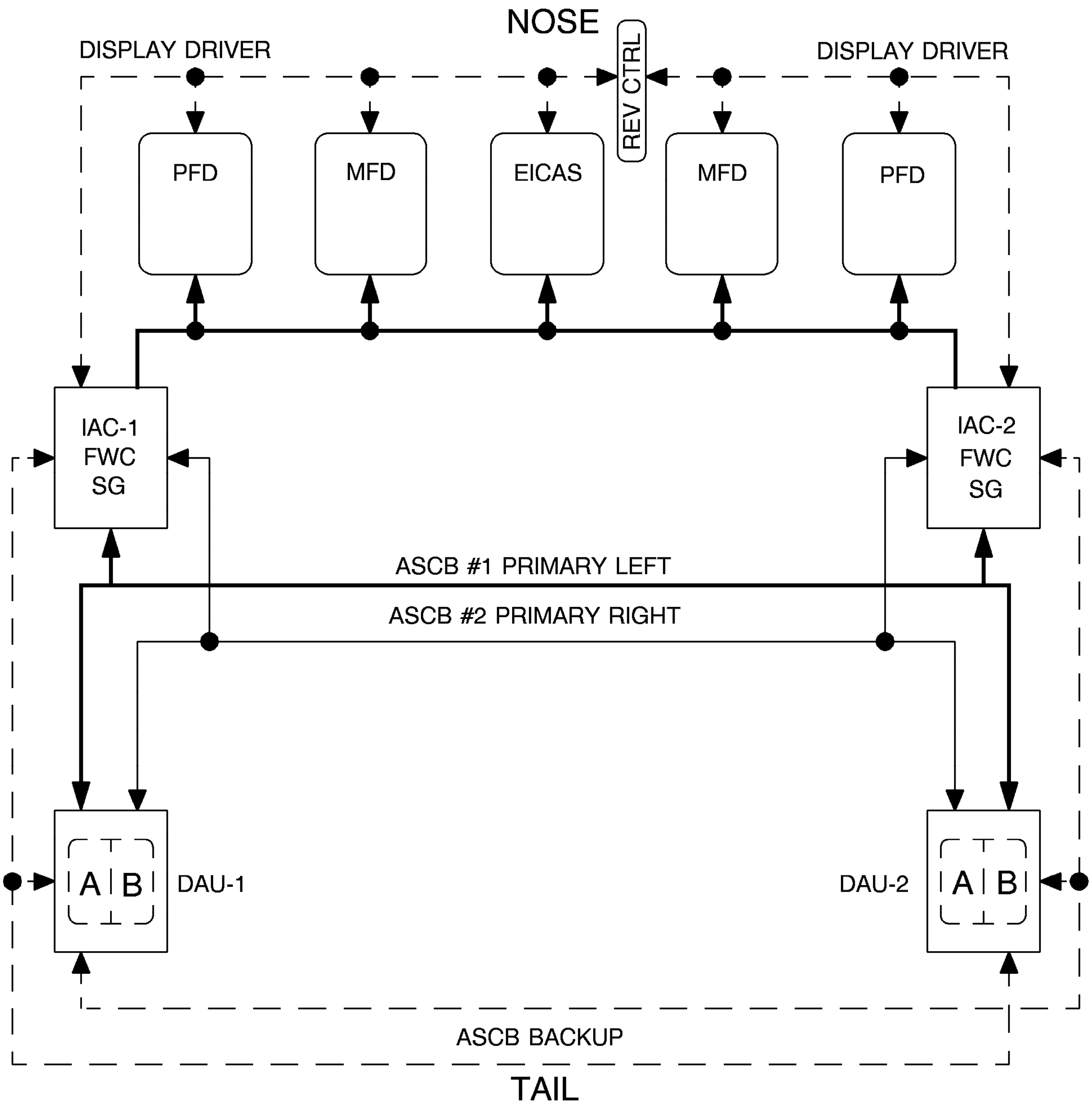


Figure 3-39

PRIMUS 2000 SYSTEM ARCHITECTURE



ASCB = AVIONICS STANDARD COMMUNICATIONS BUS
REV CIRL = REVERSION CONTROLLER
DAU = DATA ACQUISITION UNIT
FWC = FAULT WARNING COMPUTER
MFD = MULTI FUNCTION DISPLAY
PFD = FRIMARY FLIGHT DISPLAY
IAC = INTEGRATED AVIONICS COMPUTER
SG = SYMBOL GENERATOR

6785C1028

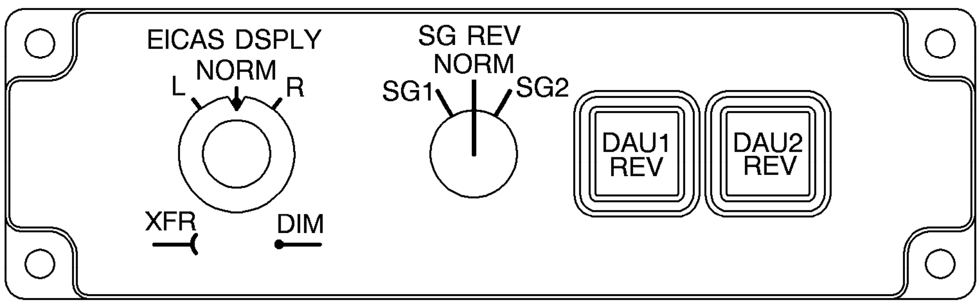
Figure 3-40

The EICAS system is designed in such a way that there is minimization of oscillating digits which can be a nuisance in digital displays. If a display becomes invalid for any reason, the display will change to amber dashes.

REVERSIONARY OPERATION

Both PFDs can be manually reverted, or displayed on an MFD, in order to provide redundancy and safety in case of a display failure. The EICAS can be reverted to either MFD, if necessary. The system is designed, however, so that MFD data cannot be displayed on a PFD. If the pilot's PFD should fail, the PFD data can be reverted to the pilot's MFD; if the EICAS display should then fail, manual reversion of the EICAS display to the copilot's MFD is the remaining option. In this case, regardless of which MFD is selected, the Primus 2000 system forces the EICAS data to the copilot's MFD

RC-841 REVERSIONARY CONTROLLER



7016882-915

Figure 3-41

The left knob of the EICAS RC-841 reversionary controller controls the position of the EICAS display. The NORM position places the EICAS display at its normal location on the center display unit; the L position places it on the pilot's multifunction display (MFD), and the R position places it on the copilot's MFD. The right knob (center position) directs which symbol generator (SG) is providing the display symbology for the DUs. The symbol generator is part of the integrated avionics computer (IAC). The center (NORM) position selects SG number 1 to drive the pilot's PFD, MFD, and the EICAS, and SG number 2 to drive the copilot's PFD, and MFD. The position SG1 selects symbol generator number 1 to drive all five display units, and SG2 position selects symbol generator number 2 to drive all five displays.

Each data acquisition unit (DAU) has two channels which are completely independent of one another. Normally channel A of DAU 1 is used for the left engine EICAS display and channel A of DAU 2 is used for the right engine EICAS display. There are two momentary switches on the reversionary controller by means of which the pilot may select channel B of either data acquisition unit to be the display source of the engine. When a DAU reversion is selected it will be annunciated in amber between the engine fan RPM and the ITT indications on the EICAS display.

When a single symbol generator is driving all five display units (DU) the condition is annunciated by an amber boxed SG1 or SG2 in all DUs. It must be remembered that the same symbol generator is driving all five display units when operating in reversionary mode. A selection that affects one display will affect all of them, except BARO SET, RADIO ALT, and MINIMUMS.

PARTIAL POWER OPERATION

For the convenience of crew and maintenance personnel, as well as to reduce the number of power on-off cycles, to reduce system "on" time, and to reduce heat production, there is an additional system switch (EICAS/OFF) on the avionics control panel which will power up only the pilot's MFD, the EICAS display controller, channel A of both data acquisition units, and the number one integrated avionics computer. When these units are powered, the pilot's MFD and the EICAS display will be operational, and the rest of the avionics may not need to be turned on. The power-up sequence takes approximately two minutes. The intent of this function is to allow checklist access and engine start without powering up the whole system. Numerous CAS messages are inhibited with the EICAS switch on and the avionics master switch off.

DISPLAYS

The EICAS display is divided into various sections; some functions, which the crew must continually monitor, are always present and are always indicated in their permanent location. There are two areas that change with conditions or selections. The crew alerting section (CAS) area is at the lower center section; the various textual messages conveying system information to the crew appear there. The system pages are located at the lower right of the display. The systems are selectable by the buttons at the bottom of the EICAS display; electronically generated white annunciators above each button identify them. When the button is pressed a box will appear around the selection and that system will be presented in the system page area. The identifying nomenclature of the displays is in white letters, as are the scales. Normally, all digital data is presented in green, except as otherwise noted. Invalid digital data will be replaced by amber dashes.

The fault-warning computer (FWC) compares engine sensor data to the display wraparound from the EICAS display unit. When the fault warning computer detects a miscompare between the actual data and the displayed data, the amber text "EICAS" will be displayed in an amber box outside the bottom left of the attitude sphere. It will flash for five seconds and then remain steady. This annunciation (amber EICAS) pertains only to the engine parameters of N_1, N_2, and ITT.

FAN RPM (N_1)

The N_1 (FAN) display is located in the upper left corner of the display. It is identified by FAN%. Three digits to the left of the decimal point and one decimal point to the right show the digital data. There is an analog display range of from 20% to 105%. If the indication becomes invalid, the vertical bars will be removed. The actual N_1 symbology is driven by the full authority digital engine control (FADEC) that is in control.

A cyan bug that appears along the outer side of the scale represents the N_1 target value. The bug is not manually settable. The left engine FADEC drives the left bug and the right engine FADEC drives the right bug. The FADEC on each engine, which is not in command of the engine, is the one that drives the target bug. If the FADEC in command should fail, the remaining FADEC

EICAS DISPLAY

SHOWING THE RIGHT ENGINE BEING STARTED

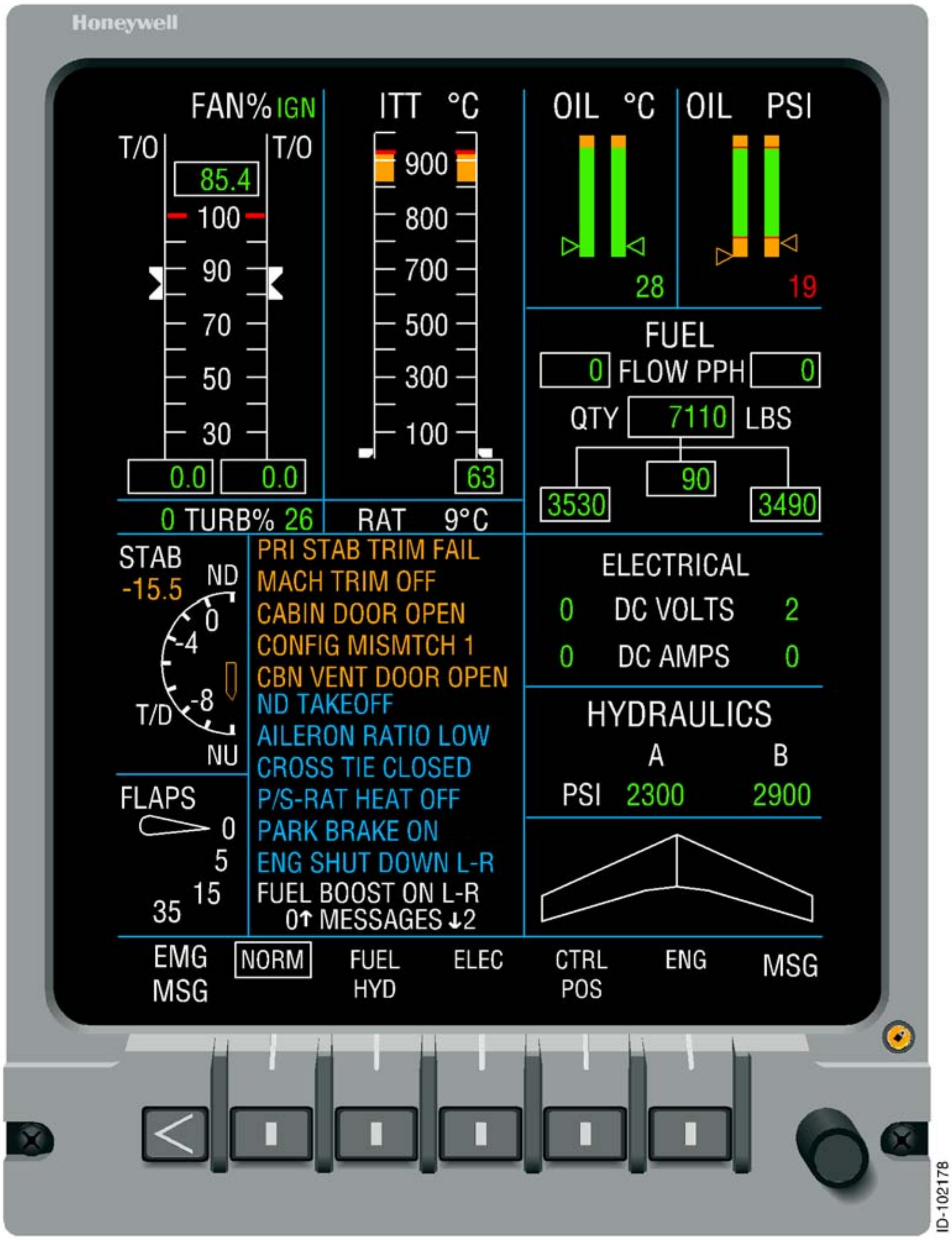


Figure 3-42

should fail, the remaining FADEC will sustain engine operation but since, in that case, the FADEC in control of the engine would be driving the target bug also, the target bug will change from cyan to amber.

There is a fixed red line at 100% on the RPM depiction. At an indicated fan speed above 100% the vertical scales and the digits will turn red. The pointers are filled white bars.

Two FADEC thrust mode indicators (FMI) will be shown next to the FAN% title on either side of it, and slightly below it. The FADEC mode indicators are: maximum takeoff (MTO), takeoff (T/O), climb (CLB), cruise (CRU), and reversionary (REV). The indicators are normally displayed in green, and annunciate the thrust mode in which the FADEC is operating. If the FAN DAMAGE CAS message or the FADEC ADC REV message is active the FMIs will become amber. If the FMI mode T/O is displayed and the throttle levers are in the takeoff detent (75±2°), then the T/O annunciation will be green, however if T/O is displayed and the throttle levers are not in the takeoff detent, then the T/O annunciation will be in white. Only one FMI can be in evidence at any one time. The ignition can be selected ON by FADEC at any time, and that fact will be annunciated in green above the FMI annunciations. In the Model 750 configuration, MTO throttle (most forward) position will result in the same takeoff power setting as the T/O position.

Engine synchronization from N_1 or N_2 is selectable at any time on the (ENG SYNC FAN/OFF/TURBINE) switch on the center pedestal. If either is selected SYNC will be displayed in green between the vertical N_1 scales.

INTERTURBINE TEMPERATURE (ITT)

The analog display range for the ITT starts at 50°C while the digital display begins at 0°C. The analog display range is from 50°C to 950°C, with a fixed red line at 850°C. The indicating pointers are filled white bars which turn to red if the indication goes above the red 850°C line. If the indication becomes invalid for any reason the ITT scales will be removed from the display. The FADEC in command of the engine generates the indicated ITT. Digital ITT readouts are only visible under the following circumstances: the ENG menu button has been depressed, an exceedance has occurred, and during engine start. The digital display will be located at the bottom of the analog display on the respective engine side.

There is a digital turbine (N_2) readout located below the N_1 analog display. The display will be on the respective engine side of the white TURB% identification below the analog display of the FAN speed. Digits to the right of the decimal point are not displayed. The display will change colors depending upon the engine parameters and conditions. The digital turbine readout ranges from 0 to 110%. The digits are colored according to the below table.

	Engine Running	Green	Red
N_2	YES	>57<101	≥101
	NO	<101	101

RAM AIR TEMPERATURE (RAT)

The ram air temperature (RAT) indication appears just below the ITT display. The display consists of the identification RAT plus two digits, and a minus sign if applicable. The label is RAT even though the display is total air temperature (TAT). The micro air data computers (MADCs) provide the temperature display, and the temperature actually displayed is the lowest of the two values, if they differ. If one source fails, the remaining RAT source will provide the display with no indication of failure. If both MADCs fail the EICAS will revert to using T2 SYN for the temperature display. T2 SYN is a synthesized compressor inlet temperature from the full authority digital engine controls (FADECs). The RAT label will still be white, but the temperature digits will become amber.

The RAT heater will operate only in flight. A squat switch disables the function on the ground.

OIL TEMPERATURE AND PRESSURE

The oil temperature and pressure are located in the upper right corner of the EICAS display. The oil temperature indication is a bi-colored vertical bar, and the oil pressure is a tri-colored vertical bar. Triangular shaped bugs, which take on the same color as the region to which they are pointing, provide the analog temperature indications. The bugs become solid when they are in the non-green regions of the displays. Digital information is present at the bottom of the display, on the respective engine side, under the following circumstances: (1) The ENG systems page is selected, (2) an exceedance has occurred (if the engine is running), or (3) during engine start. The digital display will be the same color as the region where the analog pointer is located. The color-coded indications are listed in the table below. These colors will be displayed except for when the TLA is greater than 30°, and at all times in flight, when green will be displayed.

Oil	Green	Amber	Red
Temperature °C	21 to 127	-	<127
Pressure PSIG	50 to 90	34 to 50	<34>90 (95)*

* Airplanes incorporating Honeywell P2000 Integrated Avionics Flight Control System Phase V Software.

FUEL

The fuel display includes both quantity and fuel flow. The system labels are white and the indicating digits are in green numbers inside white boxes. The display moves in increments of twenty with the right-most digit always zero. The possible fuel flow indications are from 0 to 4000 pounds per hour with the minimum fuel flow which can be indicated, once the engine is running, being 140 pounds per hour. If the total fuel quantity falls below 1200 pounds the total fuel digits will turn to amber.

Digital fuel quantity is displayed in pounds for each of the three tanks: left, center, and right. The total fuel quantity is indicated in larger green numbers inside a larger white box. When the total fuel in any wing tank becomes less than 500 pounds, the digits will change to amber to warn of the low fuel situation.

FLAPS

The flap display is a synoptic presentation having a range of from 0° to 35°. The indicator is a white airfoil shaped pointer which represents the flap position; it moves in one degree increments. The white scale digits of 0, 5, 15, and 35 do not change color. If a flap malfunction should occur and the system does not properly indicate flap position, due to invalid data or an out of range condition, the flap pointer will park at the last known position and its color will change to amber.

STABILIZER TRIM

The stabilizer trim indication is displayed in both analog and digital formats. The display is white except for a green area which represents the takeoff setting area. If flaps are 5° the green range is -2 to -5; if 15°, -5 to -8. The green color will only be present when the airplane is on the ground and the takeoff phase inhibit (TOPI) logic is active. When the pointer is in the green area, it will also be green. The digital indication will be at the top of the area designated for the trim display and the digits will follow the color scheme of the pointer. Two significant digits will be presented in 0.1° increments. If the stabilizer trim data become invalid the pointer will be removed and the digits will become amber dashes. In flight the white area will represent the nominal stabilizer trim range (display limits of +1.2° to -12°). If the stabilizer pointer exceeds the display limits or if there is a disagreement between the autopilot trim data and the EICAS, the pointer and digits will change to amber.

SYNOPTIC WING

This display is designed to give the flight crew a quick general view of slat, speed brake, and roll spoiler position. This is of particular importance because many of the flight controls are not visible from the cockpit. During preflight and ground operations the flight crew may use this display to determine speedbrake, roll spoiler, and slat position. Normally only an outline of the wing is shown in cruise flight because the spoilers, slats, and speedbrakes will be in the stowed position. If the system determines that an invalid condition exists, the symbology of the respective control surfaces will change color.

Slats

The slat symbology is a filled white bar for each slat. The bar will be absent when the slats are retracted and present when the slats are deployed. If an asymmetric slat situation should occur, the deployed slat will be shown in amber. If an electrical miscompare should occur, the side with the miscompare will be shown deployed in amber.

Speed Brakes

The speed brakes are the three inboard panels on each wing. The synoptic view displays the speed brakes as filled white bars when they are deployed to an extent greater than five percent of their full deployment. The display does not change to indicate amount of deployment. When the speed brakes are stowed there will be no symbology present. If an asymmetric condition is detected (>5% split), the symbology will become amber displaying all six panels. One resolver is attached to the middle speed brake panel on the left wing, and one is attached to the outboard panel on the right wing; these resolvers report the position, respectively, for the panels on their side.

Roll Spoilers

The roll spoilers are the two most outboard panels on each wing. The roll spoilers are shown as filled white bars only when the airplane is on the ground. The symbology will be the same regardless of the amount of deployment of the spoilers. When stowed, the symbology will not be present.

SYSTEM PAGE DISPLAYS

The system page displays are those which are pilot selectable. They occupy the space at the lower right of the EICAS display unit (DU), and are selected by the bezel buttons located along the bottom of the DU. The selection options are: NORM, FUEL HYD, ELEC, CTRL POS, and ENG which correspond to normal (electrical and hydraulic), fuel system, hydraulic systems, control positions, and engines, respectively. Upon selection, a white box will appear around the menu title and the selected display will appear. A declutter selection (DCLT) is also possible which removes some of the displays when certain altitude and systems conditions are met. It will be discussed at the end of this subsection.

NORM

This menu page selects a display of certain elements from the electrical and hydraulic systems. The electrical display is composed of DC VOLTS and DC AMPS from both generators. The hydraulic display selected on this page is the pressure of the A and B hydraulic systems in PSI. If a CAS message of HYD RUD SYS FAIL or HYD PUMP FAIL B is being displayed, the hydraulic pressure of the standby rudder system (RSS) will also be displayed (the RSS title will be displayed only if digits are displayed). Normal parameters are indicated in green, and exceedances will appear in colors appropriate to the condition, such as in the following two tables.

FUEL/HYD

When the fuel/hydraulic (FUEL HYD) menu is selected, information additional to that which is provided in the NORM display is presented. Specifically, for the fuel system, left and right fuel tank and engine fuel heater outlet temperatures are displayed. All text is white. The digit colors are in accordance with the below table.

Color	Engine °C	Tank °C
Green	≥4≤99	≥-37≤52
Amber	<4>99	<-37>52

The hydraulic portion of the Fuel/Hyd section is composed of a display of system pressures, system quantity in percent full, and the temperatures of the hydraulic fluid in degrees Celsius. The text is white and the color of the digits is in accordance with the below table. Normal ranges are in green and exceedances are in the appropriate color.

Color	Pressure PSI	% Quantity	Temperature ° C	Rudder (Press)
Green	≥2600 ≤3200	≥16	<93	≥2200 ≤3200
Amber	<2600 >3200	<16	≥93 <130	<2200 >3200
Red	<2600*	-	≥130	-

* Red if either engine running and both hydraulic pressures low; green if both engines shut down.

ELEC

Selecting the MENU button provides all available electrical system data. It is only displayed in digital format in whole numbers. The DC amps are presented in units of five. The left and right systems are presented on the respective sides of the display. The text will be white; the digital information and colors will be in accordance with the table below.

Parameter	Green	Amber	Red
VDC	≥23 ≤29	<23 >29*	CAS message)
DC AMPS < FL 410	≤ 400	>400	-
DC AMPS ≥ FL 410	≤300	>300	-
BATT °C	≥-20 ≤62.8	<-20	>62.8 >71**
BATT VDC	≥-23 ≤29	< 23 >29	-

* If the engine is not running the digits will be green.

** After 62.8°C a red BATT 1-2 O'TEMP CAS message is triggered. It is triggered again when the temperature rises above 71°C.

Observing the battery voltage is the only method to determine if external power is being supplied to an airplane bus. The airplane battery voltage will read 24 volts, and the external power will show approximately 28 DC VOLTS.

Remote Circuit Breakers

There are some remote circuit breakers in the system which will trigger a cyan CAS message (REMOTE CB TRIPPED) if they become opened. The importance of the equipment represented by these circuits is such that the crew should be aware of their loss, or of the loss of a circuit for certain back-up equipment. The circuit breakers are as follows:

Circuit Breaker	Circuit Breaker
AHRS Aux	LH Start Logic
APU Feed	LH Landing Light
AVN Emergency Feed	LH Wing Root Heater
Battery 1	Oxygen Seat Belt
Battery 2	RH Landing Light
Cabin ECU	RH Start Logic
Cockpit ECU	RH Wing Root Heater
EICAS Feed	Secondary Trim 1
Elec Emergency Feed	Secondary Trim 2
Emergency Locator Tx	Standby Battery Pack

CTRL POS

The primary purpose of this system page is to allow convenient verification of the primary flight controls before flight. Generally, the area of full travel of the controls is annunciated by bars with a tick mark in the center and tick marks representing the limit of the control surface travel. The center tick mark always indicates neutral surface position. Movement of the control surfaces is represented by triangular bugs which always maintain constant geometry over full travel of the surface. If invalid data is sensed, the bugs are removed from the display. The representation of each control surface is somewhat different; each set of controls is detailed below.

NOTE

Control position bugs are for ground use only.

Ailerons

Each aileron is represented by a bug that moves vertically in proportion to the surface movement. The upper and lower tick marks on the display represent a deflection of 15° in either direction. A split of ±2° is acceptable.

Elevator

Each elevator is represented by a bug that moves vertically in proportion to the surface movement. The upper and lower tick marks on the display represent a deflection of 18° up and 17° down.

Rudders

The rudder display is somewhat complex, due to the rudder limiting characteristics built into the rudder system. The CTRL POS page is useful for monitoring the rudder deflection in the unlikely event that the rudder limiting device should fail. Each rudder is represented by a triangular shaped bug which moves horizontally in proportion to the rudder movement. The bugs maintain constant geometry over the full travel limits of the rudders. Five vertical tick marks are shown along the horizontal line, the full length of which represents the widest range of unrestricted movement for the lower rudder. The center tick mark represent neutral surface position, while the upper and lower tick marks represent full surface position travel. At maximum travel both rudders travel together up to ±18°. The lower rudder continues up to ±30°.

Normal display for rudder limiting will show a solid green horizontal bar indicating the rudder travel that is available. If there is a failure in the rudder limiting system, availability will also be shown digitally. Availability is expressed digitally in the display as a percentage, where 100% indicates full rudder authority is available (±30° below an equivalent airspeed of 143 knots [KEAS] down to ±4° at greater than 332 KEAS). The bar length will be an average of the two rudder limiters as a function of dynamic pressure (refer to Rudder System in Section 2). Two hollow triangular shaped bugs will move horizontally across the bar to indicate upper and lower rudder position.

Single rudder limiter failures will be annunciated by an amber CAS message (RUDDER LIMIT FAIL) and amber text RUDDER LIMIT XX% located above the horizontal bar. The bar color will remain green. The rudder bar length and digits will now be a function of the operating rudder limiter constrained by the failed rudder limiter. For example, if one rudder limiter fails at 90%, the bar will continue to shrink as the operating rudder limiter moves with increasing airspeed. As the airplane slows down such that 100% rudder authority is normally available the bar would still show 90%.

Dual rudder limiter failures will be annunciated by a red CAS message RUDDER LIMIT FAIL and red text, RUDDER LIMIT XX% above the horizontal bar. The XX% will refer to the lesser limiting factor. The red rudder bar length and the digits are a function of the most restrictive limiter. A green bar will partition the red bar into two segments. The green bar length will be a function of normal operation authority versus the dynamic pressure (Q). For example, the green bar represents the amount of rudder authority the crew should have, however, the red bar extensions indicate the amount of rudder travel actually available.

The color of the bugs will follow the bar color. Each time the lower position bug moves into a red area the red CAS message RUDDER LIMIT will be reactivated.

ENG

When the ENG page is selected digital oil temperature, pressure, and ITT data will be displayed adjacent to the respective analog presentation which is always present on the EICAS display, however, when an exceedance occurs that data will be displayed when any page is displayed. The additional information provided on the status page is: which FADEC (A or B) is controlling its respective engine, and the engine status with regard to their respective oil service, represented in quarts low. The identifying text will be white. The digital color codes with respect to the indicated quantities are listed in the Eng Quarts Low table below.

Eng Quarts Low	Color
<3.0	Green
≥3.0	Amber

The bleed air duct pressure (START PRESS) will be presented digitally. Duct pressure may be from the APU, from an engine as in a cross-start situation, or from a ground power unit. The identifying text will be white, and the color code of the pressure reading will be according to the below table. Also, if the APU is running a white CAS message APU ON will appear and an additional white message will be displayed - BLD AIR VLV CLOSED or BLD AIR VLV OPEN, depending upon the status of the APU bleed air valve. The message, if it is displayed, will always be below the START PRESS annunciation. An alternate APU page is available on the MFDs.

	Green	Amber
APU Bleed Air Duct Press	≥20 ≤55	<20 >55

NORM/DCLT

When the airplane passes through 18,000 feet in the climb, a DCLT menu selection will automatically appear below the NORM menu, provided the five conditions listed after the next two paragraphs are true. Under normal conditions the airplane will be normally configured and the menu will appear. The purpose of the additional menu is to make it possible for the crew, if conditions are normal, to declutter the display. If DCLT is selected, the annunciations for stabilizer position, flap position, the systems page, and the synoptic wing view will be removed from the display. When the selection is made, the NORM DCLT menu nomenclature will be boxed. If any other menu page is selected, despite the altitude, the display will not declutter.

If at any time the crew wishes to see any of the hidden data, selecting any menu button will return all of the hidden portions. Also, any deployment of the flaps, slats, or speed brakes, plus any red or amber CAS message will automatically return the missing display elements. Detection of an asymmetric control surface will also return the display.

The display will only declutter if the following conditions are present:

1. EICAS is on the norm PAGE.
2. Pressure altitude is greater than 18,000 feet.
3. No asymmetric conditions exist.
4. Flaps, slats, and speed brakes are not deployed.
5. There are no unacknowledged CAS messages.

When "decluttered" displays are retrieved, as above, depressing the NORM DCLT menu button, or any other menu button, will toggle the display back into the declutter mode, if the flaps, speed brakes, and slats are stowed and all red or amber CAS messages have been acknowledged. Descent back through 18,000 feet will automatically return the display to NORM. A hysteresis of ±250 feet is incorporated into the automatic operation of the DCLT function, in order to prevent oscillation of the mode.

MFD PAGES

Some EICAS pages can be simultaneously displayed on the multifunction displays (MFD). Access to the menu is through the EICAS SYS menu in the MAIN 1/2 menu on the MFDs. Any combination of pages may be displayed concurrently on two MFDs and the EICAS DU. Pages for FUEL HYD, ELEC, APU, and ENG are available on the MFDs. The format of the messages and the information displayed on the MFDs is the same as that on the systems pages of the EICAS display. The NORM and CTL POS systems pages are not available on the MFDs.

The MFD APU supplementary page presents the % RPM of the APU turbine and the exhaust gas temperature (EGT) in degrees Celsius. The color of the text of the APU page is white and the color of the digits will be in accordance with the below table.

Label	Green	Amber	Red
% RPM	<101	≥101 to ≤ 108	>108
EGT °C	665	>665 ≤718	>718

ENG MSGS

When either engine shutdown (ENG SHUTDOWN) logic is active, i.e., an engine has been shut down, a menu choice entitled ENG MSGS (Engine Messages) will appear above the < key. When this button is depressed, any message that is inhibited because of the ENG SHUTDOWN logic will be de-inhibited. Pressing the ENG MSGS bezel button again will restore the ENG SHUTDOWN logic and the message will be inhibited again. If the engine shutdown logic is not active, pressing the < key will produce a white CAS message KEY NOT ACTIVE for five seconds.

CAS MESSAGES

On the Citation X, the Electronic Indicating and Crew Alerting (EICAS) System replaces the conventional annunciator panel. The Crew Alerting System (CAS) portion of the system comprises the functions described in this section. The lower middle section of the EICAS display is reserved for the CAS messages. Presentation of certain messages will be accompanied by a single attention tone, or a double chime (red message).

CREW ALERTING SYSTEM PAGE

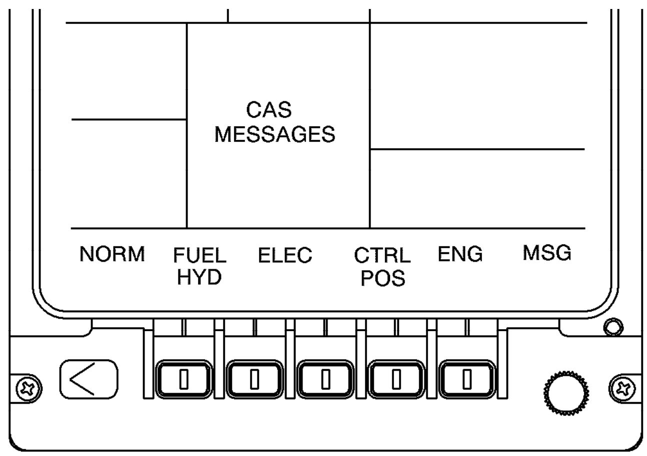


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Figure 3-43

The CAS messages are divided into four separate categories, or levels:

1. Warning (level 3)
2. Caution (level 2)
3. Advisory (level 1)
4. Status (level 0)

The colors dedicated to the various levels, beginning with level three are: red, amber, cyan (dark blue), and white. The priority order of the messages in the stacked display is: red at the top, amber in the middle, cyan at the lower middle, and white at the bottom. The possible number of CAS messages will vary slightly depending upon the equipment installed on any particular airplane.

There some conditions under which the CAS system will suppress messages. These are the Takeoff Phase Inhibit (TOPI) and Landing Operations Phase Inhibit (LOPI) situations. Certain messages, which are important but do not under the existing circumstances require immediate attention, are inhibited until the particular phase of flight during which they occurred is completed. They are discussed below in this section. Certain messages, due to their inherent characteristics, are inhibited on the ground and certain ones are inhibited in flight.

LEVEL THREE (WARNING)

A level three message is annunciated in red letters. It indicates a hazard which may require immediate recognition and corrective or compensatory action on the part of the crew. Red messages are annunciated in four ways:

1. The message will flash on the CAS screen until acknowledged, and then remain steady.
2. The message will appear on the cross-side MFD until acknowledged, and then be removed from the MFD.
3. Both of the MASTER WARNING lights will flash until acknowledged by pressing the light; the light will then extinguish.
4. There will be an audio tone (double chime) which will repeat 3 times maximum or until acknowledged.

Messages remain on the CAS display until the condition causing the message is corrected. Red messages are not allowed to scroll off the CAS display. There is room for 12 messages of 18 characters each.

LEVEL TWO (CAUTION)

A level two message is annunciated in amber letters. It indicates a need for immediate crew awareness for future corrective or compensatory action due to abnormal system conditions. Amber messages are annunciated in three ways:

1. The message will flash on the CAS screen until acknowledged, and then remain steady.
2. Both of the MASTER CAUTION lights illuminate steadily until acknowledged by pressing the light; the light will then extinguish.
3. The message will be preceded by a single attention chime.

The messages will stay on the CAS display until the condition causing the message is corrected. Amber messages can be scrolled off the screen. If a message is scrolled off the screen, there will be a status line and arrow indicating in what direction and how many messages that have been scrolled off. If an unacknowledged amber message is on the CAS display and a subsequent amber message is added, there will be no chime for each new message.

LEVEL ONE (ADVISORY)

Level one messages are annunciated in cyan (dark blue) letters. They indicate that crew awareness is required and that subsequent crew action may be required. They do not trigger any external annunciators and they require no acknowledgement. These messages flash for five seconds after appearing on the screen and then become steady. The message will remain until the condition causing its appearance is corrected. Level one messages may be scrolled off the screen.

LEVEL ZERO (STATUS)

Level zero messages are annunciated in white digits. Their purpose is to convey airplane status or operational information. These messages illuminate steadily on the CAS screen and require no acknowledgement. They do not trigger any external annunciators. Level zero messages may be scrolled off the screen.

DISPLAY

There are twelve lines in the CAS display, eleven of which are dedicated to system information, and one status line. A maximum of 18 characters can be displayed on one line. Some CAS messages have two or more colors. Under certain circumstances these messages may change color due to a redundant failures or a change in circumstances, i.e., GEN OFF L is an amber message - if the other generator should fail the message will change color to red and reappear as GEN OFF L-R. The message will require reacknowledgement. Certain messages are used for more than one related annunciation. This enables more effective use of the limited CAS message space and minimizes complexity. For instance, if an amber DU I HOT message appears and then DU 2 overheats, the original message will become DU 1-2 HOT. The new message would be relocated to the top of its stack in the same color hierarchy, and would require acknowledgement. A scroll knob (MSG) is located on the lower right side of the display; it can be used to scroll messages on and off the screen if there are more messages being displayed than can be shown at one time. When there are too many messages for them all to appear on the display at one time, or when messages have been scrolled off the display, a status line indicating a number, and an arrow, and the identification "MESSAGES" will appear at the end of the display. Its purpose is to indicate that additional messages are found in the direction of the arrow; the color of the status line will be the color of the highest level message that has been scrolled off the display.

If the screen is full of red and/or amber messages, the crew will be alerted to any new cyan or white messages by a flashing status line which will flash for five seconds. When the CAS display is full the system will not automatically scroll into view any cyan or white messages, so this is the only way the crew will become aware of the presence of additional messages.

The CAS screen will be blank when no messages are displayed. If the hardware wraparound fails, the CAS message CHECK DU 3 will appear. When CAS messages are present there will be an indented white label END at the bottom of the stack of messages to indicate that there are no more messages and/or that no messages are scrolled off the display.

FAULT WARNING COMPUTERS

As a part of the Primus 2000 complete system redundancy, the Citation X has dual fault warning computers (FWC), which contain the logic as to when a CAS message should be displayed. The fault warning computers (along with the symbol generators) comprise part of the respective (1 or 2) integrated avionics computers. If the two fault warning computers do not agree, an amber box with amber FWC will appear on both primary flight displays (PFD). The flight crew should then select the valid FWC for display on the EICAS using the SG REV switch. If the controlling FWC fails, all CAS messages and status line data will be removed and replaced with a RED X drawn through the entire CAS display area, until the crew manually selects FWC reversion by selecting SG1 or SG2 on the RC-841 reversionary/dimming control. If the cross-side fault warning computer, which is the one not driving the EICAS display, fails then an amber CAS message FWC 2 FAIL will appear.

Similarly, the Citation X is equipped with dual data acquisition units (DAU). The DAUs are separate and distinct from the fault warning computers, however, signals which result in CAS messages are sent from the originating sensors to the DAUs. The two DAUs are duplicates of each other, both having two internal channels (A and B) which compare the data before sending it on to the fault warning computers. Channel A is the default or displayed channel for each DAU. If either DAU's channel A "sees" a RED CAS message, but the other channel does not, then three CAS messages will be shown (the actual red message and the amber miscompare message [DAU 2 MISCMP] on the CAS display, and the actual red message on the cross-side MFD). The DAUs actually compare discretes; a discrete being an electrical signal (circuit) which comprises an element of information for a particular purpose. Some CAS messages require a number of discretes to be set before a CAS message is displayed. A miscompare occurs when channel A sees a different number of discretes than channel B does. If all of the discretes necessary for producing the message exist, the actual message plus the miscompare message will be displayed. Although, if an insufficient number of discretes exists then no CAS messages would be produced even in reversionary mode. Some CAS messages, however, require only one discrete to generate a CAS message. If channel B sees the discrete but channel A does not, then a DAU miscompare message will be generated. By reverting to channel B the flight crew could then observe the actual CAS message as "seen" by channel B of the DAU. The integrated maintenance test (IMT) subsystem will record all miscompare events so that maintenance personnel can later determine what discretes were involved.

The master fault warning computer drives the master (on-side) MFD and EICAS. The pilot's MFD is typically the master. Since the same message would appear on EICAS and the master MFD, there is no advantage in displaying the third message from the same source. Therefore, the non-master MFD (usually the copilot's) will display the third message. Acknowledging the red message will remove it from the multifunction display and make the display available for checklist use. If more than one level of message occurs simultaneously, a response via the MASTER WARNING will acknowledge only level three (warning) messages. A response via the MASTER CAUTION will only acknowledge amber, not red, messages. In partial power mode (only EICAS/OFF switch in the EICAS position) there will, of course, be no third location for a red message display.

If either DAU "sees" engine data but the other channel does not, then the EICAS will display an amber CAS message (DAU 1-2 MISCMP-ENG). The flight crew must then select DAU reversion to see the other channel.

If the crew selects reversion due to failure of a DAU channel A, the following information is not capable of being displayed since the excitation voltage for this data emanates only from the A channel of the DAUs:

- APU duct pressure
- BATT 1 temp
- Eng fuel temp
- Fuel tank temp
- Hydraulic pressure
- Hydraulic temp
- Hydraulic volume
- Oil level
- Oil pressure
- Oil temp
- Rudder hyd press

If both channels of a single data acquisition unit fail, EICAS will either be unable to display certain messages or the logic inputs creating them will be compromised in such a way that the message(s) is/are meaningless. The following tables list the messages which are compromised or inhibited. The first table lists those messages concerning DAU number 2, the second one DAU number 1.

Messages Compromised if DAU 2 fails:

MESSAGE	MESSAGE	MESSAGE	MESSAGE
APU GEN SWITCH ON	AC BEARING R	FUEL SCAVENGE FAIL R	PITOT HEATER R
APU GCU BIT FAIL	ANTI-ICE ENG FAIL R	FUEL TANK TEMP R	PITOT STATIC SW R
APU	ANTI-ICE ENG ON R	FUEL FLOW R	RUDDER LIMIT R
APU GEN BEARING FAIL	ANTI-ICE SLAT ON R	FUEL LEVEL LOW R	RUDDER LIMIT FAIL R
APU DUCT PRESS	ANTI-ICE STAB ON R	FUEL PRESS LOW R	SPOILERS DEPLOYED R
APU VOLTS	ANTI-ICE STAB FAIL R	FUEL BOOST PUMP ON R	SLATS STOWED R
APU AMPS	ANTI-ICE STAB O'HEAT R	FUEL FWL VLV R	SLATS DEPLOYED R
BAGGAGE AVN O'HEAT	ANTI-ICE WING FAIL R	FUEL QUANTITY R	STATIC HEATER #2 R
BAGGAGE FIRE BOTTLE	ANTI-ICE WING O'HEAT R	FUEL FILTER BYPASS R	STATIC HEATER #1 R
AUX HYD PRESS	AOA PROBE FAIL R	GEN AMPS R	START VLV OPEN R
BATT 2 VOLTS	AOA PROBE HEATER FAIL R	GCU BEARING FAIL R	T/R XSIT R
BATT 2 TEMP	AURAL WARN FAIL R	GEN VOLTS R	T/R MASTER WARNING R
CABIN PAC HI	AVN HOT BAG NOSE R	GEN BEARING FAIL R	T/R STOW R
CABIN DOOR SEAL	BATT OFF R	GEN BUS SOURCE R	T/R DEPLOY R
CABIN DOOR UNLOCKED	BATT O'CURRENT R	GEN CB R	WINDSHIELD O'HEAT R
CABIN VENT DOOR	CABIN ALT >10,000 FT R	HYD FWL VLV B	WINDSHIELD FLT WARN R
COCKPIT DUCT O'HEAT	CABIN ALT >8,500 FT R	HYD TEMP B	WING TANK O'FULL R
COCKPIT PAC O'HEAT	CABIN ALT >14,500 FT R	HYD PRESS B	PITCH FEEL FAIL
FLAP POSITION	CTR-WING XFER ON/OFF R	HYD VOLUME B	
FUEL CROSSFEED	DC BUS EMER R	HYD PRESS LOW B	SECONDARY TRIM FAIL
GLARE FAN #2	ENG OIL TEMP R	HYD VOLUME LOW B	SLATS FAIL
HYD PWR TRANS VLV	ENG START R	HP DUCT O'PRESS R	SMOKE DETECT BAGGAGE
HYD AUX PRESS LOW	ENG FUEL TEMP R	HP P'COOLER O'HEAT R	SP REFUEL DOOR OPEN
HYD UNLOAD VLV B	ENG OIL PRESS R	LAND GEAR UPLOCK R	SELCAL HF 2
NOSE FAN #2	ENG TURBINE VIB R	NOSE DOOR OPEN R	SELCAL VHF 2
ISOL VLV OPEN	ENG FAN VIB R	NACELLE DOOR R	SELCAL UHF
NOSE WHL STEERING FAIL	ENG FIRE R	OIL CHIP DETECT R	STALL WARN #2 VALID
NOSE AVN O'HEAT	FADEC CH A/B R	OIL LEVEL R	TOILET DOOR OPEN
NOSE LAND GEAR UNLOCK	FIRE BOTTLE LOW R	OIL PRESS LOW R	WEIGHT ON WHEELS
PARK BRAKE	FIRE DETECTION FAIL R	PAC HP VLV OPEN R	XFEED BUS SOURCE

(Continued Next Page for DAU Number 1)

Messages compromised if DAU number 1 fails:

MESSAGE	MESSAGE	MESSAGE	MESSAGE
AILERON LATCH	ANTI-ICE SLAT ON L	FUEL FWL VLV L	START VLV OPEN L
APU FIRE BOTTLE LOW	ANTI-ICE STAB ON L	FUEL QUANTITY L	T/R XSIT L
ANTISKID FAIL	ANTI-ICE STAB FAIL L	FUEL FILTER BYPASS L	T/R MASTER WARNING L
APU BUS SOURCE	ANTI-ICE STAB O'HEAT L	GEN AMPS L	T/R STOW L
APU FIRE	ANTI-ICE WING FAIL L	GCU BEARING FAIL L	T/R DEPLOY L
APU FIRE DETECT FAIL	ANTI-ICE WING O'HEAT L	GEN VOLTS L	WINDSHIELD O'HEAT L
BAGGAGE ALTITUDE	AOA PROBE FAIL L	GEN BEARING FAIL L	WINDSHIELD FLT WARN L
BAGGAGE DOOR	AOA PROBE HEATER FAIL L	GEN BUS SOURCE L	WING TANK O'FULL L
BATT DISC 1	AURAL WARN FAIL L	GEN CB L	LAND GEAR UNLOCKED
BATT BUS SOURCE	AVN HOT BAG NOSE L	HYD FWL VLV A	LATERAL ACCEL (FDR)
BATT 1 VOLTS	BATT OFF L	HYD TEMP A	LONGITUDE ACCEL (FDR)
BATT 1 TEMP	BATT O'CURRENT L	HYD PRESS A	NORMAL ACCEL (FDR)
COCKPIT PAC HI	CABIN ALT >10,000 FT L	HYD VOLUME A	
CABIN DOOR	CABIN ALT >8,500 FT L	HYD PRESS LOW A	PITCH/ROLL DISCONNECT
CABIN DUCT O'HEAT	CABIN ALT >14,500 FT L	HYD VOLUME LOW A	PRI STAB TRIM 1 CB
CABIN PAC O'HEAT	CTR-WING XFER ON/OFF L	HP DUCT O'PRESS L	PRI STAB TRIM 2 CB
COMPARTMENT LTS CB	DC BUS EMER L	HP P'COOLER O'HEAT L	PRIMARY TRIM FAIL
CTR FUEL QUANTITY	ENG OIL TEMP L	LAND GEAR UPLOCK L	SEAT BELT
CROSS TIE CLOSED	ENG START L	NOSE DOOR OPEN L	SMOKE DETECT CABIN
CVR FAIL	ENG FUEL TEMP L	NACELLE DOOR L	SPEED BRAKE
ESCAPE HATCH OPEN	ENG OIL PRESS L	OIL CHIP DETECT L	SPEED BRAKE ASYMMETRY
FDR FAIL	ENG TURBINE VIB L	OIL LEVEL L	SELCAL HF 1
FLAP INOP	ENG FAN VIB L	OIL PRESS LOW L	SELCAL VHF 3
FUEL GRAVITY XFLOW VLV	ENG FIRE L	PAC HP VLV OPEN L	SELCAL VHF 1
GLARE FAN #1	FADEC CH A/B L	PITOT HEATER L	STALL WARN #1 VALID
HF FAN	FIRE BOTTLE LOW L	PITOT STATIC SW L	TAILCONE DOOR OPEN
HYD AUX PUMP ON	FIRE DETECTION FAIL L	RUDDER LIMIT L	TAIL FAN FAIL
HYD SYS TEST VLV CLSD	FUEL SCAVENGE FAIL L	RUDDER LIMIT FAIL L	WEIGHT ON WHEELS
HYD UNLOAD VLV A	FUEL TANK TEMP L	SPOILERS DEPLOYED L	WINDSHIELD BLD AIR VLV
NOSE FAN #1	FUEL FLOW L	SLATS STOWED L	XFEED BUS SOURCE
AC BEARING L	FUEL LEVEL LOW L	SLATS DEPLOYED L	
ANTI-ICE ENG FAIL L	FUEL PRESS LOW L	STATIC HEATER #2 L	
ANTI-ICE ENG ON L	FUEL BOOST PUMP ON L	STATIC HEATER #1 L	

Some messages will be masked, removed, or delayed from being displayed under certain conditions. This helps to keep the CAS screen as clean as possible. Allowing certain messages to appear only when they are meaningful helps to reduce crew workload, and helps to reduce crew complacency which could develop due to CAS messages constantly appearing on the screen at times when they might have only marginal meaning.

- APU duct pressure
- BATT 1 temp
- Eng fuel temp
- Fuel tank temp
- Hydraulic pressure
- Hydraulic temp
- Hydraulic volume
- Oil level
- Oil pressure
- Oil temp
- Rudder hyd press

If both channels of a single data acquisition unit fail, EICAS will either be unable to display certain messages or the logic inputs creating them will be compromised in such a way that the message(s) is/are meaningless. The following tables list the messages which are compromised or inhibited. The first table lists those messages concerning DAU number 2, the second one DAU number 1.

Messages Compromised if DAU 2 fails:

MESSAGE	MESSAGE	MESSAGE	MESSAGE
APU GEN SWITCH ON	AC BEARING R	FUEL SCAVENGE FAIL R	PITOT HEATER R
APU GCU BIT FAIL	ANTI-ICE ENG FAIL R	FUEL TANK TEMP R	PITOT STATIC SW R
APU	ANTI-ICE ENG ON R	FUEL FLOW R	RUDDER LIMIT R
APU GEN BEARING FAIL	ANTI-ICE SLAT ON R	FUEL LEVEL LOW R	RUDDER LIMIT FAIL R
APU DUCT PRESS	ANTI-ICE STAB ON R	FUEL PRESS LOW R	SPOILERS DEPLOYED R
APU VOLTS	ANTI-ICE STAB FAIL R	FUEL BOOST PUMP ON R	SLATS STOWED R
APU AMPS	ANTI-ICE STAB O'HEAT R	FUEL FWL VLV R	SLATS DEPLOYED R
BAGGAGE AVN O'HEAT	ANTI-ICE WING FAIL R	FUEL QUANTITY R	STATIC HEATER #2 R
BAGGAGE FIRE BOTTLE	ANTI-ICE WING O'HEAT R	FUEL FILTER BYPASS R	STATIC HEATER #1 R
AUX HYD PRESS	AOA PROBE FAIL R	GEN AMPS R	START VLV OPEN R
BATT 2 VOLTS	AOA PROBE HEATER FAIL R	GCU BEARING FAIL R	T/R XSIT R
BATT 2 TEMP	AURAL WARN FAIL R	GEN VOLTS R	T/R MASTER WARNING R
CABIN PAC HI	AVN HOT BAG NOSE R	GEN BEARING FAIL R	T/R STOW R
CABIN DOOR SEAL	BATT OFF R	GEN BUS SOURCE R	T/R DEPLOY R
CABIN DOOR UNLOCKED	BATT O'CURRENT R	GEN CB R	WINDSHIELD O'HEAT R
CABIN VENT DOOR	CABIN ALT >10,000 FT R	HYD FWL VLV B	WINDSHIELD FLT WARN R
COCKPIT DUCT O'HEAT	CABIN ALT >8,500 FT R	HYD TEMP B	WING TANK O'FULL R
COCKPIT PAC O'HEAT	CABIN ALT >14,500 FT R	HYD PRESS B	PITCH FEEL FAIL
FLAP POSITION	CTR-WING XFER ON/OFF R	HYD VOLUME B	
FUEL CROSSFEED	DC BUS EMER R	HYD PRESS LOW B	SECONDARY TRIM FAIL
GLARE FAN #2	ENG OIL TEMP R	HYD VOLUME LOW B	SLATS FAIL
HYD PWR TRANS VLV	ENG START R	HP DUCT O'PRESS R	SMOKE DETECT BAGGAGE
HYD AUX PRESS LOW	ENG FUEL TEMP R	HP P'COOLER O'HEAT R	SP REFUEL DOOR OPEN
HYD UNLOAD VLV B	ENG OIL PRESS R	LAND GEAR UPLOCK R	SELCAL HF 2
NOSE FAN #2	ENG TURBINE VIB R	NOSE DOOR OPEN R	SELCAL VHF 2
ISOL VLV OPEN	ENG FAN VIB R	NACELLE DOOR R	SELCAL UHF
NOSE WHL STEERING FAIL	ENG FIRE R	OIL CHIP DETECT R	STALL WARN #2 VALID
NOSE AVN O'HEAT	FADEC CH A/B R	OIL LEVEL R	TOILET DOOR OPEN
NOSE LAND GEAR UNLOCK	FIRE BOTTLE LOW R	OIL PRESS LOW R	WEIGHT ON WHEELS
PARK BRAKE	FIRE DETECTION FAIL R	PAC HP VLV OPEN R	XFEED SOURCE

(Continued Next Page for DAU Number 1)

Messages compromised if DAU number 1 fails:

MESSAGE	MESSAGE	MESSAGE	MESSAGE
AILERON LATCH	ANTI-ICE STAB ON L	FUEL FILTER BYPASS L	STATIC HEATER #2 L
APU FIRE BOTTLE LOW	ANTI-ICE STAB FAIL L	GEN AMPS L	STATIC HEATER #1 L
ANTISKID FAIL	ANTI-ICE STAB O'HEAT L	GCU BEARING FAIL L	START VLV OPEN L
APU BUS SOURCE	ANTI-ICE WING FAIL L	GEN VOLTS L	T/R XSIT L
APU FIRE	ANTI-ICE WING O'HEAT L	GEN BEARING FAIL L	T/R MASTER WARNING L
APU FIRE DETECT FAIL	AOA PROBE FAIL L	GEN BUS SOURCE L	T/R STOW L
BAGGAGE ALTITUDE	AOA PROBE HEATER FAIL L	GEN CB L	T/R DEPLOY L
BAGGAGE DOOR	AURAL WARN FAIL L	HYD FWL VLV A	WINDSHIELD O'HEAT L
BATT DISC 1	AVN HOT BAG NOSE L	HYD TEMP A	WINDSHIELD FLT WARN L
BATT BUS SOURCE	BATT OFF L	HYD PRESS A	WING TANK O'FULL L
BATT 1 VOLTS	BATT O'CURRENT L	HYD VOLUME A	LAND GEAR UNLOCKED
BATT 1 TEMP	CABIN ALT >10,000 FT L	HYD PRESS LOW A	LATERAL ACCEL (FDR)
COCKPIT PAC HI	CABIN ALT >8,500 FT L	HYD VOLUME LOW A	LONGITUDE ACCEL (FDR)
CABIN DOOR	CABIN ALT >14,500 FT L	HP DUCT O'PRESS L	NORMAL ACCEL (FDR)
CABIN DUCT O'HEAT	CTR-WING XFER ON/OFF L	HP P'COOLER O'HEAT L	PITCH/ROLL DISCONNECT
CABIN PAC O'HEAT	ENG OIL TEMP L	JBOX LIMITER OPEN	PRI STAB TRIM 1 CB
COMPARTMENT LTS CB	ENG START L	LAND GEAR UPLOCK L	PRI STAB TRIM 2 CB
CTR FUEL QUANTITY	ENG FUEL TEMP L	LOAD SHED	PRIMARY TRIM FAIL
CVR FAIL	ENG OIL PRESS L	LOAD SHED O'RIDE	SEAT BELT
ESCAPE HATCH OPEN	ENG TURBINE VIB L	NOSE DOOR OPEN L	SMOKE DETECT CABIN
FDR FAIL	ENG FAN VIB L	NACELLE DOOR L	SPEED BRAKE
FLAP INOP	ENG FIRE L	OIL CHIP DETECT L	SPEED BRAKE ASYMMETRY
FUEL GRAVITY XFLOW VLV	FADEC CH A/B L	OIL LEVEL L	SELCAL HF 1
GLARE FAN #1	FIRE BOTTLE LOW L	OIL PRESS LOW L	SELCAL VHF 3
HF FAN	FIRE DETECTION FAIL L	PAC HP VLV OPEN L	SELCAL VHF 1
HYD AUX PUMP ON	FUEL SCAVENGE FAIL L	PITOT HEATER L	STALL WARN #1 VALID
HYD SYS TEST VLV CLSD	FUEL TANK TEMP L	PITOT STATIC SW L	TAILCONE DOOR OPEN
HYD UNLOAD VLV A	FUEL FLOW L	RUDDER LIMIT L	TAIL FAN FAIL
NOSE FAN #1	FUEL LEVEL LOW L	RUDDER LIMIT FAIL L	WEIGHT ON WHEELS
AC BEARING L	FUEL PRESS LOW L	SPOILERS DEPLOYED L	WINDSHIELD BLD AIR VLV
ANTI-ICE ENG FAIL L	FUEL BOOST PUMP ON L	SLATS STOWED L	XFEED BUS SOURCE
ANTI-ICE ENG ON L	FUEL FWL VLV L	SLATS DEPLOYED L	
ANTI-ICE SLAT ON L	FUEL QUANTITY L		

Some messages will be masked, removed, or delayed from being displayed under certain conditions. This helps to keep the CAS screen as clean as possible. Allowing certain messages to appear only when they are meaningful helps to reduce crew workload, and helps to reduce crew complacency which could develop due to CAS messages constantly appearing on the screen at times when they might have only marginal meaning.

Some examples of this inhibit logic are discussed below.

When the system detects idle cutoff (TLA <8° and the FADEC declares engine not running) on either engine, certain messages will be replaced with the cyan CAS message "ENGINE SHUTDOWN L-R" after a very slight delay. This message provides less distraction to the crew when an engine is shutdown. Also, when the throttles are not in cutoff and the FADEC declares the engine incapable, a red CAS message "ENGINE FAILED L-R" will be displayed. The table below presents the CAS message affected by this logic.

Message	Engine Failed	Engine Shut Down
AC BEARING L-R	YES	YES
BAGGAGE DOOR SEAL		YES
CABIN DOOR SEAL		YES
CHIP DETECT	YES	YES
DC BEARING L-R	YES	
ENG TLA FAILED L-R	YES	YES
ENG TR SW FAULT L	YES	YES
ENG TR SW FAULT R	YES	
ENG VIB L-R (amber)	YES	YES
ENG VIB L-R (red)	YES	YES
ENG FAILED L-R		YES
FADEC BUS FAIL L-A	YES	YES
FADEC BUS FAIL L-B	YES	YES
FADEC BUS FAIL R-A	YES	YES
FADEC BUS FAIL R-B	YES	YES
FADEC FAIL L A-B	YES	
FADEC FAIL R A-B	YES	
FADEC REV ADC-N1L	YES	
FADEC REV ADC-N1R	YES	
FAN DAMAGE	YES	
FUEL BOOST ON L-R (amber)		YES
FUEL BOOST ON L-R (white)		YES
FUEL PRESS LOW L-R	YES	YES
FUEL TEMP L-R	YES	YES
GEN OFF L-R (amber)		YES

(Inhibit Logic Table Continued Next Page)

(Inhibit Logic Table Continued)

Message	Engine Failed	Engine Shut Down
GEN OFF L-R (red)		YES
HYD PUMP FAIL A-B (amber)		YES
HYD PUMP FAIL A-B (red)		YES
OIL LEVEL LOW L-R	YES	YES
OIL PRESS LOW	YES	YES
START VLV OPEN L-R		YES
TR AUTOSTOW (amber)		YES
TR AUTOSTOW (red)		YES
WSHLD HEAT INOP L		YES
WSHLD HEAT INOP R		YES

Some CAS messages have a built in delay before they are displayed. This designed hysteresis prevents nuisance messages which would otherwise occur during valve transients and other momentary occurrences due to system reconfiguration etc.

Some CAS messages are restricted to being shown when the airplane is on the ground, and others pertain only to flight.

TAKEOFF PHASE INHIBIT (TOPI) AND LANDING PHASE INHIBIT (LOPI)

During the critical phases of flight represented by takeoff and landing, in order to minimize crew distraction and work load, as well as for reasons of safety, a majority of CAS messages are inhibited. Any messages that are currently displayed will not be removed by TOPI or LOPI, and any message that has not been acknowledged can still be acknowledged.

The following table lists the operations that are not inhibited by TOPI or LOPI modes.

TOPI	LOPI
ANTISKID FAIL	ALL REDs
APU FIRE	AUTOPILOT (aural)
DUAL GEN FAILURE	MINIMUMS (aural)
ENGINE FIRE L-R	LANDING GEAR (aural)
ENGINE FAILED L-R	SPEED BRAKES
TR AUTOSTOW	YD FAIL UPPER RUDDER A. B
NO TAKEOFF	

NO TAKEOFF ANNUNCIATION

There are certain conditions of airplane configuration and/or equipment malfunctions which will cause a NO TAKEOFF CAS message. If these conditions are present, but there is no intent (i.e., throttle position, etc.) to take off, the message will be CYAN in color and will be advisory in nature. If at least one throttle is placed to a throttle lever angle (TLA) greater than 60 degrees, the message will change to a flashing RED EICAS warning, a flashing MASTER WARNING light and a steady CAS message on the cross-side MFD. The NO TAKEOFF warning cannot be muted by acknowledging the annunciation. The NO TAKEOFF audio (chime) warning is not cancelable, even though the flashing message and the master warning can be acknowledged, which will stop the flashing. The warning will otherwise stop only when the condition causing it is rectified.

AUDIO WARNINGS

Audio signals provided in the Citation X are composed of unique tones and some CAS messages (level 2 and 3) are preceded by a chimes. The level two conditions are preceded by a single chime and level three conditions are preceded by double chimes. Some other conditions are annunciated by distinctive warning horns. The audio chime tones provided upon the appearance of level two or three CAS messages are meant to draw attention to the fact that a message has appeared and they serve to indicate, by the number of chimes, the level of seriousness. Also, some aural warnings (i.e., WINDSHEAR), do not have complementary visual CAS or MFD annunciations. The level of audio output from the integrated avionics computers increases in four steps as a function of dynamic pressure (Q) sensed by the system, in order to guarantee that the audio messages will be audible in all flight regimes.

Aural Priorities

The aural prioritization for the Primus 2000 system installed in the Citation X is:

1. WINDSHEAR
2. GROUND PROXIMITY WARNING SYSTEM (GPWS)
3. TRAFFIC and COLLISION ALERTING SYSTEM (TCAS)
4. ENGINE INDICATING and CREW ALERTING SYSTEM (EICAS) CHIMES

Each system has the capability to mute or inhibit the subordinate systems. For example WINDSHEAR will inhibit the two remaining aural systems.

In the Citation X occurrence of conditions which produce different unique tones are the following: altitude deviation ± 250 feet, altitude alert ± 1000 feet, abnormal autopilot disconnect, and decision height altitude. The landing gear warning horn and the V_{MO}/M_{MO} overspeed warning horn also produce distinctive aural warnings. A trim-in-motion clacker will also sound during autopilot trimming, if the autopilot trims longer than a minimum set time.

The following table lists those CAS messages, their level, and the tone configuration.

CAS Message	Level	Tone
ENGINE FIRE L	3	Double Chime
ENGINE FIRE R	3	Double Chime
ENGINE FAILED L	3	Double Chime
ENGINE FAILED R	3	Double Chime
TR AUTOSTOW L-R	3	Double Chime (Note 1)
RUDDER LIMITER FAIL	3	Double Chime
APU FIRE	3	Double Chime
BAGGAGE SMOKE	3	Double Chime
CABIN SMOKE	3	Double Chime
CABIN ALTITUDE	3	Double Chime
HYD PUMP FAIL A-B	3	Double Chime (Note 1)
HYD O'TEMP A-B	3	Double Chime
OIL PRESS LOW L	3	Double Chime
OIL PRESS LOW R	3	Double Chime
BATTERY O'TEMP 1-2	3	Double Chime
PYLON BLEED LEAK L-R	3	Double Chime
ENG VIBRATION L-R	3	Double Chime
GEN OFF L-R	3	Double Chime (Note 1)
NO TAKEOFF	3	Double Chime
AUTO SLATS FAIL	3	Double Chime
CHECK PFD	3	Double Chime
EMERGENCY DESCENT	3	Double Chime
MASTER WARNING *	-	Chime

* Denotes non-CAS message

Notes:
1. Single chime for left or right
2. Non-repeating single chime
3. Autopilot unique tone
4. Unique tone (all unique tones are different)
5. Distinctive warning horn
6. Distinctive stand alone horn
7. Distinctive trim-in-motion clacker
8. The double chimes repeat until acknowledged

(CAS Messages Table for Tone Configuration, Continued Next Page)

CAS Messages Table for Tone Configuration (Continued)

CAS Message	Level	Tone
AP OFF - Abnormal	2	Note 3
PRI STAB TRIM FAILURE	2	Note 2
YD FAIL	1	Note 2
AP OFF Normal*	1	Note 2
MASTER CAUTION *	-	Chim
ALTITUDE DEVIATION ±250' *	-	Note 2
ALTITUDE ALERT ±1000' *	-	Note 4
VERTICAL TRACK ALERT *	-	Note 2
Decision Height *	-	Note 2
LANDING GEAR *	-	Note 5
SEL-CAL	0	Note 2
OVERSPEED *	-	Note 6
TRIM IN MOTION *	-	Note 7

* Denotes non-CAS message

Notes:
1. Single chime for left or right
2. Non-repeating single chime
3. Autopilot unique tone
4. Unique tone (all unique tones are different)
5. Distinctive warning horn
6. Distinctive stand alone horn
7. Distinctive trim-in-motion clacker
8. The double chimes repeat until acknowledged

ROTARY TEST SWITCH

The rotary test switch has functions which interface with the crew alerting system (CAS), and which are tested in the various positions of the switch. For information concerning these CAS messages refer to Rotary Test Switch in Section Two of this Manual.

PRIMUS 2000 PILOT'S MANUAL

The engine indicating and crew alerting system (EICAS) is part of the Primus 2000 avionics system. For a more detailed list of all possible CAS messages and conditions which will cause their annunciation, as well as for further detailed and specific information concerning the EICAS system, refer to the Primus 2000 Pilot's Manual for the Primus 2000 Integrated Avionics System and Flight Control Systems for the Citation X - Publication Number A28-1146-104-00, or appropriate revision. When the Citation X, equipped with the Primus 2000 Integrated Avionics System and Flight Control System is being operated, the above manual must be immediately available to the flight crew.

ALPHABETIC LIST OF CAS MESSAGES

In the following list: A = Amber, C = Cyan, R = Red, and W = White.

C AC BEARING L-R
W ACFT MAINTENANCE
C AHRS 1-2 AUX POWER
W AHRS 1-2 BASIC
A AILERON LATCHED
A ANTI SKID FAIL
A AOA HEAT FAIL L-R
A AOA PROBE FAIL L-R
A AP STAB TRIM INOP
R APU FIRE
W APU ON
R AUTO SLATS FAIL
A AVN HOT BAG - NOSE
W AVN MAINTENANCE
A BAGGAGE ALTITUDE
A BAGGAGE DOOR OPN
A BAGGAGE DOOR SEAL
R BAGGAGE SMOKE
R BATT 1-2 O'TEMP
A BUS CRTL 1-2 FAIL
W BUS ISO OPEN L-R
R CABIN ALTITUDE
A CABIN ALTITUDE
A CABIN DOOR OPEN
A CABIN DOOR SEAL
A CABIN PAC O'TEMP
A CBN VENT DOOR OPN
A CHECK AP ENGAGE
A CHECK DU 1-2-3-4-5
R CHECK PFD
W CHECKLISTMISMATCH
A CHIP DETECT L-R
A COCKPIT PAC O'TEMP
A CONFIG MISMTCH 1-2
A CTR XFER OFF L-R
A CTR XFER XSIT L-R
C CVR FAIL
A DAU 1-2 MISCMP
A DAU 1-2 MISCMP-ENG
A DAU 1A-1B-2A-2B FAIL
A DAU ALL FAIL
C DC BEARING L-R-APU
A DC OVERCURRENTL-R
A DU 1-2-3-4-5 HOT
A DUCT O-TEMP CABIN
A DUCT O'TEMP CKPT
R EMERGENCYDESCENT
A ENG A/I COLD L-R
C ENG A/I COLD L-R
A ENG A/I HOT L-R
A ENG MTR VLV FAIL L
A ENG MTR VLV FAIL R
A ENG O'SPD SHUTDN L
A ENG O'SPD SHUTDN R
C ENG SHUTDOWN L-R
A ENG TLA FAILED L-R
A ENG TR SW FAULT L
A ENG TR SW FAULT R
A ENG VIBRATION L-R
R ENG VIBRATION L-R
R ENGINE FAILED L-R
R ENGINE FIRE L-R
A ESCAPE HATCH OPEN
A FADEC BUS FAIL L-A
A FADEC BUS FAIL L-B
A FADEC BUS FAIL R-A
A FADEC BUS FAIL R-B
A FADEC FAIL L A-B
A FADEC FAIL R A-B
A FADEC FAULT L A-B
A FADEC FAULT R A-B
A FADEC REV ADC-N1 L
A FADEC REV ADC-N1 R
A FAN DAMAGE L-R
C FDR FAIL
A FGC A-B FAIL
W FGC A-B MASTER
C FGC-ADC MISCMP
C FGC ATT MISCMP
C FIRE BOTTL LOW APU
C FIRE BOTTL LOW L-R
A FIRE DETECT FAIL A
A FIRE DETECT FAIL L
A FIRE DETECT FAIL R
A FLAPS FAIL
A FLEX MISCMP
C FLIGHT IDLE L-R
A FLT CONTROL FAULT
A FUEL BOOST ON L-R
W FUEL BOOST ON L-R
A FUEL DOOR OPEN
A FUEL FLTR BYPASS L
A FUEL FLTR BYPASS R
W FUEL FW VLV CLSD L
W FUEL FW VLV CLSD R
A FUEL FW VLV XSIT L
A FUEL FW VLV XSIT R
W FUEL GRV XFLWOPEN
C FUEL GRV XFLW XSIT
A FUEL IMBALANCE
A FUEL LEVEL LOW L-R
A FUEL MOTV FAIL L-R
A FUEL PRESS LOW L-R
A FUEL TEMP L-R
W FUEL XFEED OPEN
A FUEL XFEED XSIT
A FWC 1-2 FAIL
A GEN OFF L-R
R GEN OFF L-R
A GPWS FAIL
A GROUND IDLE L-R
C GUST LOCK ON
A HP DUCT O'PRESS L
A HP DUCT O'PRESS R
A HP PCOOLR O'HT L-R
W HYD AUX PUMP ON
W HYD FW SHUTOFF A-B
A HYD O'TEMP A-B
R HYD O'TEMP A-B
A HYD PTU FAIL
A HYD PUMP FAIL A-B
R HYD PUMP FAIL A-B
A HYD PUMP UNLOAD A
A HYD PUMP UNLOAD B
A HYD VOLUME LOW A-B
A IAC 1-2 O'TEMP
A IAC BIT INOP 1-2
A ICE DETECTED
W ICE DETECTED
W IMT - AFCS ON
W IMT - IAS HIGH
W IMT - NO EFIS
W IMP - NO WOW
W IRS HI LAT ALN 1-2
C JBOX LIMTER OPEN L
C JBOX LIMTER OPEN R
W KEY NOT ACTIVE
A LATERAL MODE OFF
A LOAD SHED
C LOAD SHED OVERRIDE
A MACH TRIM OFF
A NACELLE OPEN L-R
C NO TAKEOFF
R NO TAKEOFF
A NOSE DOOR OPEN L-R
A NOSE WHL STR INOP
C OIL FLTR BYPASS L
C OIL FLTR BYPASS R
A OIL LEVEL LOW L-R
R OIL PRESS LOW L-R
A P/S-RAT HEAT OFF
C P/S-RAT HEAT OFF
W PAC HI CKPT-CBN
W PAC HP VLV OPN L-R
C PARK BRAKE ON
A PARK BRAKE ON
A PARK BRK/LOW PRESS
A PITCH FEEL FAIL
A PITCH/ROLL DISC
A PITOT HTR FAIL L-R
A PITOT HTR FAIL SB
A PRI STAB TRIM FAIL
A DC XTIE
R PYLON BLEED LEAK L-R
A RAT HEAT FAIL L-R
A RAT PROBE FAIL L-R
C RAT PROBE FAIL L-R
C REMOTE CB TRIPPED
A RETRIM L-R WING DWN
A RETRIM NOSE UP-DWN
A RUD STBY SYS FAIL
A RUDDER LIMIT FAIL
R RUDDER LIMIT FAIL
W SATCOM CALL 1-2
A SEC STAB TRIM FAIL
W SELCAL HF 1-2 UHF
W SELCAL VHF 1-2-3
A SG 1-2 FAIL
A SLAT A/I COLD L-R
C SLAT A/I COLD L-R
A SLAT A/I HOT L-R
A SLATS ASYMMETRY
A SLATS FAIL
W SPEED BRAKES
A SPEED BRAKES
A STAB A/I COLD L-R
A STAB A/I HOT L-R
R STAB BLD LEAK L-R
A STAB TRIM MISCMP
A STALL WARN L-R
A START VLV OPEN L-R
A STATIC HT FAIL L-R
A TAILCONE BLD LEAK
A TAILCONE DOOR OPEN
A TOILET DOOR OPEN
C TONE GEN 1-2 FAIL
A TR AUTOSTOW L-R
R TR AUTOSTOW L-R
A VERTICAL MODE OFF
A WINDSHEAR FAIL
A WING A/I COLD L-R
C WING A/I COLD L-R
A WING A/I HOT L-R
C WING BLD LEAK L-R
A WING CUFF COLD L-R
A WING CUFF HOT L-R
A WING TANK O'FULL L
A WING TANK O'FULL R
A WSHLD HEAT INOP L
A WSHLD HEAT INOP R
A WSHLD O'TEMP L-R
A YD FAIL LOWER A-B
C YD FAIL LOWER A-B
A YD FAIL UPPER A-B
C YD FAIL UPPER A-B
A YD NOT CENTERED
A YD OFF LOWER
C DC XTIE

AREA NAVIGATION

P2000 FLIGHT MANAGEMENT SYSTEM

The FMZ Series P2000 Flight Management System is an integrated flight management system which receives input from various sensors, processes the information, and computes a composite airplane position from the data. It provides lateral steering information to the pilot through the electronic horizontal situation indicators (EHSI) in the primary flight displays (PFD) and through the selectable displays in the multifunction displays (MFD), and when connected to the autopilot, roll steering commands. It also provides vertical steering commands through the VNAV mode when the FMS (LNAV) is engaged as the NAV mode. In the Citation X, the vertical navigation mode operates only through the flight management system. The FMZ P2000 FMS also provides certain airplane performance information based on information contained in its memory bank and/or provided by the pilot for each flight. The system also provides navigation information outputs which enable display of the active flight plan on the PFD and MFD. The FMZ P2000 is installed as a standard dual system which operates in conjunction with the Primus 2000 Flight Guidance System.

The system uses inputs from VOR, DME, GPS (Global Positioning Satellite), and the attitude and heading reference system (AHRS) sources. Other optional navigation sources such as an inertial reference system (INS) and/or a VLF/Omega system may be interfaced with the FMS. The navigation computer automatically selects the best navigation combinations of fixing (DME/DME, VOR/DME, GPS, VLF, AHRS, etc.), based on a predefined priority, combined with qualitative selectivity of signals.

The FMZ P2000 consists of a color Control Display Unit (CD-810) and a navigation computer (NZ-2000). The standard Honeywell Global Positioning System (GPS), a separate sensor which supplies information to the navigation computer, increases the overland and overwater navigation capacity and provides navigation capability outside the range of reception of VOR and DME facilities.

The navigation database must be updated every 28 days. A DL-900 data loader (provided standard with the airplane) must be used, with current software, to update the FMS. Pilot entered individual flight plans that have been stored are not affected by the data base, and are not entered into it. They must be separately amended or deleted.

The CD-810 color control display unit (CDU) enables the pilot to interface with the system. It provides the display for navigation and performance computations and, through its alphanumeric keyboard, provides access to the system for inserting flight plans, giving navigation commands and extracting information from the system, etc. The alphanumeric keys make entries only to the scratchpad at the bottom of the CDU display. There are CDU keys for the numbers 0 to 9, a decimal, a dash, and a slash. There is also a delete key (DEL), a clear key (CLR), and a period. The scratchpad is a working area where the pilot can enter and verify data before selecting the data to its proper position. The scratchpad also displays advisory and alerting messages. Its first priority is the display of alerting messages, followed by advisory messages, the delete function, and finally entries from the keyboard or line select keys.

Through the color coding of the CDU display it is possible to highlight and differentiate information for immediate recognition. Vertical and atmospheric data are colored cyan (dark blue), lateral navigation information and index selections are green, FROM waypoints are yellow, TO waypoints are magenta, prompts and titles are white, and flight plan names are displayed in orange.

P2000 CONTROL DISPLAY UNIT (CDU)

6285P6085

FIgure 3-44

There are four line select keys on each side of the CDU. Data is selected to a line from the scratchpad, or vice-versa, through the use of the line select keys. These keys are identified from top to bottom as 1L through 4L on the left side and 1R through 4R on the right side. When an index is displayed, for example, the line select keys are used to select functions from the index displayed on the CDU. In displays other than indices, the bottom line select keys (4L and 4R) are primarily used for direct access to other functions in the FMS system.

Six annunciators are located along the top of the CDU. They operate independently of the cathode ray tube (CRT) readout and the keyboard. They display advisory (amber) and alerting (white) messages

A brightness control is located on the face of the CDU. Overall brightness of the CRT may be selected and the selected brightness will be maintained, under different lighting conditions, by automatic photo sensors.

The FMZ P2000 system is powered up when electrical power is available and the avionics master switch is ON.

AUTOTUNING

In various aircraft the system of autotuning the navigation radios (and sometimes other avionics) by the flight management system is treated in different ways. For this reason the following specific information concerning the Citation X is provided. In the Citation X there are no external autotuning switches to enable or disable the autotuning function; it is controlled through the FMS CDU or the radio control head only. If the FMS is selected on the SC-840 for navigation, the FMS system will autotune unless it is disabled to prevent it from doing so, or unless the pilot has tuned the NAV radios through the FMS or from the radio control head. The FMS will not autotune a frequency that the pilot has selected. It will also not autotune when the preview (PRE) mode has been selected. The left FMS autotunes the left (pilot's) radios and the right FMS autotunes the right (copilot's) radios. There is no “cross-selection” of autotuning.

The last three lines of the RADIO TUNING page on the CDU are dedicated to the VOR and DME (NAV) radios. The currently tuned frequencies and VOR identifiers for those radios are displayed under the headings NAV 1 and NAV 2. The same display and functions are also displayed on page one of the PROGRESS page.

When the FMS is using VOR and DME data for navigation, a U appears in front of the Navaid identifier on the VOR/DME page. The small letter in front of the NAVAID identifies in the lower part of the RADIO TUNING page indicates the tuning mode for the NAV radios (VOR and DME). If the letter T is displayed, the FMS is tuning the station and verifying the data from the NAVAID before it starts using the station to compute the airplane’s positions

The following tuning modes exist: A (auto tune), V (VOR tune), R (remote tune), and M (manual tune).

To prevent the FMS from using a VOR/DME radio, use the DEL key. Enter *DELETE* in the scratchpad, then push a line select key to the left of any identifier displayed on the VOR/DME page The FMS displays DESEL above all three identifiers on the page signifying that the FMS cannot use that radio for position computations. The same procedure is used to reselect the radio for autotuning.

The display of the letter M on the CDU radio tuning page, beside the pertinent NAV, indicates that manual tuning has been selected. The letter A displayed in front of the station identifier indicates that the receivers are being autotuned by the FMS. Regardless of the tuning mode, the FMS is constantly tuning the scanning channels of the DME for position update.

Operator's Manual

For detailed operating information, consult the Honeywell FMZ Series Flight Management System Pilot's Operating Manual, Publication Number A28-1146-043-04 dated April 1989 and revised July 1995, or later revision for FMS software version 4.1.

Limitations

A single installation of the Honeywell FMS is not approved as a sole means of navigation; therefore, if one of the dual FMSs is inoperative or removed and a single FMS is to be used as the primary means of navigation, or when an FMS (without a backup) is coupled to the autopilot, flight director or EHSI, the navigation equipment required by the FARs applicable to the specific type of operation being conducted, must be installed and operating. Dual installations of the FMZ P2000, as installed in the Citation X, are not approved as a sole means of navigation. Refer to the applicable supplement to the airplane flight manual for additional limitations and operating information.

AIRBORNE FLIGHT INFORMATION SYSTEM (AFIS) (OPTIONAL)

The Global Airborne Flight Information System (AFIS) interfaces the flight planning and performance management functions of the Honeywell FMZ-800 Flight Management System with Global Data Center Computers, by means of the Aircraft Communications Addressing and Reporting System (ACARS). ACARS provides the computer data link between the airplane and the Global Data Center, by which transfer of digital data concerning flight plan, weather, and message traffic is possible.

The Model 750 AFIS installation consists of a Data Management Unit (DMU), a configuration module, and an antenna. An AFIS with SATCOM sensor is also available. If the SATCOM option is installed, a satellite communications unit (SCU), an additional antenna for satellite communications, and an amplifier are also installed. The FMS DL-900 data loader is the disk interface for the AFIS functions, and the FMS control display unit (CDU) provides access for the AFIS function through the NAV index. The AFIS function replaces the DATA BASE function (2R) on page one of the NAV INDEX when the system is installed and configured. The Global Data Center and ACARS, with its VHF/ground telephone system interface, make up the ground portion of the system. The global data system provides the services of flight planning, aviation, weather, and flight related message forwarding, through its "mainframe" computers which accept and process digital data, and provide the requested information on a real time basis.

Operator's Manual

For detailed operating information, consult the Airborne Flight Information System (AFIS) (Optional) information in the Honeywell FMZ Series Flight Management System Pilot's Operating Manual, Pub. No. A28-1146-043-04 dated April 1989 and revised July 1995, or later revision.

ALTITUDE ALERTING AND REPORTING

Altitude data for both altitude alerting and reporting is obtained from the micro air data computers (MADCs). The coded uncorrected (mean sea level) altitude information provided by the MADCs is passed on by the transponders to the air traffic control system, which decodes the information and presents it on the controller's radar screen. For a complete description of the altitude reporting system refer to Transponders, in this section.

Desired altitude for both primary flight displays (PFDs) for altitude alerting, (or for ALT SEL operation), is set by using the center knob (ALT SEL) on the copilot's RI-871 remote instrument controller which is located on the center pedestal. When turned at one click at a time the data increments or decrements at 100 foot increments. When the knob is turned at a faster rate the data changes in large increments. Clockwise operation increases the value; counterclockwise decreases it. The selected altitude appears in the altitude alert box which is located at the top of the altitude display on the PFDs. The set data is cyan under normal circumstances. The digits are boxed when the airplane is within the altitude alert operating region. When departing a selected altitude, the select display and the box turn amber.

When the airplane is in excess of 250 feet from the selected altitude, the color of the altitude bug and the digital numbers in the altitude select box will be amber; when the airplane approaches to within 1000 feet of the selected altitude a chime will sound. When the airplane is within 250 feet of the selected altitude, the color of the digits (and the altitude select bug) will change to cyan. If the airplane then deviates by +250, -250 feet or more from the selected altitude a chime is sounded. The digits remain amber until the airplane returns to within 250 feet of the selected altitude, or a new altitude is set, which resets the new altitude.

SECTION IV

OPERATING INFORMATION

CONTENTS

OPERATING PROCEDURES

Operating procedures in this manual are organized into NORMAL, ABNORMAL, and EMERGENCY procedures. The Abnormal and Emergency procedures are organized with reference to EICAS (Engine Instrument and Crew Alerting System) messages, Primus 2000 system messages, and separate annunciators.

NORMAL PROCEDURES

Normal procedures are those recommended for normal preflight, flight, and postflight operation. Some checks, as noted in the Limitations Section of this operating manual are required to ensure proper system integrity.

The Normal Procedures Section also includes white Crew Alerting System (CAS) messages and expanded systems information and procedures. White CAS messages are advisory information about normal systems status.

The Normal Procedures Section also includes a Special Procedures Section. In it particular equipment and procedures are discussed, and suggested techniques are provided. These procedures and techniques have been gained from experience by Cessna flight test pilots in particular operations. They are provided with the intent of providing safe, smooth, efficient, and comfortable operation of the airplane.

NORMAL PROCEDURES

This section presents an expanded form of the abbreviated cockpit checklist provided with each Model 750. Should any conflict exist between this information and the checklist in the FAA Approved Airplane Flight Manual, the flight manual shall take precedence. Any implied technique presented assumes that proper pilot skill and judgment are exercised.

PREFLIGHT INSPECTION

PRELIMINARY EXTERIOR INSPECTION

1. Engine/Pitot/APU Covers - REMOVED.
2. APU Inlets, Exhaust and Oil (if starting APU before preflight) - CHECK.
3. Batteries - CONNECTED (left and right).
4. Flaps/Slats - CHECK POSITION.

COCKPIT/CABIN INSPECTION

WARNING

SLATS, LANDING GEAR, SPEED BRAKES, ROLL SPOILERS, FLIGHT CONTROLS AND THE LEFT THRUST REVERSER WILL OPERATE IF THE "A" SYSTEM AUXILIARY HYDRAULIC PUMP IS ON. THE UPPER RUDDER IS POWERED AND FLAPS WILL MOVE IF ELECTRICAL POWER IS ON. USE CAUTION FOR PERSONNEL OUTSIDE THE AIRPLANE WHEN MOVING COCKPIT CONTROLS.

NOTE

- If operating from or to extreme cold surface temperature or airport above 8,000 feet MSL, special additional procedures apply. Refer to Normal Procedures, EXTREME COLD WEATHER OPERATIONS.
- Prior to cockpit inspection, check tailcone to ensure the battery is connected.

1. Documents, manuals and equipment - ONBOARD AND CURRENT.
   a. To be displayed in airplane at all times:
      (1) Airworthiness and Registration Certificates.
      (2) Transmitter License(s).
   b. To be carried in the airplane at all times:
      (1) FAA Approved Airplane Flight Manual.
      (2) Honeywell P2000 Integrated Avionics System Pilot's Manual for the Citation X.
      (3) Honeywell FMZ Series Flight Management System, Pilot's Operating Manual.
      (4) Other applicable pilot's manuals as required in Section 1, under Operating Limitations or applicable AFM supplement.
2. Required Equipment - ONBOARD AND SERVICED.
3. Cabin - CHECK.
   a. Seat Belts - CONDITION.
   b. Emergency Exit - SECURE/CLEAR/LOCK PIN REMOVED/COVER IN PLACE.
   c. Main Gear Manual Release - CONNECTED and STOWED.

(Continued Next Page)

PREFLIGHT INSPECTION (Continued)

4. Circuit Breakers - IN.
5. Portable Fire Extinguisher - SERVICED/SECURE (under copilot's seat).
6. Oxygen System - CHECK.
   a. Masks - TEST/100% SELECTED.
   b. Left and Right MIC SEL Switch - HEADSET.
   c. PASS OXY Knob - AUTO.
   d. Oxygen Pressure(s) - GREEN ARC (1600 to 1800 PSI).
   e. Smoke Goggles - STOWED.
7. Cockpit Switches and Controls - CHECK/SET.
   a. LH AHRS Switch (if installed) - SLV.
   b. EMERG LT Switch - ARM/CHECK INSIDE LIGHTS/OFF.
   c. DAY/NITE DIM Switch - AS REQUIRED.
   d. Fuel CROSSFEED Knob - OFF.
   e. GRVTY XFLOW Switch - OFF.
   f. CTR WING XFER Switches - NORM.
   g. Load Shed Switch - NORM.
   h. LH and RH GEN Switches - GEN.
   i. BATT 1 and BATT 2 Switches - OFF.
   j. EXT POWER Switch - OFF.
   k. Avionics Power Switch - OFF.
   l. EICAS Switch - OFF.
   m. LH and RH FUEL BOOST Switches - NORM.
   n. LH and RH IGNITION Switches - NORM.
   o. LH and RH FADEC Switches - NORM.
   p. STBY PWR Switch - TEST/ON/OFF.
      1) Test and Hold - GREEN LIGHT illuminated.
      2) ON - AMBER LIGHT/STBY INST LIGHTS/STBY ENG INST VERIFY ON.
      3) OFF.
   q. Landing Gear Handle - DOWN.
   r. EMERG GEAR EXT Handle - IN.
   s. Nose Gear Uplock Manual Release Handle - STOWED.
   t. ANTI-ICE Switches - OFF/NORM.
   u. A AUX Switch - OFF.
   v. HYDRAULIC PUMPS “A” and “B” UNLOAD Switches - NORM.
   w. ANTISKID Switch - NORM.
   x. LIGHT Switches - OFF.
   y. CABIN DUMP Switch - Down/Cover Down.
   z. ISO VLV Switch - Down/Cover Down.
   aa. MANUAL RATE Knob - MIN (full counterclockwise).
   ab. ALT SEL/NORM Switch - NORM.
   ac. PAC BLEED SELECT Switch - NORM.
   ad. WEMAC BOOST Switch - OFF.
   ae. Pressurization RATE Knob - NORM (marks aligned).
   af. CKPT and CABIN TEMP SEL Knobs - AS DESIRED.
   ag. PAC ISOL VALVE Knob - CLSD.
   ah. CKPT and CAB PAC Knobs - ON.
   ai. L and R ENG BLD AIR Knobs - HP/LP.
   aj. RH AHRS Switch (if installed) - SLV.
   ak. APU Switches - OFF/NORMAL.
   al. ELT Switch (if installed) - ARMED.

(Continued Next Page)

PREFLIGHT INSPECTION (Continued)

am. INTERIOR MASTER Switch - NORMAL/COVER DOWN.
an. Secondary Trim Switch - OFF/COVER DOWN.
ao. SPEEDBRAKE Handle - ZERO (0).
ap. Throttles - CUTOFF.
aq. Flap Handle - AGREES WITH FLAPS POSITION.
ar. GND IDLE Switch - NORM.
as. ENG SYNC Knob - OFF.
at. Taxi Light/Landing Light Switches - OFF.
au. IRS Mode Control Knobs (if installed) - OFF.
av. Aileron Latch Handle - DOWN.
aw. Pitch/Roll Disconnect Handle - DOWN/NORM.

8. DC Power Load Shed/Emergency Bus - CHECK.

NOTE

External power and APU generator must be off to accomplish this.

a. LOAD SHED Switch - EMER.
b. BATT 1 Switch - ON.
c. BATT 2 Switch - OFF.
d. Avionics/ EICAS Power Switches - ON/EICAS.
e. Emergency Bus Relay - CHECK.

NOTE

It is not necessary to verify power to each item of equipment. This check is to verify operation of the emergency bus isolation relay.

Power will be supplied to the following Items:

Both Rudder Limiters
Pilot and Copilot Audio Panels
Audio Warnings***
VHF Comm 1
VHF Nav 1
RMU 1
Standby Nav/Comm (Honeywell Radios Only)
Standby HSI
Standby Attitude *
Standby Pitot/Static Heat
Auxiliary Panel Lights
AHRS 1 or IRS 1
Emergency Lighting **
MADC 1
LH Windshield Heat
"A" AUX Hydraulic Pump
Upper Rudder Actuator
Pitch Feel
Rudder Trim
Aileron Trim
Secondary Stabilizer Trim
APU
Engine Start Logic
Both Engine A and B FADECs
Engine Fire Detect and Extinguishers
Firewall Shutoff - Fuel and Hydraulic
Standby Engine Instruments *
Landing Gear Control and Indicator Lights (except retract)
HF Radio 1 (750-0023 and on, if installed)

* Powered by Standby Battery
** Also powered by emergency light battery pack
*** Secondary pitch trim clacker and pilot's overspeed warning only

(Continued Next Page)

PREFLIGHT INSPECTION (Continued)

f. BATT 2 Switch - ON.
g. BATT 1 Switch - OFF.
h. Emergency Bus Relay - CHECK/NO BUS POWERED.
i. Avionics Power Switch - OFF.
j. LOAD SHED Switch - NORM.
(1) Pressurization Test - FAULT LIGHT ON, THEN OFF.
(2) DU 2 and 3 - POWERED.
k. Battery Voltage - CHECK.
l. BATT 1 Switch - ON.

9. Gear Handle - DOWN/3 GREEN LIGHTS.
10. External Power/APU - AS REQUIRED.
    a. If External Power - EXT POWER PLUG IN and EXT PWR Switch - ON.
    b. If APU - Refer to APU start checklist.
11. Avionics Power Switch - ON.
12. Flaps - SET 15°/CHECK.
13. Stabilizer, Slat, Speed Brakes - CHECK INDICATIONS.

NOTE

If preflight behind the slats is desired, the slats can be extended by turning on the ”A“ auxiliary hydraulic pump.

14. Fuel Quantity/Balance - CHECK.
15. Hydraulic Quantities - CHECK.

NOTE

Hydraulic reservoir servicing level can be checked at the reservoir or on the EICAS. Normal quantity as displayed on the EICAS will typically be 50% to 75%. 100% is full, 16% or below will cause a HYD VOLUME LOW Amber CAS message and Master Caution.

16. PITOT/STATIC Anti-Ice Switches - ON/CHECK, EICAS CLEARS/OFF.

WARNING

DO NOT LEAVE ON FOR EXTENDED PERIODS. INJURY TO PERSONS AND/OR DAMAGE TO PROBES MAY OCCUR.

NOTE

- The RAT will normally not heat on the ground. If physical inspection is desired, placing the rotary test switch to the WS TEMP position will enable RAT heat on the ground.

- RAT, PITOT/STATIC and AOA HEAT FAIL CAS messages should not be on.

(Continued Next Page)

PREFLIGHT INSPECTION (Continued)

17. Exterior/Interior/EMERG Light Switches - ON/CHECK/OFF, or AS REQUIRED (leave on if not seen from cockpit or verified by a second crew member outside).
    a. Emergency Lights - ILLUMINATED.
    b. Landing Lights - ILLUMINATED.
    c. Taxi Lights - ILLUMINATED.
    d. RH Wing Inspection/Overwing Exit/NAV/Strobe/Wing Tip Lights - ILLUMINATED.
    e. RH Tail Flood Light (if installed) - ILLUMINATED.
    f. Ground Recognition Light - ILLUMINATED.
    g. Aft Nav Light - ILLUMINATED.
    h. LH Tail Flood Light (if installed) - ILLUMINATED.
    i. LH Wing Inspection/NAV/Strobe/Wing Tip Lights - ILLUMINATED.
    j. Exterior/Interior/EMERG Lights - AS REQUIRED.

NOTE

Exterior lights not verifiable from the cockpit should be checked by external walk-around. Expedite if using battery power.

18. EICAS/Batteries - AS REQUIRED.

(Continued Next Page)

PREFLIGHT INSPECTION (Continued)

EXTERIOR INSPECTION

WARNING

PITOT TUBES, RAT PROBES AND AOA PROBES MAY STILL BE HOT.

NOTE

- In cold weather and/or icing conditions, refer to Normal Procedures, EXTREME COLD WEATHER OPERATIONS and Section IV, GROUND DEICE/ANTI-ICE OPERATIONS. Give particular attention to engine inlets, fan blades, wheel wells, wing trailing edge, (forward of flaps) and behind slats for ice/slush from previous landing.
- During inspection, make a general check for security condition, and cleanliness of the airplane and components. Check particularly for damage, fuel, oil and hydraulic leakage, security of access panels and doors, and removal of keys from locks.

LEFT FORWARD FUSELAGE

1. Cabin Door/Seals - CONDITION. Check both primary and secondary seals for fraying, wear, and cuts, etc. Damaged door seals may cause pressurization loss or difficulty in achieving cabin pressurization; therefore, it is important that both seals be carefully checked for condition.
2. Fairing Vent - CLEAR.
3. RAT Probe - CLEAR.
4. AOA Probe - ROTATES FREELY. Slots open.
5. Static Ports - CLEAR.
6. Drain Lines - CLEAR.
7. Static Drain - CLOSED.
8. Pitot Tube - CLEAR.

LEFT NOSE COMPARTMENT

1. Emergency Gear and Brake Pressures - CHECK PER PLACARD.
2. Nose Wheel Steering Accumulator precharge pressure - CHECK PER PLACARD (bleed to precharge if required).
3. Standby Battery - TEST CHARGE AND HEATER.
4. Oxygen Bottle (if installed) - VALVE WIRED OPEN.
5. Air Data and Rain Removal Hoses - CONNECTED.
6. Nose Compartment Door - SECURE/LOCKED. Check latches closed and properly engaged. For additional security, the door should be key locked and the key removed.

(Continued Next Page)

PREFLIGHT INSPECTION (Continued)

NOSE GEAR

1. Taxi Lights - CONDITION.
2. Wheels/Tires/Strut - CONDITION/SCISSORS PIN INSTALLED. Nose strut extension should be between 3.25 and 7.0 inches. Temperature and airplane weight will cause the extension of the nose gear strut to vary. The dimensions given are nominal values. Chine and tread of nose tires must be in good condition and tires must be properly inflated to meet the water/slush runway operating limitation. Approved nose tires must be inflated to 130 PSIG, +5 or -5 PSIG (unloaded) or 135 PSIG, +5 or -5 PSIG (loaded). Visually inspect the nose landing gear assembly, power steering mechanism, wheel well area and doors for damage and security. Proper oleo strut extension of a fully fueled airplane is five to seven inches.
3. Wheel Well - CONDITION.

RIGHT FORWARD FUSELAGE

1. Radome - CONDITION/SECURE.
2. Pitot Tube - CLEAR.
3. Nose Compartment Door - SECURE/LOCKED. Check latches closed and properly engaged.
4. Oxygen Blowout Disc(s) - INTACT. Disc should be in place and intact, or the oxygen bottle(s) may be empty. Cause of missing disc(s) must be determined.
5. Static Drain - CLOSED.
6. Static Ports - CLEAR.
7. Standby Pitot Tube - CLEAR.
8. AOA Probe - ROTATES FREELY.
9. RAT Probe - CLEAR.
10. Fairing Vent - CLEAR.
11. Single Point Fuel Door - PRECHECK LEVERS DOWN/CAP SECURE/DOOR SECURE.
12. Fuel Tank Transfer Access Door - SECURE.
13. Upper/Lower Antennas - CONDITION.

RIGHT WING

1. Landing Light - CONDITION.
2. Engine Inlet Duct/Fan - CLEAR/CONDITION. Assume a position forward of the wing that will provide maximum visibility of the engine inlet, and visually check for obstructions or damage.
3. Emergency Exit - CONDITION.
4. Fuel Quick Drains - DRAIN/CHECK FOR CONTAMINATION. Prior to the first flight of the day, drain a fuel sample from each quick drain and check for water or contamination. Push straight up on the drains when taking fuel samples, as the drain may lock open if it is rotated.
   a. Fuel Quick Drains:
      1 - Forward Tank
      1 - Center Tank
      1 - RH Wing/Mid-Chord/Inboard
      2 - 1 per Each Hopper Tank

(Continued Next Page)

PREFLIGHT INSPECTION (Continued)

5. Fuel Quantity Dipsticks (2) - SECURE.

NOTE

- The center tank dipstick is located near the right wing root and the right wing dipstick is located approximately half span.
- A second center tank dipstick is accessible through an access panel in the belly fairing (not normal preflight item).

6. Wing Leading Edge/Slat/Anti-Ice Exit - CONDITION.

NOTE

The slat anti-ice air exit slots should periodically be checked for blockage caused by polishing agents, etc. Blockage can reduce anti-ice protection.

7. Fuel Filler Cap - SECURE. Check locking latch closed and directed aft. Check cover closed and secured.
8. Fuel Tank Pressure Relief Valve - CLOSED/NO LEAKS.
9. Fuel Tank Vent Inlet Scoop - CLEAR.
10. NAV/Anti-Collision/Wing Tip Lights - CONDITION.
11. Static Wicks (5) - CHECK.

NOTE

A maximum of two static wicks (entire airframe) and no two consecutive adjacent wicks, may be damaged or missing.

12. Aileron/Flaps/Spoilers/Trailing Edge - CONDITION.
13. Fuel Tank Vents - CLEAR.
    a. Bottom of inboard flap island.
    b. Lower wing skin forward of inboard flap.
14. Main Landing Gear Door/Wheels/Tires/Brakes/Strut/Wheel Well - CONDITION and SECURE.

NOTE

- Main gear strut extension should be between 1.8 and 3.5 inches.
- Check brake wear indicators on both brake housings.

Temperature and airplane weight will cause the extension of the nose gear strut to vary. The dimensions given are nominal.values. Check tires for wear and inflation. Tire inflation pressure is 180 +5 or -5 PSIG (unloaded) or 187 +5 or -5 PSIG (unloaded). Refer to Tires, Servicing in this section. Check brake wear indicators on both brake housings. Visually inspect doors and taxi light for security. Inspect wheel well area for damaged or broken lines and electrical wiring for condition. Check actuator and oleo for damage, leaks and proper attachment.

PREFLIGHT INSPECTION (Continued)

RIGHT NACELLE/PYLON

1. Generator/Alternator Cooling Air Inlet/Exhaust - CLEAR.
2. Drain Lines - CLEAR.
3. Oil Level - CHECK (minimum quantity 4 quarts low). Sight gage is located inside the door on the bottom of the nacelle.
4. Thrust Reversers - CONDITION/STOWED.
5. Engine Exhaust/Bypass Ducts - CLEAR.
6. Cowling/Latches - SECURE/ALL LATCHES LATCHED.
7. Rudder Standby Hydraulic Service Door - SECURE.

NOTE

Rudder standby system hydraulic pressure is monitored by EICAS. If the system is cycling rapidly or the RUD STBY SYS FAIL amber CAS message is displayed, electrical power should be turned off to check accumulator pressure (per placard). The accumulator must be discharged to the precharge level by cycling the rudder until RSS pressure is zero to verify the accumulator precharge.

8. Precooler Exhaust Doors - CLOSED. Lower door (visible in bottom of pylon) should be closed on the ground. Upper door should also be closed, but it is not visible on walk-around.
9. Hydraulic Reservoir Access Door - SECURE.

RIGHT AFT FUSELAGE

1. Vents - CLEAR.
2. Antennas - SECURE.
3. External Power Receptacle Door (unless in use) - SECURE.
4. Battery Compartment - BATTERY CONNECTED/DOOR SECURE.
5. Toilet Service Door - SECURE.
6. “B” Hydraulic System Main Accumulator Pressure - CHECK PER PLACARD/DOOR SECURE.

EMPENNAGE

1. Ground Air Door - AS REQUIRED.
2. PAC Heat Exchanger Exhaust - CLEAR.
3. Tail Stand Door - SECURE.
4. APU Drain - CHECK.
5. APU Oil Level - CHECK/DOOR SECURE.
6. APU Inlets and Exhaust - CLEAR.
7. Horizontal Stabilizer - CONDITION/POSITION (LH side).
8. Elevators - CONDITION.
9. Static Wicks (8) - CHECK.

NOTE

Three (3) on each elevator, one (1) on each horizontal stabilizer tip. Maximum of two static wicks (entire airframe), no two consecutive, may be damaged or missing.

(Continued Next Page)

PREFLIGHT INSPECTION (Continued)

10. Top Stinger/Light - CONDITION.
11. Rudders - CONDITION.

NOTE

The upper rudder YAW DAMPER is disabled on the ground. Oscillatory movement of the upper rudder with airplane electrical power or ground power on is evidence of possible landing gear squat switch failure.

12. APU Service Door - CHECK.
13. Tailcone - CHECK/DOOR SECURE (no red latches).

NOTE

Check general condition of tailcone and tailcone equipment. Ensure ski box door is closed, tailcone access door is closed and all latches secured.

LEFT AFT FUSELAGE

1. “A” Hydraulic System Main Accumulator Pressure - CHECK PER PLACARD/DOOR SECURE.
2. Battery Compartment - BATTERY CONNECTED/DOOR SECURE.

AFT BAGGAGE COMPARTMENT

1. Ladder and Baggage - SECURE.
2. Air Inlets/Outlets - CLEAR.
3. Baggage Light - OFF.
4. Door Seal - CONDITION. Inspect door seals for wear, cuts, tears, etc.
5. Access Door - SECURE/CHECK HANDLE AND PIN INDICATORS.

LEFT NACELLE/PYLON

1. Hydraulic Reservoir Access Door - SECURE.

NOTE

Hydraulic reservoir servicing level can be checked at the reservoir or on the EICAS. Normal quantity as displayed on the EICAS will typically be 50% to 75%. 100% is full, 16% or below will cause a amber CAS message, HYD VOLUME LOW and Master Caution.

2. Precooler Exhaust Doors - CLOSED. Lower door (visible in bottom of pylon) should be closed on the ground. Upper door should also be closed, but it is not visible on walk-around.
3. Engine Exhaust/Bypass Ducts - CLEAR.
4. Thrust Reversers - CONDITION/STOWED.
5. Oil Level - CHECK (minimum quantity 4 quarts low). The sight gage is located inside the door on the bottom of nacelle.
6. Drain Lines - CLEAR.
7. Generator/Alternator Cooling Air Inlet/Exhaust - CLEAR.
8. Cowling/Latches - SECURE/ALL LATCHES LATCHED.

(Continued Next Page)

PREFLIGHT INSPECTION (Continued)

LEFT WING

1. Main Landing Gear Door/Wheels/Tires/Brakes/Strut/Wheel Well - CONDITION and SECURE.

NOTE

- Main gear strut extension should be between 1.8 and 3.5 inches.
- Check brake wear indicators on both brake housings.

Check tires for wear and inflation. Tire inflation pressure is 173 +5, or -5 PSIG. Refer to Tires under Servicing in this section. Check brake wear indicators on both brake housings. Visually inspect doors and taxi light for security. Inspect wheel well area for damaged or broken lines and electrical wiring for condition. Check actuator and oleo for damage, leaks and proper attachment.

2. Fuel Tank Vents - CLEAR.
   a. Bottom of inboard flap island.
   b. Lower wing skin forward of inboard flap.
3. Ailerons/Flaps/Spoilers/Trailing Edge - CONDITION.
4. Static Wicks (5) - CHECK.

NOTE

A maximum of two static wicks (entire airframe), no two consecutive adjacent static wicks, may be damaged or missing.

5. NAV/Anti-Collision/Wing Tip Lights - CONDITION.
6. Fuel Tank Vent Inlet Scoop - CLEAR.
7. Fuel Filler Cap - SECURE. Check locking latch closed and directed aft. Check cover closed and secured.
8. Fuel Tank Pressure Relief Valve - CLOSED/NO LEAKS.
9. Wing Leading Edge/Slat/Anti-Ice Exit - CONDITION.

NOTE

The slat anti-ice air exit slots should periodically be checked for blockage caused by polishing agents, etc. Blockage can reduce anti-ice protection.

10. Fuel Quantity Dipstick - SECURE (left wing half span).
11. Left Wing Fuel Quick Drain - DRAIN/CHECK.
12. Landing Light - CONDITION.
13. Engine Inlet Duct/Fan - CLEAR/CONDITION. Assume a position forward of the wing that will provide maximum visibility of the engine inlet, and visually check for obstructions or damage.
14. Dorsal Fin Air Inlet - CLEAR (can be viewed from cabin steps).

COCKPIT PREPARATION

1. Preflight Inspection - COMPLETE.
2. Cockpit Switches - VERIFY/SET.
   a. EMERG LT Switch - ARM.
   b. DAY/NITE DIM Switch - AS REQUIRED.

(Continued Next Page)

COCKPIT PREPARATION (Continued)

c. LH and RH GEN Switches - GEN.
d. LH/RH FUEL BOOST Switches - NORM.
e. LH/RH FADEC Switches - NORM.
f. LH/RH IGNITION Switches - NORM.
g. STBY Gyro - CAGED.
h. STBY PWR Switch - ON.
i. Exterior Lights - AS REQUIRED.
j. Pressurization Control Switches - AS REQUIRED.
k. Bleed/Environmental Control Knobs - SET.
l. All Other Switches - AS REQUIRED.

NOTE

The windshield anti-ice can be operated continuously during most ground and flight operations. It will also aid cockpit warming. Do not leave windshield anti-ice switches on during extended ground operations due to reduced controller cooling capacity.

WARNING

SLATS, LANDING GEAR, SPEED BRAKES, ROLL SPOILERS, FLIGHT CONTROLS AND THE LEFT THRUST REVERSER WILL OPERATE IF THE “A” SYSTEM AUXILIARY HYDRAULIC PUMP IS ON. THE UPPER RUDDER IS POWERED AND FLAPS WILL MOVE IF ELECTRICAL POWER IS ON. USE CAUTION FOR PERSONNEL OUTSIDE THE AIRPLANE WHEN MOVING COCKPIT CONTROLS.

3. BATT 1 and BATT 2 Switches - ON.
4. Avionics/EICAS Power Switches - ON/EICAS.
5. Parking Brake - SET.

NOTE

Turn the “A” auxiliary hydraulic pump on and allow “A” system pressure to reach approximately 2000 PSI, then set the brake and turn the “A” auxiliary hydraulic pump OFF.

6. APU - START or GPU - CONNECTED. Refer to Normal Procedures, APU GROUND OR IN-FLIGHT START.

CAUTION

THE APU IS NOT APPROVED FOR UNATTENDED GROUND OPERATION.

7. IRS (if installed) - ALIGN/NAV.
8. FMS (if IRS installed) - INSERT PRESENT POSITION.
9. Fuel Transfer/Crossfeed - CHECK/OFF.
   a. FUEL CROSSFEED Switch - LH TANK (FUEL XFEED OPEN, FUEL BOOST ON, L white CAS message ON).
   b. FUEL CROSSFEED Switch - RH TANK (FUEL XFEED OPEN, FUEL BOOST ON, R white CAS message ON).
   c. FUEL CROSSFEED Switch - OFF.
   d. CTR WING XFER Switches - NORM/AS REQUIRED.

(Continued Next Page)

COCKPIT PREPARATION (Continued)

NOTE

- If there is to be a delay before flight with the APU operating, position the CTR WING XFER switches to OFF. LH boost pump pressure will activate the center tank transfer and could result in a fuel spill if the automatic shut-off fails. If the delay is prolonged, the fuel imbalance, due to APU fuel burn, can be reduced by selecting the crossfeed switch to RH TANK and the LH Fuel Boost switch to OFF.

- The FUEL MOTV FAIL L-R amber CAS message for the selected tank may momentarily illuminate when crossfeed is selected.

10. FLT CONTROL SHUTOFF Switch Annunciators - ALL EXTINGUISHED.
11. Warning Systems - CHECK/OFF.

WARNING

IF THE SLATS ARE UP AND EITHER HYDRAULIC SYSTEM IS PRESSURIZED, SLATS WILL EXTEND AND RETRACT DURING THE AOA TEST. ENSURE PERSONNEL ARE CLEAR.

NOTE

The rotary test knob must remain in the AOA position until the AOA test is completed; which in turn tests both the AUTO SLAT FAIL function and the MINIMUM SPEED function.

12. Cockpit Voice Recorder - TEST.
13. Aileron and Rudder Trim - CHECK/SET FOR TAKEOFF.
14. Flight Guidance Computer/Stabilizer Trim/Yaw Dampers - CHECK/SET.
    a. Secondary Trim - CHECK/OFF/COVER DOWN.

NOTE

Trim clacker will sound if trim is activated for more than three seconds.

    b. Primary Stabilizer Trim (pilot and copilot) - CHECK/SET FOR TAKEOFF.
    c. FGC - Verify mach trim and yaw damper are engaged in either "A" or "B".
    d. Upper Yaw Damper - VERIFY “A” or “B” is engaged.

NOTE

- Lower YD and Mach trim (M TRIM) can be selected ON (not deselected).

- FGCs will automatically switch between A or B on alternating flights and will automatically switch back to the sequenced FGC the first time a manual switch is attempted. Subsequent manual switches will be allowed to change the selected FGC.

- Do not check individual halves of trim switches for more than 20 seconds. FGC monitors will trip.

- Do not make rapid primary trim reversals when setting stabilizer. FGC monitors may trip.

(Continued Next Page)

COCKPIT PREPARATION (Continued)

NOTE (Continued)

- Nominal stabilizer trim range is +1.2 to -12 degrees. It is possible that normal rig tolerance could be slightly outside these values. The EICAS trim display will be amber outside the nominal range. There may be up to 0.5 degrees difference in indicated stabilizer position when switching between primary and secondary trim.

HORIZONTAL STABILIZER POSITION FOR TAKEOFF

EXAMPLE:
TAKEOFF FLAPS - 15,
HORIZONTAL STABILIZER SETTING AT 23% MAC = -6.2 DEGREES

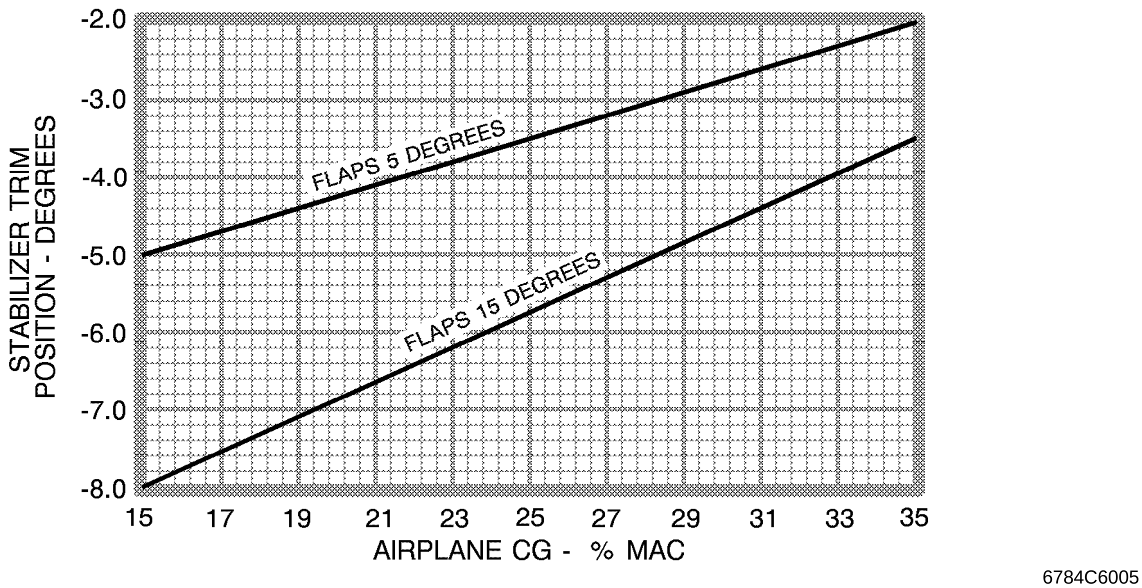

Figure 4-2

DELAY BEFORE FLIGHT WITHOUT APU/GPU

1. IRS (if installed) - OFF.
2. STBY PWR Switch- OFF.
3. EMERG LT Switch - OFF.
4. AVIONICS POWER Switch - OFF.
5. BATT 1 and BATT 2 Switches - OFF.

BEFORE START

1. If Delay - Without APU/GPU.
   a. STBY PWR Switch - ON.
   b. EMERG LT Switch - ARM.
   c. BATT 1 and BATT 2 Switches - ON.
   d. APU - START (Refer to Normal Procedures, APU GROUND OR IN-FLIGHT START.) or GPU-CONNECT/EXT POWER Switch - ON.
   e. AVIONICS POWER Switch - ON.
   f. IRS (if installed) - ALIGN/NAV.
   g. FMS (if IRS installed) - INSERT PRESENT POSITION.
2. Parking Brake - VERIFY SET.
3. Wheel Chocks - REMOVED.
4. Cabin Door - CLOSE/LOCK.
   Check the ten window indicators for proper door pin positions and the handle lock indicator for handle lock. Check CAS for door indications.

   NOTE

   Electric power must be on when the cabin door is being closed in order to detect proper sequencing as the door is closed.
5. Passenger Briefing - COMPLETED.
   Ensure that passengers are informed of the escape routes from the airplane, and are informed of the location and use of emergency equipment that is onboard the airplane.
6. Seats/Belts/Harnesses/Pedals - ADJUST/SECURE.
   Check seats locked in the desired position. Check seat belts snug and shoulder harnesses latched to the buckle. Rudder pedals adjust individually by depressing the tab on the inboard side and moving fore or aft. Three positions are available. Check locked in the desired position.
7. Cockpit Side Windows - CLOSED/LATCHED.
8. Exterior Lights - AS REQUIRED.
9. EICAS - CHECK. Verify EICAS operating properly.
   Check for failure/abnormal indications before starting engines.
10. ATIS/Clearance/FMS - AS REQUIRED. Program FMS.
11. Flight Instruments/Avionics - CHECK/SET.
    Set course bugs and pointers as required for departure. COMM/NAV/ADF radios tuned and verified. Transponder set to STBY.
12. Fuel Quantity/Balance - CHECK.
    Maximum intentional fuel imbalance is 400 lbs., however, fuel should be balanced for takeoff since an imbalance will affect performance.
13. CTR WING XFER Switches - NORM/AS REQUIRED.
14. V-Speeds - SET (Confirm from the FAA Approved Flight Manual, Section IV, Performance).

(Continued Next Page)

BEFORE START (Continued)

SIMPLIFIED CRITERIA - FLAPS 15° TAKEOFF

WEIGHT RANGE - POUNDS	23,000 - 27,000	27,001 - 30,000	30,001 - 33,000	33,001 - 35,700
V_1	114	116	125	133
V_R	116	119	128	134
V_2	129	127	132	137
RUNWAY LENGTH - FEET (MINIMUM)	4500	5000	6000	7000
V_{REF} (FLAPS FULL)	118	126	* 136	* 142
V_{APP}	124	131	* 142	* 147

* For use in an emergency landing. Maximum design landing weight is 31,800 pounds. Landing at weights above 30,000 pounds may exceed Landing Brake Energy limits.

NOTE

The above criteria apply only to takeoff with flaps 15°, at or below 2000 feet MSL, and temperatures at or below 30°C. Refer to the FAA Approved Flight Manual, Section IV, Performance, TAKEOFF PERFORMANCE, for other restrictions on use of simplified criteria and takeoff data for other conditions.

STARTING ENGINES

1. APU (or Ground Air Service) BLEED AIR Switch - ON (check start duct pressure).
2. PAC ISOL VALVE Knob - CLOSED.

NOTE

- Start duct pressure prior to engine start should normally be at least 30 PSI. At high elevation airports the APU may not achieve this pressure. Minimum start pressure for high elevation start may decrease to 25 PSI.
- If restarting a warm engine, allow ITT to drop below 200°C (150°C above 8,000 feet pressure altitude) before attempting a start. A hung start may result from high residual ITT.
- For cold weather operations (below -15°C), refer to Normal Procedures, EXTREME COLD WEATHER OPERATIONS.

3. Right Engine - START.

NOTE

- Abort the start for any of the following conditions: no oil pressure indication within 15 seconds after N_2 rotation, no N_1 rotation, compressor surge, or ITT rapidly approaches 800°C. Refer to Abnormal Procedures, ENGINE START MALFUNCTION.

(Continued Next Page)

STARTING ENGINES (Continued)

NOTE (Continued)

- Abort the start for hung start (no acceleration for 15 seconds) or N_2 stagnation 45-55%. Refer to Abnormal Procedures, ENGINE START MALFUNCTION.
- Abort the start if the engine reaches starter cutout speed (approximately 56% N_2), then rolls back. Do not re-engage the starter, as starter shaft may shear. Refer to Abnormal Procedures, ENGINE START MALFUNCTION.
- If a third attempt is necessary, it is recommended to use a ground cart with at least 5 psi more duct pressure than the APU. No more than three start attempts are recommended.

a. ENGINE START BUTTON - PRESS (confirm START button and DISENGAGE button illuminate).
b. Throttle - IDLE (by 10% N_2 RPM).

NOTE

- The throttle lever may be moved out of cut-off after engine N_2 rotation begins. Start sequence will begin at 10% N_2. Positioning the throttle to idle before engine start will display CAS messages inhibited by shutdown logic.
- The FADEC will turn on ignition at approximately 14% N_2 RPM and initiate start fuel at 33% N_2 RPM or 10 seconds after ignition is turned on. Fuel flow will indicate 140 PPH when the throttle lever is advanced to idle, but actual fuel flow does not begin until 33% N_2 RPM or 10 seconds after ignition is turned on.

c. N_1 Rotation - CONFIRM.
d. Oil Pressure - CHECK.
e. ITT - MONITOR.
f. START TERMINATION - CONFIRM BY 57% N_2 (START and DISENGAGE lights extinguished).

4. Hydraulic Pressure - VERIFY.

NOTE

Prior to start, the RUD STBY SYS FAIL amber CAS message will not be illuminated, indicating normal operation of the "B" rudder standby system. Starting the right engine first allows the following hydraulic system checks. As the right engine is started, the "B" system pressure will increase to 3000 PSI, and the PTU will begin cycling the "A" system pressure between approximately 1500 and 2700 PSI. If PTU noise is objectionable, the auxiliary pump may be turned on once PTU operation is confirmed. The auxiliary pump should be turned off after the left engine is started. The "A" system pressure will then increase to 3000 PSI when the left engine is started. If the left engine is started first, the "A" system must be unloaded after right engine start to ensure the PTU is operational (first flight of day).

(Continued Next Page)

STARTING ENGINES (Continued)

5. Left Engine - START (same as right, except if a third attempt is necessary, it is recommended to use the cross bleed start method or a ground unit with at least 5% more duct pressure than the APU).
6. Hydraulic Pressure - VERIFY.
7. Generators - CHECK DC AMPS/VOLTS.

NOTE

Battery charge can be checked by selecting the battery switches off, noting amperage decrease, then selecting the battery switches back on.

8. Ground Air Service/GPU (if used) - DISCONNECT.
9. APU Bleed Air Switch - OFF (check bleed sources).
   a. Select EICAS SYS, ENG on the MFD (duct pressure is from right engine).
   b. R ENG BLD AIR Knob - OFF (pressure should be zero).
   c. PAC ISOL VALVE Knob - OPEN (pressure is from left engine).
   d. L ENG BLD AIR Knob - OFF (pressure should be zero).
   e. L ENG BLD AIR Knob - HP/LP (check pressure).
   f. PAC ISOL VALVE Knob - CLOSED (pressure should be zero).
   g. R ENG BLD AIR Knob - HP/LP (check pressure).
10. APU BLEED AIR Switch - AS DESIRED.

NOTE

If the APU is installed and operational, it is recommended that it remain operating through initial climb, with bleed on, to provide emergency restart and generator capability.

STARTING SECOND ENGINE: CROSS BLEED METHOD

CAUTION

HIGH EXHAUST VELOCITIES CAN CAUSE DAMAGE TO OTHER AIRCRAFT AND EQUIPMENT. ENSURE THE AREA BEHIND THE AIRPLANE IS CLEAR.

NOTE

This procedure should only be used when the APU is inoperative and a ground airstart cart is not available.

1. PAC ISOL VALVE Knob - OPEN.
2. PAC BLEED SELECT Switch - HP.
3. Opposite ENG BLD AIR Knob - HP/LP.
4. Opposite Engine - ADJUST, to achieve and maintain 30 PSI minimum start pressure (approximately 55% N_1).
5. Engine - START.
   a. ENGINE START BUTTON - PRESS (confirm START button and DISENGAGE button illuminate).
   b. Throttle - IDLE (by 10% N_2 RPM).

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STARTING SECOND ENGINE: CROSS BLEED METHOD (Continued)

NOTE

- The throttle lever may be moved out of cut-off after engine N_2 rotation begins. Start sequence will begin at 10% N_2. Positioning the throttle to idle before engine start will display CAS messages inhibited by shutdown logic.
- The FADEC will turn on ignition at approximately 14% N_2 RPM and initiate start fuel at 33% N_2 RPM or 10 seconds after ignition is turned on. Fuel flow will indicate 140 PPH when the throttle lever is advanced to idle, but actual fuel flow does not begin until 33% N_2 RPM or 10 seconds after ignition is turned on.

c. N_1 Rotation - CONFIRM.
d. Oil Pressure - CHECK.
e. ITT - MONITOR.
f. START TERMINATION - CONFIRM BY 57% N_2 (START and DISENGAGE lights extinguished).

6. Opposite Engine - IDLE.
7. Hydraulic Pressure - VERIFY.
8. Generators - CHECK DC AMPS/VOLTS.

NOTE

Battery charge can be checked by selecting the battery switches off, noting amperage decrease, then selecting the battery switches back on.

9. PAC BLEED SELECT Switch - NORMAL.
10. PAC ISOL VALVE Knob - CLOSED.

BEFORE TAXI

1. Flight Controls - FREE/CORRECT EICAS INDICATIONS.

NOTE

Upper rudder will not move with flaps selected up.

a. FLT CONTROL SHUTOFF Switch Annunciators - EXTINGUISHED.

2. Flaps/Slats Lever - UP.
3. Rudder Control/EICAS (first flight of the day) - VERIFY UPPER RUDDER REMAINS CENTERED WITH FLAPS UP.
4. Flaps/Slats - SET FOR TAKEOFF/CHECK EICAS INDICATIONS.
5. Speed Brakes - CHECK/STOWED/EICAS INDICATIONS.
6. AHRS or IRS - ALIGNED/NO FLAGS.
7. EICAS - CHECK (all messages either normal or resolved).
8. Standby Gyro - UNCAGED.
9. Anti-Ice Systems - AS REQUIRED.
10. Pressurization - SET to takeoff or landing field elevation.
11. Passenger Advisory Lights - PASS SAFETY.
12. Seats/Seat Belts/Shoulder Harnesses/Aft Divider Sliding Doors - CHECK/SECURE/LATCHED OPEN (if belted toilet seat occupied).

TAXI

1. Exterior Lights - AS REQUIRED.
2. Brakes - APPLY and HOLD.
3. Parking Brake - RELEASE.
4. Brakes - CHECK.
5. Nose Wheel Steering - CHECK.
6. Thrust Reversers - CHECK/STOWED (the following thrust reverser check must be successfully completed).
   a. Thrust Reversers - DEPLOY (Idle).
   b. ARM, UNLOCK, DEPLOY Lights - ILLUMINATED.
   c. STOW Switches - EMER.
      (1) Thrust Reversers - STOW.
      (2) UNLOCK and DEPLOY Lights - OUT.
      (3) ARM Light - REMAINS ILLUMINATED.
   d. Thrust Reversers - STOW.
      (1) ARM Light - REMAINS ILLUMINATED.
   e. STOW Switches - NORM.
      (1) Thrust Reversers - REMAIN STOWED.
      (2) All Thrust Reverser Lights - OUT.

NOTE

- Taxiing with the left thrust reverser deployed will reduce the need for braking at light weights. The right thrust reverser should not be used for extended taxi if the APU and APU bleed is on, due to ingestion of reversed exhaust gases. Exercise care when taxiing with deployed reversers over or near loose gravel or sand.
- If taxiing through slush/ice, taxi with slats/flaps up to preclude ice contamination of flaps or slats systems.

7. Flight Instruments - CHECK.
   Check EFIS EADIs and EHSIs for correct indications and warning flags out of view. Check magnetic compass indicating correctly and turning freely. Verify bank indicators indicating properly in turns and standby gyro stable in turns. Check altimeter settings.

BEFORE TAKEOFF

1. Anti-Ice Systems (if required) - CHECK.
   a. LH and RH ENGINE, STABILIZER, and SLAT ANTI-ICE - ON/CHECK COLD MESSAGES (2-3 minutes).
   b. Throttles - APPROXIMATELY 40% N_1.
   c. Check CAS - COLD (messages go out, No HOT or LEAK messages).

NOTE

The WING AI COLD, SLAT AI COLD, and STAB AI COLD messages are delayed 1.5 minutes and the ENG AI COLD message is delayed 3 minutes after being turned ON. ENG AI COLD and WING AI COLD messages will not illuminate if OAT is above 15°C ±3°C. This check may need to be accomplished during climb if destination or enroute icing is expected.

(Continued Next Page)

BEFORE TAKEOFF (Continued)

   d. ANTI-ICE Switches - AS REQUIRED. It is suggested that Pitot/Static Anti-Ice be employed for all flights. Observe ground operations limitations (maximum two minutes).
   e. Throttles - IDLE.

2. Seats/Seat Belts/Shoulder Harnesses/Aft Divider Sliding Doors - CHECK/SECURE/LATCHED OPEN (if belted toilet seat occupied).
3. Flaps/Slats - SET FOR TAKEOFF.
4. Speed Brakes - RETRACTED (0%).
5. Trims (3) - SET FOR TAKEOFF.

HORIZONTAL STABILIZER POSITION FOR TAKEOFF

EXAMPLE:
TAKEOFF FLAPS - 15
HORIZONTAL STABILIZER SETTING AT 23% MAC = -6.2 DEGREES

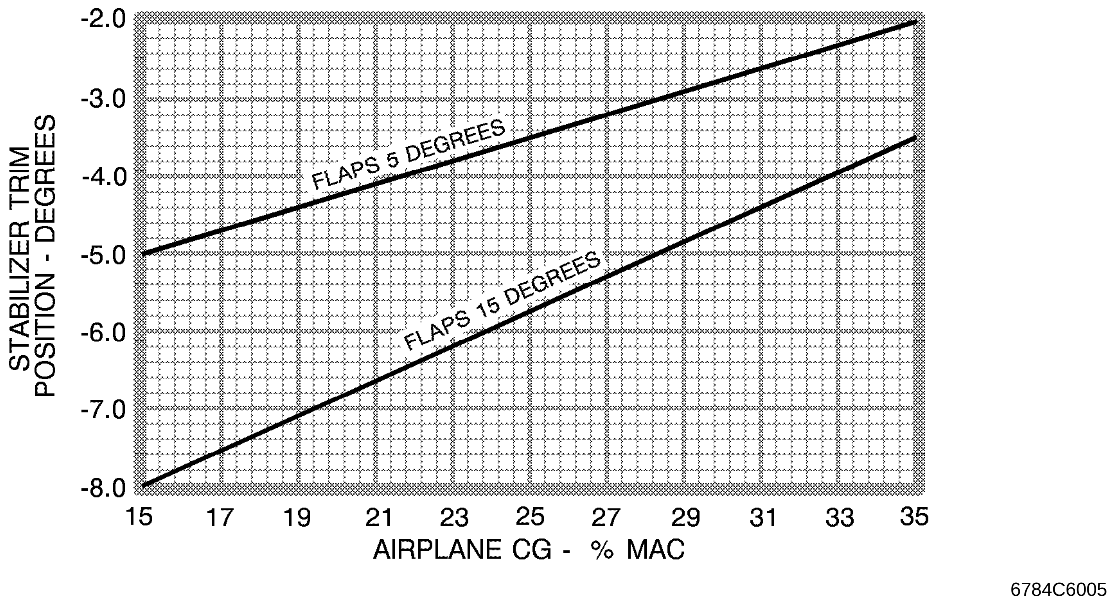

Figure 4-3

6. Yaw Damper and Mach Trim - CHECK ON.
7. Crew Briefing - COMPLETE. It is suggested that the pilot brief the copilot and crew, if applicable, on takeoff procedures at this point. The briefing may consist of discussion concerning crew coordination with respect to: flap settings, use of anti-ice, review of throttle procedures, V-speeds, and planned action(s) in event of emergency, and other applicable procedures.

CLEARED FOR TAKEOFF

8. Radar - AS REQUIRED.
9. Transponder - TA/RA.
10. LH and RH PITOT STATIC Anti-Ice Switches - BOTH ON.
11. Anti-Ice Switches - AS REQUIRED.
    Systems ON which may have been turned OFF due to ground operating limitations as well as any additional requirements.
12. Exterior Lights - AS REQUIRED.
    Do not operate the anti-collision lights in conditions of fog, clouds, or haze as the reflection of the light beam can cause disorientation or vertigo.

(Continued Next Page)

BEFORE TAKEOFF (Continued)

13. Engine Instruments - CHECK.
    Select NORM EICAS menu page and check electrical system 28-29 volts, hydraulic systems 3000 PSI, oil temperature and pressure in normal range.
14. EICAS - CHECK.
    Check EICAS messages clear or indicating normal condition.

TAKEOFF

1. Throttles - TO/MC DETENT (FADEC mode indicator - green T/O).
2. Brakes - RELEASE.
3. EICAS - CHECK NORMAL INDICATIONS, N_1 matches command.
4. Elevator Control - ROTATE AT V_R to achieve 13° initial pitch.

NOTE

- The brakes may be released prior to setting TO thrust on rolling takeoffs. The required runway length will be longer than the normal takeoff distance.
- Use of the flight director TO command is recommended for initial pitch attitude reference.

AFTER TAKEOFF/CLIMB

1. Landing Gear - UP.
   After establishing a positive rate of climb, pull the gear handle out and place it to the UP position. The green GEAR DOWN lights will extinguish and the red UNLOCK light will illuminate until the gear reaches the up and locked position. Gear transition takes approximately six seconds.

   NOTE

   When operating from airports with precipitation conditions (standing water) on runways, it is recommended that retracting of the landing gear be delayed a sufficient amount of time to clear any accumulated moisture in the brakes and wheel assemblies.

2. Flaps/Slats - UP (airspeed above 170 KIAS).
   After reaching a comfortable altitude and an airspeed above 170 KIAS with wings level, push the flap handle in and move it full forward to the UP detent. Observe that the flaps position indicator in the EICAS moves to a FLAPS UP indication. Airspeed in excess of the minimum retraction airspeed will accentuate the pitch change during retraction.
3. Throttles - CLB DETENT.

   NOTE

   - Takeoff Thrust (TO/MC detent) with ITT in the amber range (851°C to 888°C) is limited to 5 minutes.
   - Thrust must be reduced to the Climb (CLB) detent within 5 minutes after takeoff.
   - Use of Climb Thrust (CLB detent) during normal operations beyond 10 minutes after reaching cruise altitude will significantly decrease engine life and increase operator costs.

4. Anti-Ice Systems - AS REQUIRED.

   NOTE

   - Windshield anti-ice may be on continuously during most ground and all flight operations to aid in cockpit heating.
   - When climbing with bleed air anti-ice on, the throttles may be placed in the TO/MC detent, if ITT remains ≤850°C, to improve climb performance.

5. ENG SYNC Knob - AS DESIRED.
6. Pressurization - CHECK.
   Verify that the cabin is pressurizing according to the proper schedule.
7. Passenger Advisory Lights - AS REQUIRED.
8. Altimeters (transition altitude) - SET.
   Set altimeters to 29.92 Hg. (or 1013 Mb) at transition altitude (18,000 feet in the U.S.) and crosscheck. Set standby altimeter, if desired. Turn off exterior/recognition lights that are not required.
9. Exterior Lights (FL180) - AS DESIRED.
10. APU (prior to climb above FL310) - OFF. Refer to Normal Procedures, APU SHUTDOWN.

CRUISE

1. Throttles - CRU detent or AS REQUIRED.
   Upon level off, climb thrust is normally maintained while accelerating to the desired cruise speed. Thrust is then adjusted to maintain the desired airspeed per the airplane cruise performance charts. If engine RPM does not automatically synchronize at the desired cruise setting, turn off the engine synchronizer, roughly synchronize the engine with the throttles, and turn the synchronizer switch back to FAN or TURB.

NOTE

- It is recommended that throttles be reduced to the CRU detent or below within 10 minutes after reaching desired altitude.
- For maximum range, thrust required to maintain the optimum angle-of-attack (maximum lift vs drag condition) diminishes with fuel burn-off due to lower airspeed requirements to maintain the optimum angle-of-attack at the lower gross weights. Maximum performance therefore requires a gradually diminishing airspeed and power setting schedule.
- For flight in rough air, refer to Normal Procedures, TURBULENT AIR PENETRATION.

2. Pressurization - CHECK.
3. Oxygen Mask (when required) - DON/NORM.
4. Fuel Transfer - VERIFY.

NOTE

The center-to-wing transfer system, CTR WING XFER switches in NORM, will automatically start center tank to wing transfer at approximately 3250 to 3500 pounds of fuel in each wing and maintain approximately that level in the wings until the center tank is empty. Exact wing fuel level will vary with pitch attitude.

AFTER TAKEOFF/CLIMB

1. Landing Gear - UP.
   After establishing a positive rate of climb, pull the gear handle out and place it to the UP position. The green GEAR DOWN lights will extinguish and the red UNLOCK light will illuminate until the gear reaches the up and locked position. Gear transition takes approximately six seconds.

   NOTE

   When operating from airports with precipitation conditions (standing water) on runways, it is recommended that retracting of the landing gear be delayed a sufficient amount of time to clear any accumulated moisture in the brakes and wheel assemblies.
2. Flaps/Slats - UP (airspeed above 170 KIAS).
   After reaching a comfortable altitude and an airspeed above 170 KIAS with wings level, push the flap handle in and move it full forward to the UP detent. Observe that the flaps position indicator in the EICAS moves to a FLAPS UP indication. Airspeed in excess of the minimum retraction airspeed will accentuate the pitch change during retraction.
3. Throttles - CLB DETENT.

   NOTE

   - Takeoff Thrust (TO/MC detent) with ITT in the amber range (851°C to 888°C) is limited to 5 minutes.
   - Thrust must be reduced to the Climb (CLB) detent within 5 minutes after takeoff.
   - Use of Climb Thrust (CLB detent) during normal operations beyond 10 minutes after reaching cruise altitude will significantly decrease engine life and increase operator costs.
   - Use of climb thrust (CLB detent) during normal operations beyond 10 minutes after reaching cruise altitude will significantly decrease engine life and increase operator costs.
4. Anti-Ice Systems - AS REQUIRED.

   NOTE

   - Windshield anti-ice may be on continuously during most ground and all flight operations to aid in cockpit heating.
   - When climbing with bleed air anti-ice on, the throttles may be placed in the TO/MC detent, if ITT remains ≤850°C, to improve climb performance.
5. ENG SYNC Knob - AS DESIRED.
6. Pressurization - CHECK.
   Verify that the cabin is pressurizing according to the proper schedule.
7. Passenger Advisory Lights - AS REQUIRED.
8. Altimeters (transition altitude) - SET.
   Set altimeters to 29.92 Hg. (or 1013 Mb) at transition altitude (18,000 feet in the U.S.) and crosscheck. Set standby altimeter, if desired. Turn off exterior/recognition lights that are not required.
9. Exterior Lights (FL180) - AS DESIRED.
10. APU (prior to climb above FL310) - OFF. Refer to Normal Procedures, APU SHUTDOWN.

CRUISE

1. Throttles - CRU detent or AS REQUIRED.
   Upon level off, climb thrust is normally maintained while accelerating to the desired cruise speed. Thrust is then adjusted to maintain the desired airspeed per the airplane cruise performance charts. If engine RPM does not automatically synchronize at the desired cruise setting, turn off the engine synchronizer, roughly synchronize the engine with the throttles, and turn the synchronizer switch back to FAN or TURB.

NOTE

- It is recommended that throttles be reduced to the CRU detent or below within 10 minutes after reaching desired altitude.
- For maximum range, thrust required to maintain the optimum angle-of-attack (maximum lift vs drag condition) diminishes with fuel burn-off due to lower airspeed requirements to maintain the optimum angle-of-attack at the lower gross weights. Maximum performance therefore requires a gradually diminishing airspeed and power setting schedule.
- For flight in rough air, refer to Normal Procedures, TURBULENT AIR PENETRATION.

2. Pressurization - CHECK.
3. Oxygen Mask (when required) - DON/NORM.
4. Fuel Transfer - VERIFY.

NOTE

The center-to-wing transfer system, CTR WING XFER switches in NORM, will automatically start center tank to wing transfer at approximately 3250 to 3500 pounds of fuel in each wing and maintain approximately that level in the wings until the center tank is empty. Exact wing fuel level will vary with pitch attitude.

DESCENT

1. LH and RH WINDSHIELD ANTI-ICE Switches - BOTH ON.
2. Side Window Vent Knobs - CLOSED.
3. Pressurization - CHECK/SET LANDING ELEVATION.
4. ANTI-ICE Switches - AS REQUIRED.

NOTE

- Cabin pressure may not be maintained at high altitude while at idle with all anti-ice on. Adjust throttles as required to maintain cabin pressure.

- Minimum airspeed for sustained flight in icing conditions (except approach and landing) is 200 KIAS, with slats retracted.

5. APU - AS DESIRED.
   a. Altitude below FL310, airspeed $\leq$ 300 KIAS.
   b. Altitude below FL200, airspeed $\leq$ 350 KIAS.
6. Exterior Lights (FL180) - AS REQUIRED.
7. Altimeter (transition level) - SET.
   Set altimeters before passing transition altitude (18,000 feet in the U.S.). Turn on desired external lights, recognition lights, etc. to facilitate visual contact by other aircraft at lower altitudes.

NOTE

If landing at airport elevation above 8000 feet MSL, refer to the FAA Approved Flight Manual,Section III, Normal Procedures, HIGH ALTITUDE AIRPORT OPERATIONS.

APPROACH

1. Landing Data - CONFIRM.
   Determine landing data by consulting appropriate charts in the FAA Approved Flight Manual, Section IV, Performance. Gross weight, runway available, ambient temperature, wind, runway gradient, pressure altitude, and runway surface condition must be considered.
   a. Airspeed - V_{APP}/V_{REF}.
   b. Landing Distance.

SIMPLIFIED CRITERIA - FLAPS FULL LANDING

WEIGHT POUNDS	23,000	24,000	26,000	28,000	30,000	31,800
V_{REF} - KIAS	108	110	115	121	126	132
V_{APP} - KIAS	113	116	121	126	131	136

Runway length - 4500 feet or longer.

NOTE

The above criteria apply only to landings with full flaps, at or below 2000 feet MSL, and temperatures at or below 45°C. Refer to the FAA Approved Airplane Flight Manual, Section IV, Performance, APPROACH AND LANDING, for other restrictions on use of simplified criteria and landing data for other conditions.

2. Crew Briefing - COMPLETE.
   Brief copilot/crew on desired duties, missed approach procedures, etc.
3. Avionics/Flight Instruments - CHECK/SET.
   Check NAV receivers on proper frequency and required heading and course information set. Cross check flight instruments for correct indications. Set COMM transceivers to sequential frequencies intended to be used.
4. Minimums - SET (RA/BARO).
   Set the radio altimeter to the decision height, minimum descent altitude, or other applicable altitude reference.
5. FUEL CROSSFEED Switch - OFF.
   Fuel crossfeed should be terminated before landing to clear the EICAS annunciations and, in the case of interwing transfer, to assure adequate fuel supply to the engines in case of a go-around.
6. Exterior Lights - AS REQUIRED. Turn on exterior lights/recognition lights as required for recognition below 10,000 feet.
7. Flaps/Slats - AS REQUIRED (V_{FE} 5°/250 KIAS; 15°/210 KIAS).
8. Passengers - BRIEF.
9. Seats/Seat Belts/Shoulder Harnesses/Aft Divider Sliding Doors - CHECK/SECURE/LATCHED OPEN (if belted toilet seat occupied).
10. Passenger Advisory Lights - PASS SAFETY.
    Illuminates NO SMOKING, FASTEN SEAT BELT, and EMERGENCY EXIT signs.
11. LH and RH IGNITION Switches - NORM.
    The NORM position provides automatic engine relight capability, in case of a flameout caused by a bird strike or other foreign object ingestion.
12. Pressurization - ZERO DIFFERENTIAL at touchdown.
13. ENG SYNC Knob - OFF.

BEFORE LANDING

1. Landing Gear - DOWN and LOCKED (3 green lights); V_{LO}/V_{LE} 210 KIAS.
   Pull the gear handle out and place it to the DOWN position. The red UNLOCK light will illuminate while the gear extends. Check the three GREEN, GEAR DOWN lights illuminated and UNLOCK light extinguished when gear is full down.
2. Flaps - AS REQUIRED (V_{FE}15°/210 KIAS; FULL/180 KIAS).
3. Speed Brakes - RETRACTED (0%).
4. EICAS - CHECK.
5. Airspeed - V_{REF}.
6. Autopilot - OFF above minimum use height.
   The autopilot must be off for landing. Observe the autopilot minimum use height in accordance with the FAA Approved Flight Manual, Section II, Limitations. The yaw damper may continue to be used to touchdown at which time the weight-on-wheels switch will override it.

LANDING

Consistently comfortable and safe landings are best achieved from a stabilized approach. The point at which the airplane should be stabilized with airspeed at V_{REF} to V_{REF} +10, full flaps, and the desired descent rate is normally coincident with commencing the final descent to landing. Under instrument conditions, this usually occurs at the final approach fix inbound. During visual approaches, this would be a point approximately where a turn to base leg would be initiated, adjusted for traffic pattern altitude.

After passing the initial approach fix or nearing the airport traffic area, airspeed should be reduced below 210 KIAS and the flaps extended to the 15-degree position. Approaching the final instrument fix inbound (one dot from glideslope interception on an ILS), or at a downwind position abeam the touchdown point, extend the landing gear below 210 KIAS. At the point where final descent to landing is begun, reduce airspeed below 180 KIAS and extend FULL flaps, establish the desired descent rate, and adjust power to maintain V_{REF} to V_{REF} +10 indicated airspeed.

For maneuvering prior to final approach, minimum airspeeds of V_{REF} +30, V_{REF} +20 and V_{REF} +10 should be maintained clean, flaps 15 degrees, and flaps FULL down, respectively, to provide an adequate margin above stall.

Speed control on final should be precise for optimum landing performance. This is best accomplished by establishing V_{REF} airspeed well before crossing the threshold. In gusty wind conditions, it is recommended that one-half the gust factor in excess of 5 knots be added to V_{REF}.

Power management during the approach/landing phase is relatively easy in the Model 750 because an N_1 setting in the 60 to 65 percent range will normally result in desired indicated airspeeds for the various configurations. Depending on air traffic control requirements, thrust necessary for the entire approach can often be set during descent, keeping in mind that fan (N_1) RPM will decrease very slightly for a fixed throttle setting with a decrease in altitude or indicated airspeed.

(Continued Next Page)

LANDING (Continued)

Using a sea level airport with zero wind at a typical landing weight (27,000 pounds), a throttle setting that results in approximately 60 percent N_1 will give approximate level flight indicated airspeeds of 170 knots clean and 150 with flaps 15 degrees. With gear extended and flaps FULL down (35°), initiating an average descent (500 FPM) will result in approximately V_{REF} airspeed. Higher field elevations, landing gross weights, and/or a headwind component will require a higher power setting.

Approaching within approximately 50 feet of airport elevation, power should be gradually reduced to counter the acceleration induced by ground effect. Wind velocity and direction will dictate the rate at which the throttles are retarded. In very high surface headwind conditions, as an example, it may be necessary to maintain at or near approach power until close to touchdown. With a tailwind, a fairly rapid power reduction may be necessary in the final descent to landing phase for accurate speed control. In ground effect, where induced drag is reduced, leaving approach power on will cause the airplane to float to a longer touchdown than desired. Retarding the throttles gradually in the final descent will normally result in idle thrust being reached just before touchdown.

CROSSWIND LANDING TECHNIQUE

Consistent crosswind landings should be accomplished using a “crab” technique. Due to its long span, and highly swept wing, the airplane should not be flown using the wing-down sideslip technique. Final approach should be flown in a crab with wings level. As the airplane is transitioned into a flare attitude, smoothly apply rudder to approximately align the airplane for touchdown while maintaining wings level with aileron control. Depending on the crosswind velocity, full runway alignment may not be practical due to resulting drift. Allow the airplane to touchdown in a crab. Do not attempt to hold it off the runway. As the airplane touches, deploy the speed brakes and smoothly apply and hold forward elevator control to lower the nose to the ground. Use nose wheel steering through the rudder pedals for directional control, transitioning to the tiller as speed reduces. After touchdown, it will be necessary to apply and maintain aileron control into the wind to keep the upwind wing from lifting during rollout.

Refer to Figure 4-4 for roll-pitch restrictions regarding wingtip and tailcone ground clearance during landing.

LANDING (WITH THRUST REVERSERS)

Touchdown, preceded by a slight flare, should occur on the main wheels. Check thrust at idle, extend the speed brakes, lower the nose wheel to the runway, and apply the wheel brakes. Maintain nose wheel ground contact with forward elevator pressure and deploy the thrust reversers. Check thrust reverser DEPLOY annunciators are illuminated before adding reverse thrust.

(Continued Next Page)

LANDING (Continued)

WING TIP/TAILCONE GROUND CONTACT ROLL-PITCH ENVELOPE

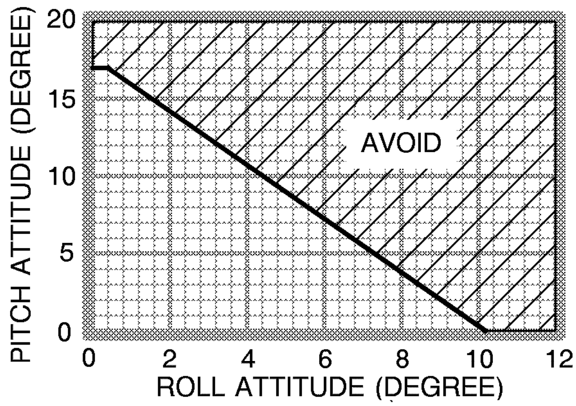

Figure 4-4

CAUTION

EXCESSIVE ROLL AND/OR PITCH ATTITUDE, WITH THE MAIN GEAR ON THE GROUND DURING TAKEOFF OR LANDING, CAN RESULT IN TAILCONE AND/OR WINGTIP GROUND CONTACT.

There is a slight nose up pitch associated with the deployment of the thrust reversers. Therefore, light forward pressure should be used during the thrust reverser deployment, especially at high speeds such as an aborted takeoff or a no flaps landing. The nose wheel must be on the ground before adding reverse power to eliminate the possibility of foreign object damage and to improve directional control.

CAUTION

- DO NOT ATTEMPT TO RESTOW REVERSERS AND TAKEOFF ONCE REVERSERS HAVE STARTED TO DEPLOY.
- IF THE REVERSERS ARE DEPLOYED AND THE AIRPLANE SKIPS, THE REVERSERS WILL AUTO-STOW AND THEN REDEPLOY ON THE SUBSEQUENT TOUCHDOWN. IF THE REVERSERS HAVE FULLY DEPLOYED AND REVERSE THRUST HAS BEEN INCREASED ABOVE IDLE PRIOR TO THE SKIP, REVERSE (OR FORWARD) THRUST WILL NOT BE AVAILABLE DURING THE SUBSEQUENT ROLLOUT, UNLESS THE THROTTLE LEVERS ARE AT OR RETURNED TO IDLE PRIOR TO ATTEMPTING THRUST INCREASE.

Once the thrust reversers are deployed, move the thrust reverser levers aft to obtain maximum reverse thrust. The FADECs will prevent the pilot from exceeding the takeoff thrust rating. This allows the pilot to keep his attention on the landing rollout instead of diverting his attention to the reverse power settings. The thrust reverser levers should be placed in idle reverse at 70 knots to prevent foreign object damage to the engine.

(Continued Next Page)

LANDING (Continued)

1. Throttles - IDLE.
2. Speed Brakes - EXTEND at touchdown (100%).
3. Elevator Control - FORWARD PRESSURE at touchdown.
4. Brakes - APPLY after nose wheel ground contact.

NOTE

- Speed brakes and thrust reversers cause a nose up pitch when deployed. This characteristic is more noticeable as the center-of-gravity approaches the light weight aft limit. Maintain forward elevator control pressure.

- For most normal landings, when runway length is not critical, brakes may be delayed. Refer to The FAA Approved Flight Manual, Section IV, Performance, APPROACH and LANDING for procedures used to obtain scheduled performance.

5. Thrust Reversers - DEPLOY after nose wheel ground contact.

CAUTION

- IF REVERSERS ARE DEPLOYED AND THE AIRPLANE SKIPS, THE REVERSERS WILL AUTO-STOW AND THEN REDEPLOY ON THE SUBSEQUENT TOUCHDOWN. IF THE REVERSERS HAVE FULLY DEPLOYED AND REVERSE THRUST HAS BEEN INCREASED ABOVE IDLE PRIOR TO THE SKIP, REVERSE (OR FORWARD) THRUST WILL NOT BE AVAILABLE DURING THE SUBSEQUENT ROLLOUT UNLESS THE THROTTLES ARE AT OR RETURNED TO IDLE PRIOR TO ATTEMPTING THRUST INCREASE.
- IF LANDING WITH A SINGLE REVERSER ON A SLIPPERY RUNWAY OR WITH NOSE WHEEL STEERING INOPERATIVE, REDUCE THRUST TO IDLE BY 70 KIAS.

6. Thrust Reversers - IDLE BY 65 KIAS.
   Use of reverse thrust below 65 KIAS increases the possibility of foreign object damage to the engines.

LANDING (WITHOUT USE OF THRUST REVERSERS)

Touchdown, preceded by a slight flare, should occur on the main wheels. Check thrust at idle and extend the speed brakes while lowering the nosewheel. With the nose wheel on the runway, braking should be commenced according to runway length available to reduce brake wear. Apply smooth, gradually increasing pressure until a comfortable turn off speed is reached. If maximum braking performance is desired, do not modulate brake pedals. The antiskid system is most effective with continuous brake pedal pressure.

NOTE

Antiskid system "dropout" occurs at approximately 10 knots where braking reverts to straight power brake mode.

LANDING (Continued)

WING TIP/TAILCONE GROUND CONTACT ROLL-PITCH ENVELOPE

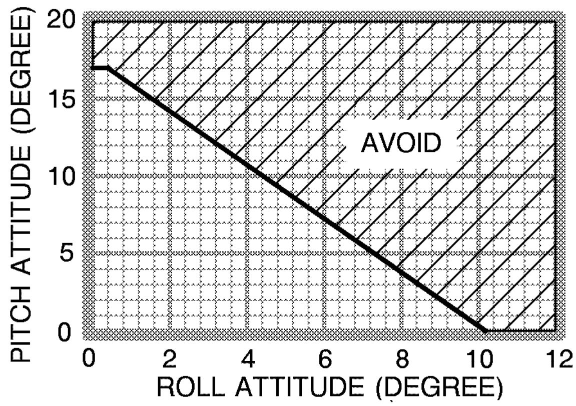

Figure 4-4

CAUTION

EXCESSIVE ROLL AND/OR PITCH ATTITUDE, WITH THE MAIN GEAR ON THE GROUND DURING TAKEOFF OR LANDING, CAN RESULT IN TAILCONE AND/OR WINGTIP GROUND CONTACT.

There is a slight nose up pitch associated with the deployment of the thrust reversers. Therefore, light forward pressure should be used during the thrust reverser deployment, especially at high speeds such as an aborted takeoff or a no flaps landing. The nose wheel must be on the ground before adding reverse power to eliminate the possibility of foreign object damage and to improve directional control.

CAUTION

- DO NOT ATTEMPT TO RESTOW REVERSERS AND TAKEOFF ONCE REVERSERS HAVE STARTED TO DEPLOY.
- IF THE REVERSERS ARE DEPLOYED AND THE AIRPLANE SKIPS, THE REVERSERS WILL AUTO-STOW AND THEN REDEPLOY ON THE SUBSEQUENT TOUCHDOWN. IF THE REVERSERS HAVE FULLY DEPLOYED AND REVERSE THRUST HAS BEEN INCREASED ABOVE IDLE PRIOR TO THE SKIP, REVERSE (OR FORWARD) THRUST WILL NOT BE AVAILABLE DURING THE SUBSEQUENT ROLLOUT, UNLESS THE THROTTLE LEVERS ARE AT OR RETURNED TO IDLE PRIOR TO ATTEMPTING THRUST INCREASE.

Once the thrust reversers are deployed, move the thrust reverser levers aft to obtain maximum reverse thrust. The FADECs will prevent the pilot from exceeding the takeoff thrust rating. This allows the pilot to keep his attention on the landing rollout instead of diverting his attention to the reverse power settings. The thrust reverser levers should be placed in idle reverse at 70 knots to prevent foreign object damage to the engine.

(Continued Next Page)

LANDING (Continued)

1. Throttles - IDLE.
2. Speed Brakes - EXTEND at touchdown (100%).
3. Elevator Control - FORWARD PRESSURE at touchdown.
4. Brakes - APPLY after nose wheel ground contact.

NOTE

- Speed brakes and thrust reversers cause a nose up pitch when deployed. This characteristic is more noticeable as the center-of-gravity approaches the light weight aft limit. Maintain forward elevator control pressure.

- For most normal landings, when runway length is not critical, brakes may be delayed. Refer to The FAA Approved Flight Manual, Section IV, Performance, APPROACH and LANDING for procedures used to obtain scheduled performance.

5. Thrust Reversers - DEPLOY after nose wheel ground contact.

CAUTION

- IF REVERSERS ARE DEPLOYED AND THE AIRPLANE SKIPS, THE REVERSERS WILL AUTO-STOW AND THEN REDEPLOY ON THE SUBSEQUENT TOUCHDOWN. IF THE REVERSERS HAVE FULLY DEPLOYED AND REVERSE THRUST HAS BEEN INCREASED ABOVE IDLE PRIOR TO THE SKIP, REVERSE (OR FORWARD) THRUST WILL NOT BE AVAILABLE DURING THE SUBSEQUENT ROLLOUT UNLESS THE THROTTLES ARE AT OR RETURNED TO IDLE PRIOR TO ATTEMPTING THRUST INCREASE.

- IF LANDING WITH A SINGLE REVERSER ON A SLIPPERY RUNWAY OR WITH NOSE WHEEL STEERING INOPERATIVE, REDUCE THRUST TO IDLE BY 70 KIAS.

6. Thrust Reversers - IDLE BY 60 KIAS.
   Use of reverse thrust below 60 KIAS increases the possibility of foreign object damage to the engines.

LANDING (WITHOUT USE OF THRUST REVERSERS)

Touchdown, preceded by a slight flare, should occur on the main wheels. Check thrust at idle and extend the speed brakes while lowering the nosewheel. With the nose wheel on the runway, braking should be commenced according to runway length available to reduce brake wear. Apply smooth, gradually increasing pressure until a comfortable turn off speed is reached. If maximum braking performance is desired, do not modulate brake pedals. The antiskid system is most effective with continuous brake pedal pressure.

NOTE

Antiskid system "dropout" occurs at approximately 10 knots where braking reverts to straight power brake mode.

ALL ENGINE GO-AROUND

1. Go-Around Button - PRESS.

NOTE

The flight director go-around mode is recommended to establish the climb pitch attitude reference. Pressing the throttle mounted go-around button disengages the autopilot, if on, and engages the flight director to wings level, +10 degrees pitch up go-around mode.

2. Throttles - TO/MCT.
3. Airplane Pitch Attitude - POSITIVE ROTATION TO +10° (go-around pitch command) or AS REQUIRED.
4. Flaps - 15° (or 5° if 15° flap landing).
5. Landing Gear (Positive Climb and Flaps ≤15°) - UP.

NOTE

If the landing gear are retracted before the flaps reach 15°, the landing gear warning will sound briefly.

6. Flaps - AS REQUIRED.
7. Climb Speed - AS REQUIRED.
8. Throttles - AS REQUIRED.

AFTER LANDING

1. Thrust Reversers - STOW.
   Do not advance throttles from idle until the thrust reverser UNLOCK lights are out.
2. Speed Brakes - RETRACTED (0%).
3. Flaps/Slats - UP/AS REQUIRED.

NOTE

When landing/taxiing in slush/ice, leave flaps at 15° until post flight inspection of slats, flaps and wing trailing edge.

4. Radar - OFF.
   The weight-on-wheels (squat) switch will prevent the radar from transmitting on the ground, however, it is better practice not to taxi into parking with the radar on.
5. Transponder - STANDBY.
6. PITOT/STATIC Anti-Ice Switches - OFF.
7. Anti-Ice Systems - ENGINES - AS REQUIRED; SLAT and STABILIZER - OFF.

NOTE

In humid conditions the windshield anti-ice may be left on for external defogging, however, it should not be left on for an extended period of time because of reduced cooling of the controllers on the ground. Observe ground operating limitations.

(Continued Next Page)

AFTER LANDING (Continued)

8. Exterior Lights - AS REQUIRED.
   The anti-collision lights are extremely bright and should be turned OFF when clear of the runway, in consideration of other airplanes and ground personnel, if not otherwise required.
9. APU - AS DESIRED.

SHUTDOWN

1. Parking Brake - SET.
   Pressing both brake pedals down and pulling up on the parking brake T-handle located at the aft end of the center pedestal will set the parking brakes. Recharge the hydraulic accumulator by momentarily operating the “A” AUX Hydraulic Pump. Do not leave the airplane unattended without chocks or the parking brake set.

NOTE

If the brakes are very hot do not set the parking brakes.

2. Anti-Ice Systems - ALL OFF.
3. Throttles - CUTOFF.
   When ITT has stabilized, place throttles to cutoff.

NOTE

The ENGINE FAIL and GEN FAIL red CAS messages may be momentarily displayed during normal engine shutdown if both engines are shut down in rapid succession.

4. IRS Mode Control Knobs (if installed) - OFF (allow 10 seconds before turning off STBY PWR).
5. Passenger Advisory Lights - OFF.
6. Standby Gyro - CAGED.
7. STBY PWR - OFF.
8. Avionics Power/EICAS Switches - OFF.
9. EMERG LT - OFF.
10. GRVTY XFLOW Switch - OFF.
11. APU - OFF. Refer to Normal Procedures, APU SHUTDOWN.
12. Exterior Lights - OFF.
13. BATT 1 and BATT 2 Switches - OFF.

NOTE

- If the brakes are hot, release the parking brake after wheel chocks are in place.
- If ambient temperature is below 0°C, refer to Normal Procedures, EXTREME COLD WEATHER OPERATIONS.

For quick deplaning at night, either battery switch may remain ON to make available all cabin lighting until passengers and cabin baggage are disembarked. Turning the ANTI-ICE WING INSP light switch on provides additional illumination in front of the cabin door. An illuminated two-position courtesy light switch located on the forward door post is wired to the hot battery bus and turns on the emergency exit lights, which can be used for entry and exit.

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ALL ENGINE GO-AROUND

1. Go-Around Button - PRESS.

NOTE

The flight director go-around mode is recommended to establish the climb pitch attitude reference. Pressing the throttle mounted go-around button disengages the autopilot, if on, and engages the flight director to wings level, +13 degrees pitch up go-around mode.

2. Throttles - TO/MCT.
3. Airplane Pitch Attitude - POSITIVE ROTATION TO +10° initially. When target airspeed is achieved, increase pitch to +13° or AS REQUIRED.
4. Flaps - 15° (or 5° if 15° flap landing).
5. Landing Gear (Positive Climb and Flaps $\leq$15°) - UP.

NOTE

If the landing gear are retracted before the flaps reach 15°, the landing gear warning will sound briefly.

6. Flaps - AS REQUIRED.
7. Climb Speed - AS REQUIRED.
8. Throttles - AS REQUIRED.

AFTER LANDING

1. Thrust Reversers - STOW.
   Do not advance throttles from idle until the thrust reverser UNLOCK lights are out.
2. Speed Brakes - RETRACTED (0%).
3. Flaps/Slats - UP/AS REQUIRED.

NOTE

When landing/taxiing in slush/ice, leave flaps at 15° until post flight inspection of slats, flaps and wing trailing edge.

4. Radar - OFF.
   The weight-on-wheels (squat) switch will prevent the radar from transmitting on the ground, however, it is better practice not to taxi into parking with the radar on.
5. Transponder - STANDBY.
6. PITOT/STATIC Anti-Ice Switches - OFF.
7. Anti-Ice Systems - ENGINES - AS REQUIRED; SLAT and STABILIZER - OFF.

NOTE

In humid conditions the windshield anti-ice may be left on for external defogging, however, it should not be left on for an extended period of time because of reduced cooling of the controllers on the ground. Observe ground operating limitations.

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AFTER LANDING (Continued)

8. Exterior Lights - AS REQUIRED.
   The anti-collision lights are extremely bright and should be turned OFF when clear of the runway, in consideration of other airplanes and ground personnel, if not otherwise required.
9. APU - AS DESIRED.

SHUTDOWN

1. Parking Brake - SET.
   Pressing both brake pedals down and pulling up on the parking brake T-handle located at the aft end of the center pedestal will set the parking brakes. Recharge the hydraulic accumulator by momentarily operating the “A” AUX Hydraulic Pump. Do not leave the airplane unattended without chocks or the parking brake set.

NOTE

If the brakes are very hot do not set the parking brakes.

2. Anti-Ice Systems - ALL OFF.
3. Throttles - CUTOFF.
   When ITT has stabilized, place throttles to cutoff.

NOTE

The ENGINE FAIL and GEN FAIL red CAS messages may be momentarily displayed during normal engine shutdown if both engines are shut down in rapid succession.

4. IRS Mode Control Knobs (if installed) - OFF (allow 10 seconds before turning off STBY PWR).
5. Passenger Advisory Lights - OFF.
6. Standby Gyro - CAGED.
   The standby gyro is caged by pulling the knob and rotating it clockwise.
7. STBY PWR - OFF.
8. Avionics Power/EICAS Switches - OFF.
9. EMERG LT - OFF.
10. GRVTY XFLOW Switch - OFF.
11. APU - OFF. Refer to Normal Procedures, APU SHUTDOWN.
12. Exterior Lights - OFF.
13. BATT 1 and BATT 2 Switches - OFF.

NOTE

- If the brakes are hot, release the parking brake after wheel chocks are in place.

- If ambient temperature is below 0°C, refer to Normal Procedures, EXTREME COLD WEATHER OPERATIONS.

For quick deplaning at night, either battery switch may remain ON to make available all cabin lighting until passengers and cabin baggage are disembarked. Turning the ANTI-ICE WING INSP light switch on provides additional illumination in front of the cabin door. An illuminated two-position courtesy light switch located on the forward door post is wired to the hot battery bus and turns on the emergency exit lights, which can be used for entry and exit.

(Continued Next Page)

SHUTDOWN (Continued)

When securing the airplane, install the engine covers and pitot tube covers. Check the battery, passenger advisory and courtesy light switches are OFF. Closing the door extinguishes the integral courtesy light. All doors and the nose compartment can be key locked. A locking pin can be installed in the internal emergency exit door handle to prevent access from the outside. This pin must be removed prior to flight. In conditions of blowing or drifting snow, install engine covers after shutdown as soon as the engines have cooled.

To preclude possible oxygen loss due to leakage through the oxygen masks, it is recommended that the crew oxygen masks be unplugged between flights.

SHUTDOWN (QUICK TURN)

1. Parking Brake - SET.
2. APU - START. Refer to Normal Procedures, APU GROUND OR IN-FLIGHT START.

CAUTION

THE APU IS NOT APPROVED FOR UNATTENDED GROUND OPERATION.

3. Anti-Ice Systems - OFF.
4. Throttles - CUTOFF.
5. Passenger Advisory Lights - OFF.
6. Exterior Lights - AS REQUIRED.
7. Return to Normal Procedures, BEFORE START.

APU GROUND OR IN-FLIGHT START

1. BATT 1 and BATT 2 Switches - ON.
2. LH FUEL BOOST Switch - NORM.

NOTE

If the APU will be left operating on the ground for an extended period with fuel in the center tank, select the LH CTR WING XFER switch to NORM to minimize fuel imbalance. The APU can be fed from the right wing by selecting crossfeed from the right tank and selecting the left boost pump OFF.

3. LOAD SHED Switch (single generator/engine) - EMER.

CAUTION

IF THE APU IS BEING STARTED WITH ONLY ONE GENERATOR ON-LINE, THE LOAD SHED SWITCH MUST BE PLACED TO EMER PRIOR TO THE START.

4. APU STARTER DISENGAGE Switch - NORMAL.
5. APU MASTER Switch - ON.
6. APU TEST - PUSH.
7. APU GENERATOR Switch - ON.
8. APU BLEED AIR Switch - OFF.
9. APU DC VOLTS - CHECK (22 volts minimum).
10. APU - START.

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APU GROUND OR IN-FLIGHT START (Continued)

NOTE

Hold APU START switch up until APU RELAY ENGAGED light illuminates. Up to 5 seconds may be required to enable start logic.

11. APU RELAY ENGAGED Light - ON, then OFF before READY TO LOAD light ON.
12. READY TO LOAD Light - ON.
13. LOAD SHED Switch - NORM.
14. GPU - DISCONNECT/CLEAR (if used).
15. APU Ammeter - CHECK (300 amps maximum/ground; 200 amps maximum in flight).
16. APU BLEED AIR Switch- ON (for engine start); AS REQUIRED (for PAC bleed).

APU SHUTDOWN

1. APU START Switch - STOP.
2. APU BLEED AIR Switch - OFF.
3. READY TO LOAD Light - OFF.
4. APU MASTER - OFF.

TURBULENT AIR PENETRATION

Flight through severe turbulence should be avoided if possible. The following procedures are recommended for flight in severe turbulence.

1. Maximum airspeed 300 KIAS or .90 MACH, whichever is less. Do not chase airspeed.
2. Maintain a constant attitude without chasing the altitude. Avoid sudden large control movements.
3. If Autopilot is on - ALTITUDE HOLD, DISENGAGE.
4. Passenger Advisory Lights - PASS SAFETY.

ADVERSE FIELD CONDITIONS

All flight manual field length data assumes a dry, hard surface runway except where otherwise noted. Precipitation-covered runway conditions will degrade braking effectiveness and will require significantly greater actual takeoff abort and landing field lengths.

Considerations for landing on a precipitation-covered runway are similar to those for short field operations where velocity and speed are minimized and maximum roll out distance is made available. Runway composition, condition and construction, the amount of precipitation and the depth of main landing gear tire tread remaining affect the magnitude of braking degradation, so it is impossible to apply a fixed factor to cover all conditions. Please refer to the FAA Approved Airplane Flight Manual, Section VII, Advisory Information, for data that will permit estimation of the minimum runway required under various precipitation-covered runway conditions. Again, maximizing roll out runway available and touching down at minimum safe speed will provide the greatest possible margin.

(Continued Next Page)

ADVERSE FIELD CONDITIONS (Continued)

With precipitation cover on the runway, braking should be very judicious. If runway length permits, delay braking slightly until some aerodynamic deceleration has taken place. Under normal braking conditions, the antiskid system is very effective in preventing skids and producing minimum stopping distances. However, on a precipitation-covered runway, the phenomena of hydroplaning may greatly reduce the antiskid effectiveness due to the possibility of the airplane wheels not rotating up to a speed equal to the airplane ground speed. With 180 PSI main gear tire inflation the minimum dynamic hydroplaning initiating ground speed may occur at speeds above approximately 94 knots.

Since ground speed is the critical factor, landing on precipitation-covered runways with any tailwind component should be avoided. Good tread depth tends to relieve hydrodynamic pressure under the tire on wet runways, and inflation is important because a low tire pressure lowers the minimum hydroplaning speed. Anticipated operation on precipitation-covered runways dictates close monitoring of tire condition and pressure.

Use of the thrust reversers on precipitation-covered runways is the same as that for a landing on a normal or dry runway. Cockpit visibility is not hampered by blowing rain, snow or ice thrown forward by the thrust reverser. Single engine reversing during crosswind landings on precipitation-covered runways should be used with discretion.

After landing on ice or slush, a complete check of the airplane, including overboard vents and control surfaces, should be conducted.

WHEEL FUSIBLE PLUG CONSIDERATIONS

Brake application reduces the speed of an airplane by means of friction between the brake stack components. The friction generates heat, which increases the temperature of the brakes and wheel assembly, resulting in an increased tire pressure. Each main wheel incorporates fuse plugs, which melt at a predetermined temperature, to prevent a possible tire explosion due to excessively high tire pressure. Flight crews must take precautions when conducting repetitive traffic circuits, including multiple landings/or multiple rejected takeoffs, to prevent overheating the brakes, which could melt the fuse plug and cause loss of all tire pressure and possible tire and wheel damage. During such operations, available runway permitting, minimize brake usage, and consider cooling the brakes in flight with the landing gear extended. Maximizing use of reverse thrust and extending speed brakes will assist in bringing the airplane to a stop.

DATA FOR WET, SLUSH, SNOW AND ICE COVERED RUNWAYS

The most accurate and practical guidance material available for adverse runway operations is found in the FAA Approved Airplane Flight Manual, Section VII, Advisory Information. This advisory information is not FAA approved.

BUDDY START PROCEDURE

In situations where additional air pressure from another airplane is needed in the STARTING ENGINES procedure, a Buddy Start system can be used. Only the Buddy Start Hose (P/N 0043-0028-1) manufactured by Kaiser Electroprecision is recommended for the Buddy Start procedure.

1. BEFORE START procedure - COMPLETE.
2. Both donor and starting airplanes should be situated within the 60-foot length of the Buddy Start Hose so that the quick-disconnect couplings can be secured and exhaust blast minimized.
3. Connect the Buddy Start Hose to the ground air start nipple on both airplanes.

CAUTION

WHEN CONNECTING OR DISCONNECTING THE BUDDY START HOSE TO EITHER AIRPLANE WITH AN ENGINE OR APU RUNNING, ENSURE THAT ALL BLEED AIR SOURCES ARE TURNED OFF (L ENG BLD AIR AND R ENG BLD AIR SWITCHES - OFF ON MODEL 750).

4. CKPT PAC and CAB PAC switches - OFF.
5. APU BLEED AIR MAX COOL switch - OFF.
6. PAC off and APU valves closed on donor airplane.
7. Start the donor airplane normally and maintain 55% N_1 according to STARTING SECOND ENGINE: CROSS BLEED METHOD in this section.
8. The starting airplane should follow the remaining STARTING ENGINES sequence in this section.
9. Disconnect Buddy Start Hose from both airplanes.

WARNING

THE BUDDY START HOSE CONNECTIONS AND NOZZLE HANDLES WILL BE HOT. ALWAYS USE PROTECTIVE CLOTHING AND GLOVES BEFORE HANDLING THE CONNECTIONS.

NOTE

Donor airplanes other than the Model 750 may be used, but manufacturer's procedures for engine starting must be followed. The operator should determine the proper bleed configuration and engine speed to provide a minimum receiving aircraft motoring N_2 of 30%.

FUEL ANTI-ICE ADDITIVES

Fuel anti-ice additives are not required for fuel system ice protection; however, fuel anti-ice additives control bacteria and fungi. The anti-ice additives EGME (MIL-I-27686)/DIEGME (MIL-I-85470) have shown, through service experience, that they provide acceptable protection from micro-organisms such as bacteria and fungi that can rapidly multiply and cause serious corrosion in tanks and may block filters, screens and fuel metering equipment. If used, the concentration should be 0.10 to 0.15% by volume. BIOFOR JF, in concentrations not to exceed 270 PPM, is also approved for the control of micro-organisms. A corrosion/lubricity additive found in qualified Product List of MIL-I-25017 may also be used.

PROCEDURE FOR ADDING FUEL ANTI-ICING ADDITIVE

For single point refueling, anti-ice additive must be preblended or mixed at the fuel truck.

When the airplane is being refueled through the over wing ports, use the following procedure to blend anti-icing additive to nontreated fuel:

1. Attach additive to refuel nozzle, making sure blender tube discharges in the refueling stream.

2. Start refueling (minimum 30 gallons per minute, maximum 60 gallons per minute) while simultaneously fully depressing and slipping ring over trigger of blender (rate of less than 30 gallons per minute may be used when "topping off").

WARNING

ANTI-ICING ADDITIVES CONTAINING ETHYLENE GLYCOL MONOMETHYL ETHER (EGME) ARE HARMFUL IF INHALED, SWALLOWED OR ABSORBED THROUGH THE SKIN, AND WILL CAUSE EYE IRRITATION. IT IS ALSO COMBUSTIBLE. BEFORE USING THIS MATERIAL, REFER TO ALL SAFETY INFORMATION ON THE CONTAINER.

CAUTION

- DIETHYLENE GLYCOL MONOMETHYL ETHER (DIEGME) IS SLIGHTLY TOXIC IF SWALLOWED AND MAY CAUSE EYE REDNESS, SWELLING AND IRRITATION. IT IS ALSO COMBUSTIBLE. BEFORE USING THIS MATERIAL, REFER TO ALL SAFETY INFORMATION ON THE CONTAINER.

- ASSURE THE ADDITIVE IS DIRECTED INTO THE FLOWING FUEL STREAM WITH THE ADDITIVE FLOW STARTED AFTER THE FUEL FLOW STARTS AND IS STOPPED BEFORE FUEL FLOW STOPS. DO NOT ALLOW CONCENTRATED ADDITIVE TO CONTACT COATED INTERIOR OF FUEL TANK OR AIRPLANE PAINTED SURFACE.

- USE NOT LESS THAN 20 FLUID OUNCES OF ADDITIVE PER 156 GALLONS OF FUEL OR MORE THAN 20 FLUID OUNCES OF ADDITIVE PER 104 GALLONS OF FUEL.

(Continued Next Page)

FUEL ANTI-ICE ADDITIVES (Continued)

PROCEDURE FOR CHECKING FUEL ADDITIVES

Prolonged storage of the airplane will result in a water buildup in the fuel which "leaches out" the additive. An indication of this is when an excessive amount of water accumulates in the fuel tank sumps. The concentration of additive can be checked using an anti-icing additive concentration test kit available from Cessna Aircraft Company, Citation Marketing Division, Wichita, KS 67277. It is imperative that the instructions for the test kit be followed explicitly when checking the additive concentration. The concentrations by volume for EGME/DIEGME shall be 0.10 percent minimum and 0.15 percent maximum, either individually or mixed in a common tank. Fuel, when added to the tank, should have a minimum concentration of 0.10 percent by volume.

ENGINE ANTI-ICE

The importance of proper system use cannot be overemphasized as serious engine damage can result from ice ingestion. Engine anti-ice function is preventative in nature and flight into visible moisture with a ram air temperature of below -10°C should be anticipated so that the systems is operational when icing conditions are encountered. Even though the engine compressor section will not ice, due to inlet temperature rise, turning the engine anti-ice on after ice has accumulated could conceivably result in ice from the inboard wing leading edge being freed and ingested by the engine. Ice will normally form on the fan spinner, the aft side of the fan blades and the fan stators. This ice will result in an audible engine vibration. When this vibration is noticed, the ice can be cleared by cycling the throttle approximately 20% N_1 a few times until the vibration clears. By design, this ice will all pass through the fan bypass duct. No engine damage will occur. It may be necessary to accomplish this engine clearing procedure at five to ten minute intervals in heavy icing conditions.

In descent, the engine anti-ice should be turned on well before entering an icing environment to ensure that sufficient time is available for all system parameters to be met.

Ice formation observed on the wing cannot be used as a valid indication of possible engine icing. The ENGINE ANTI-ICE Switch should be ON and operating any time the airplane is being operated in visible moisture at a temperature of below +10°C.

FLIGHT INTO ICING

Flight into known icing is the intentional flight into icing conditions that are known to exist by either visual observation or pilot weather report information. Icing conditions exist when indicated RAT is +10°C or below, and visible moisture in any form is present (such as clouds, fog with visibility of one mile or less, rain, snow, sleet or ice crystals). Icing conditions also exist when RAT on the ground and for takeoff is +10°C or below when operating on ramps, taxi-ways or runways where surface snow, ice, standing water or slush may be ingested by the engines, or freeze on the engines, nacelles, or engine sensor probes. Cessna Citations, equipped with properly operating anti-ice equipment, are approved to operate in maximum intermittent and maximum continuous icing conditions as defined by FAR 25, Appendix C, when that equipment is in operation. The equipment has not been designed or certified, to provide protection against freezing rain or severe conditions of mixed or clear ice. During all operations, the pilot is expected to exercise good judgement and be prepared to alter the flight plan, i.e., exit icing, if conditions exceed the capability of the airplane and equipment.

(Continued Next Page)

FLIGHT INTO ICING (Continued)

Ice accumulations significantly alter the shape of airfoils and increase the weight of the airplane. Flight with ice accumulated on the airplane will increase stall speeds and alter the speeds for optimum performance. Flight at high angle-of-attack (low airspeed) can result in ice building on the underside of the wings and the horizontal stabilizer aft of areas protected by leading edge anti-ice systems. Minimum airspeed for sustained flight in icing conditions (except approach and landing) is 200 KIAS. Prolonged flight in icing conditions with the flaps and/or landing gear extended is prohibited. Trace or light amounts of icing on the horizontal stabilizer can alter airfoil characteristics which will affect stability and control of the airplane.

Freezing rain and clear ice will be deposited in layers over the entire surface of the airplane and can "run back" over control surfaces before freezing. Rime ice is an opaque, granular and rough deposit of ice that usually forms on the leading edges of wings, tail surfaces, pylons, engine inlets antennas, etc.

EXTREME COLD WEATHER OPERATIONS

Remove EROS crew oxygen masks, if temperature will be less than -10°C, and drain all cabin fluids.

When the airplane is parked in any conditions of falling or blowing snow, regardless of temperature, the engine, APU and pitot covers should be installed. The airplane should be parked with slats and flaps retracted. Prior to flight, the airplane must be cleared of snow and if wing, empennage or control surfaces are frosted, they must be deiced. Refer to the FAA Approved Flight Manual, Section VII, DEICING PROCEDURES.

If the airplane is to be parked outside for more than a few hours at temperatures below -15°C, the following special considerations are advised:

The airplane batteries should be removed to a warm environment or battery heaters installed and connected. Below -20°C, nicad batteries may be inert and will not charge or discharge.

Hydraulic accumulators, pneumatic storage bottles, and oxygen cylinders will indicate a lower pressure because of the temperature drop. Refer to the appropriate temperature charge placards. It should be noted that hydraulic and pneumatic systems are more prone to leaks in extreme cold. A significantly lower charge may indicate a leak. Prior to preflight, the flaps should be extended to allow inspection of the wing trailing edge for hydraulic leaks.

The APU should be started as soon as possible or external power used to supply electrical and avionics power and cabin heat. The APU should start normally using external power or warm batteries provided that the airplane has not been cold soaked below -40°C. Preheating will be required if the cold soak was below -40°C. To facilitate cabin warming, select PACs to HI, PAC isolation valve OPEN and both PACs to MANUAL, full hot. APU max cool bleed may be used provided the APU does not cycle on the overtemp limit.

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EXTREME COLD WEATHER OPERATIONS (Continued)

Some electrical systems and avionics computers and displays may be slow to warm up. The glare shield auxiliary panel lighting should be turned on and allowed to reach full brightness. Cabin fluorescent lighting will also be slow to illuminate and should be turned on if its use is anticipated. The IACs may be slow to warm up and may result in slightly distorted displays. Failures of the FGC, the yaw damper, the mach trim, and the primary stabilizer trim may also occur until the computers are warmed up. LCD displays in the RMUs, aileron/rudder trim indicator, standby engine instruments and optional AOA indicators may require several minutes to reach full brightness. FMS computers may require several minutes to give accurate initial position. Typically, warmup may take 20 minutes or more.

NOTE

Dispatch is prohibited until all required avionics systems are verified to be functioning properly.

Prior to engine start, the rudder control should be cycled to ensure proper operation of the rudder standby system. Cold temperature may result in low pressure excursions and the RUD STBY SYS FAIL message. If the message is displayed, once it is verified that RSS pressure is cycling normally, the message and pressure display can be cleared by selecting the SG REV switch to SG1 (approximately 5 seconds), NORM (approximately 5 seconds), SG2 (approximately 5 seconds), and back to NORM.

NOTE

If this procedure is conducted too quickly, it will clear V-speeds if they have been set and cause both engines' FADEC to be in ADC reversionary mode. V-speeds and FADEC must be reset.

The right engine should be started first. Following right engine start, flight controls should be exercised to verify that the PTU will maintain "A" system hydraulic pressure. Following left engine start, all flight controls, slats and speed brakes should be cycled through full travel several times to verify that all controls reach full travel and operate normally. Hydraulic quantity should be monitored (EICAS) prior to takeoff to verify that no system leaks have occurred.

NOTE

Dispatch is prohibited following cold soak unless it is verified (EICAS), and visually confirmed by comparing deflection of adjacent panels, that all flight controls operate normally and that all speed brake and roll spoiler panels fully extend and retract normally. Several cycles of the controls may be required to verify proper operation.

Engine preheat is required if the engine oil temperature is below -40°C. Engine oil temperature as displayed in EICAS, is a good indicator of cold soak. Engine starts using ground or APU air should be normal except that the exhaust will smoke initially and engine oil pressure will be high. Engine oil pressure above 95 PSI is normal during cold starts. The engine may not be operated above idle until oil pressure is at or below 95 PSI. Once engine oil pressure is in normal limits, the engine may be operated above idle, but cannot exceed 40% N_1 until the engine fuel temperature is in normal limits, $\geq$4°C. This process should take only a few minutes.

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EXTREME COLD WEATHER OPERATIONS (Continued)

Fuel tank temperature limits for the type of fuel being used must be observed. Refer to Operating Limitations, FUEL LIMITATIONS.

NOTE

If tank fuel temperature is below -31°C, engine fuel temperature may fall below 4°C when power is increased for takeoff. Make a static run to about 60% N_1 to allow the engine oil temperature to increase and engine fuel temperature to return to normal limits prior to takeoff.

When fuel tank temperature is lower than approximately -30°C, engine fuel temperatures may briefly fall below 4°C (with accompanying FUEL TEMP L-R message) when takeoff thrust is applied. Engine fuel temperature of 4°C or above at takeoff thrust must be obtained prior to initiating the takeoff roll. When fuel temperature is cold, failure of sump drains to drain may indicate the presence of frozen water in the sump.

PASSENGER COMFORT

When parked during daylight in hot weather, it is suggested that the cabin window shades be closed to reduce solar heat transfer. An optional exterior windshield cover performs the same function for the cockpit and is very effective. To circulate cool air in the interior, either engine or the onboard auxiliary power unit may be started, the isolation valve opened and the CKPT and CAB PAC switches positioned to HIGH. Temperature is then controlled with the CKPT and CABIN TEMP SEL, hot/cold switches. Closing unused overhead outlets will direct airflow to the occupied seats. Increased air circulation is available by turning on the WEMAC BOOST. Operating either engine (preferably the right) above idle RPM will increase airflow and environmental control unit efficiency. Operation of the onboard auxiliary power unit will run the environmental control unit without the need to start the airplane engines.

The abbreviated checklist is designed to enable the crew to perform all prestart functions in advance. This permits items, such as the warning test, to be completed before passenger boarding, and acceleates the ramp departure without compromising safety or thoroughness.

Leaving the chocks, brake checks can be done lightly and smoothly. If heavy braking is required on landing roll, the use of a minimum amount of nose down control pressure counters the apparent nose down pitching moment so that decelration feel in the cabin is less abrupt. Back pressure, however, which could result in raising the airplane nose and/or increase the possibility of a blown tire, is not recommended.

The pressurization system procedures outlined in this chapter may at first appear complex, but thorough understanding of the controller and indicators coupled with minimal practical experience greatly simplifies operation. Optimum system performance in terms of passenger comfort is best achieved by slow, smooth selection of altitudes and rates and reducing the variables when setting the controller by not making power changes simultaneously. Lightweight takeoffs and/or rolling takeoffs in cold ambient conditions may cause pressurization oscillations (bumps) as the airplane lifts off because the cabin did not have sufficient time to pre-pressurize. Cabin pressure oscillations can be prevented by taking the time to allow the pre-pressurization to begin before the brakes are released. This procedure will allow the cabin to correctly pre-pressurize prior to lift off and will provide a smooth transition to pressurized flight.

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EXTREME COLD WEATHER OPERATIONS (Continued)

Some electrical systems and avionics computers and displays may be slow to warm up. The glare shield auxiliary panel lighting should be turned on and allowed to reach full brightness. Cabin fluorescent lighting will also be slow to illuminate and should be turned on if its use is anticipated. The IACs may be slow to warm up and may result in slightly distorted displays. Failures of the FGC, the yaw damper, the mach trim, and the primary stabilizer trim may also occur until the computers are warmed up. LCD displays in the RMUs, aileron/rudder trim indicator, standby engine instruments and optional AOA indicators may require several minutes to reach full brightness. FMS computers may require several minutes to give accurate initial position. Typically, warmup may take 20 minutes or more.

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EXTREME COLD WEATHER OPERATIONS (Continued)

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NOTE

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PASSENGER COMFORT

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Leaving the chocks, brake checks can be done lightly and smoothly. If heavy braking is required on landing roll, the use of a minimum amount of nose down control pressure counters the apparent nose down pitching moment so that decelration feel in the cabin is less abrupt. Back pressure, however, which could result in raising the airplane nose and/or increase the possibility of a blown tire, is not recommended.

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PASSENGER COMFORT (Continued)

Power management has an impact on cabin comfort and changes should be made smoothly and symmetrically. An approximate estimate of synchronization can be made by observing the RPM gages and exact adjustments made with the engine synchronizer. Although the higher pitched turbine sound is generally more noticeable in the cockpit, the lower pitched, fan out-of-synchronization condition is usually more prevalent in the area of the rear seats.

Good crew coordination and smooth operation of the controls and systems serves the best interests of safety, economy and passenger comfort.

NAVIGATION/COMMUNICATION

Distance Measuring Equipment (DME) ground speed or time to station readouts are only accurate when the airplane is proceeding directly to or from the selected station. Since it is slant range that is computed, ground speed or time to station accuracy increases with distance from the station. The GSPD readouts on the primary flight displays (PFDs) can be considered reasonably close to actual speed when distance from the station in miles is equal to or greater than the airplane altitude in thousands of feet.

For proper system operation the long range navigation system (flight management systems - FMSs) require operation of the distance measuring equipment sets (DMEs). The DMEs are normally in operation any time electrical power is on the airplane and the system self-tests have been satisfactorily completed, however, failure of a DME set can affect the calculations of its respective FMS, since DME/DME function is the method of choice, when available, for the FMS to use in its position calculations. Caution should be exercised when very high frequency omnidirectional radio range (VOR) navigation is desired. When a long range navigation system (FMS 1 or FMS 2) is selected on the SC-840 source controller, electronic horizontal situation indicator (EHSI) and electronic attitude director indicator (EADI) azimuth information (if programmed) will be FMS course data. Always check the GC-810 Flight Guidance Controller in APR for VOR or instrument landing system (ILS) approaches.

When tuning the automatic direction finder (ADF), identification is best received when ANT (antenna) function is selected. Relative bearing information is available only when ADF function is selected. When ADF is not required for navigation, select ANT to eliminate excessive radio magnetic indicator (RMI) needle seeking.

During ground operation, radio transmissions can be blocked by surrounding terrain or structures. This may possibly be overcome by using the other COMM, because of airplane antenna location. The COMM 1 antenna is on top of the fuselage and the COMM 2 antenna is on the bottom. Flying through dry precipitation, it is possible for static electricity to build-up to cause very high frequency communication systems to automatically squelch to a point where reception range is greatly reduced. Disabling the squelch by depressing the SQ button on the RMU bezel will cause background static in the speaker or headset, but normal reception range will be restored. If the headset microphone fails to function properly, check the appropriate instrument subpanel MIC SEL switch in the HEAD SET position.

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GROUND DEICE/ANTI-ICE OPERATIONS

During cold weather operations, flight crews are responsible for ensuring the aircraft is free of ice contaminants.

Ground icing may occur whenever there is high humidity with temperatures of +10°C or colder. Type I deice, and Type II or Type IV anti-ice fluids may be used sequentially to ensure compliance with FAA regulations (clean wing concept) requiring critical component airframe deicing and anti-icing.

NOTE

It is recommended that flight crews refamiliarize themselves seasonally with the following publications for expanded deice and anti-ice procedures:

- Cessna Maintenance Manual Chapter 12.
- FAA Advisory Circular AC 120-58 (large aircraft), dated September 30, 1992 or later.
- FAA Advisory Circular AC 135-17 (small aircraft), dated December 14, 1994 or later.
- Cessna Citation Service Letter SL750-30-03, dated May 5, 1998, or later.

DEICING/ANTI-ICING PROCEDURES (TYPE I, TYPE II, AND TYPE IV FLUIDS)

ONE STEP DEICING - Type I fluid is used to remove ice, slush and snow from the airplane prior to departure, and to provide minimal anti-icing protection, as provided in the Type I holdover timetable (refer to applicable service letter).

TWO STEP DEICE/ANTI-ICE - May be used to ensure the airplane remains clean after deicing. Type II or Type IV fluid is used to provide longer term anti-icing protection, as provided in the Type II or Type IV holdover timetable (refer to applicable service letter).

CAUTION

TYPE I, TYPE II, AND TYPE IV FLUIDS ARE NOT COMPATIBLE AND MAY NOT BE MIXED. ADDITIONALLY, MOST MANUFACTURERS PROHIBIT MIXING OF BRANDS WITHIN A TYPE.

Line personnel should be supervised by the PIC or SIC to ensure proper application of deice or anti-ice, fluids. Refer to Figures 4-5 and 4-6

NOTE

The first area to be deiced/anti-iced should be easily visible from the cabin/cockpit and should be used to provide a conservative estimate for unseen areas of the airplane before initiating takeoff roll.

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DEICING/ANTI-ICING PROCEDURES (TYPE I, TYPE II, AND TYPE IV FLUIDS) (Continued)

Holdover timetables (refer to applicable service letter) are only estimates and vary depending on many factors which include temperature, precipitation type, wind and airplane skin temperature. Holdover times are based on mixture ratio. Times start when the last application begins.

Guidelines for holdover times anticipated by SAE Type I, Type II, or Type IV, and ISO Type I, Type II, or TYPE IV fluid mixtures are a function of weather conditions and outside air temperature (OAT).

CAUTION

- AIRPLANE OPERATORS ARE SOLELY RESPONSIBLE FOR ENSURING HOLDOVER TIMETABLES CONTAIN CURRENT DATA.
- TABLES ARE FOR USE IN DEPARTURE PLANNING ONLY AND THEY SHOULD BE USED IN CONJUNCTION WITH PRETAKEOFF CONTAMINATION CHECK PROCEDURES.

NOTE

- Tables do not apply to other than SAE or ISO Type I, Type II or Type IV FPD fluids.
- The responsibility for the application of this data remains with the user.
- The freezing point of Type I, Type II, and Type IV fluid mixture must be at least 10°C (18°F) below the current OAT.

SPRAYING TECHNIQUE - TYPE I FLUID

Type I fluid should be sprayed on the airplane (with engines off) in a manner which minimizes heat loss to the air. If possible, fluid should be sprayed in a solid cone pattern of large coarse droplets at a temperature of 160° to 180°F. The fluid should be sprayed as close as possible to the airplane surfaces, but not closer than 10 feet if a high pressure nozzle is used. Refer to Figures 4-5 and 4-6 for essential areas to be deiced and anti-iced.

SPRAYING TECHNIQUE - TYPE II FLUID

Application techniques for Type II fluid are the same as for Type I, except that since the airplane is already clean, the application should last only long enough to properly coat the airplane surfaces. Refer to Figures 4-5 and 4-6 for essential areas to be deiced/anti-iced.

Type II, fluid should be applied cold to a "clean" airplane. It is, however, sometimes heated and sprayed as a deicing fluid. For this case, it should be considered a Type I fluid, as the heat may change the characteristics of the thickening agents in the fluid. Type II fluid, therefore, applied in this manner, will not be as effective as if it were applied cold.

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DEICING/ANTI-ICING PROCEDURES (TYPE I, TYPE II, AND TYPE IV FLUIDS) (Continued)

SPRAYING TECHNIQUE - TYPE IV FLUID

Application techniques for Type IV fluid are the same as for Type I, except that since the airplane is already clean, the application should last only long enough to properly coat the airplane surfaces. Refer to Figures 4-5 and 4-6 for essential areas to be deiced/anti-iced.

Type IV, fluid should be applied cold to a "clean" airplane. It is, however, sometimes heated and sprayed as a deicing fluid. For this case, it should be considered a Type I fluid, as the heat may change the characteristics of the thickening agents in the fluid. Type IV fluid, therefore, applied in this manner, will not be as effective as if it were applied cold.

NOTE

- Holdover time starts when last application has begun.
- Some Type IV fluids could form a thick or high-strength gell during "dry-out" and when rehydrated form a slippery film.
- Some Type IV fluids exhibit poor aerodynamic elimination (flow-off) qualities at colder temperatures.
- Heated areas of aircraft (i.e.; heated leading edge) should be avoided due to the fact that fluid may "dry-out" into hard globular nodules.
- Type IV fluid should not be used undiluted below -24°C (-11°F).

PRETAKEOFF CONTAMINATION CHECK - GROUND ICING CONDITIONS

When ground icing conditions are present, a pretakeoff contamination check should be conducted by the PIC/SIC within 5 minutes prior to takeoff, preferably just prior to taxiing onto the active runway. Critical areas of the airplane such as empennage, wing, windshield and control surfaces should be checked to ensure they are free of ice, slush and snow or that the deice/anti-ice fluids are still protecting the airplane.

AIRPLANE DEICING

MINIMUM DIRECT SPRAY AREAS:	ENGINE INLETS AND EXHAUSTS, ENGINE PYLON, RAM AIR INLETS, BRAKES, PITOT HEADS, STATIC PORTS, WINDSHIELD, CABIN WINDOWS, AND AOA VANES.

NOTE: SHADED AREAS INDICATE ESSENTIAL AREAS TO BE DEICED.

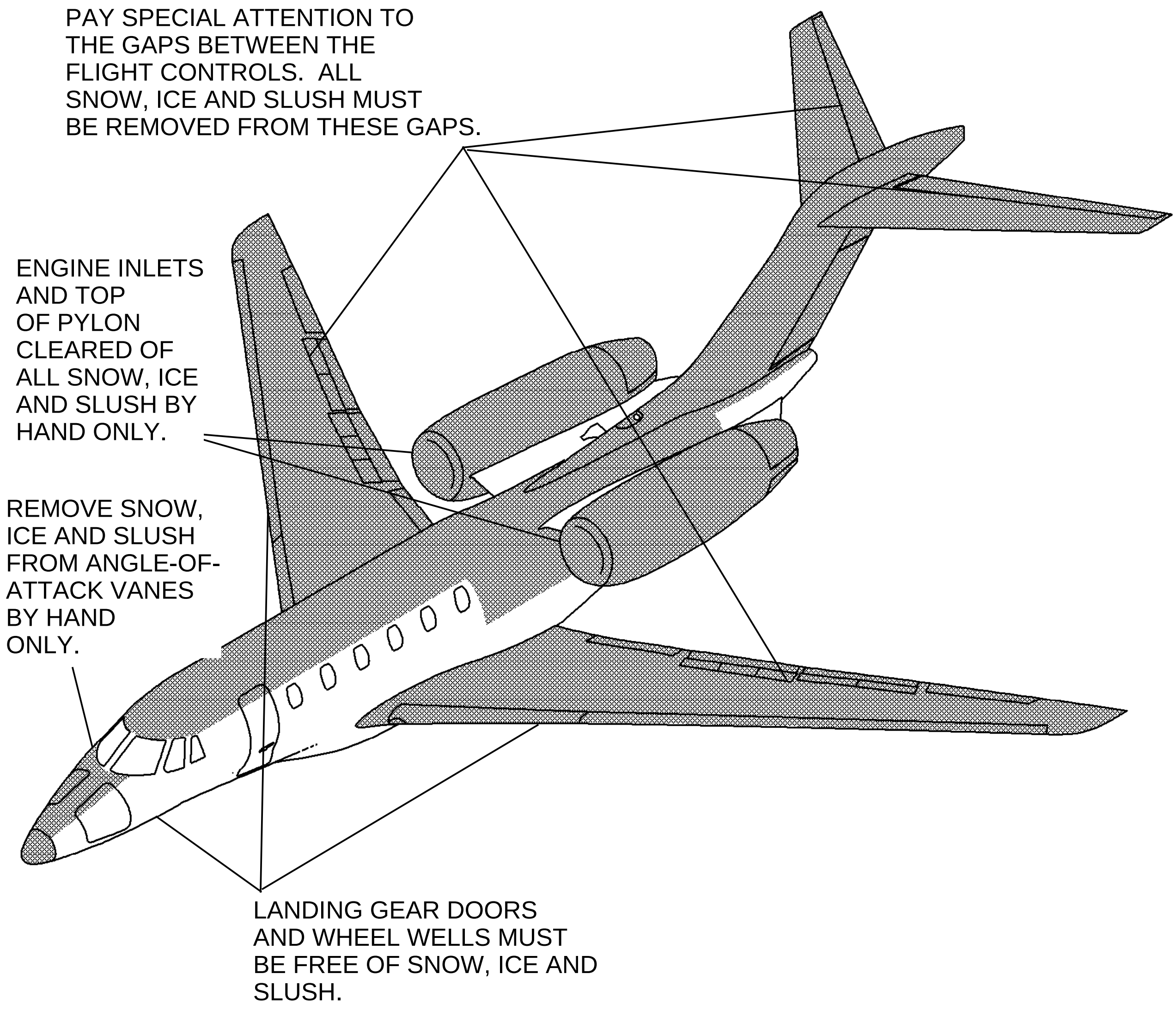

Figure 4-5

AIRPLANE ANTI-ICING

MINIMUM DIRECT SPRAY AREAS:	ENGINE INLETS AND EXHAUSTS, ENGINE PYLON, RAM AIR INLETS, BRAKES, PITOT HEADS, STATIC PORTS, WINDSHIELD, CABIN WINDOWS, AND AOA VANES.

NOTE: THE SHADED AREAS INDICATE AREAS WHERE ANTI-ICE FLUID IS APPLIED. UPPER FUSELAGE IS ANTI-ICED TO PRECLUDE ICE FORMATION WHICH COULD BE INGESTED INTO ENGINE INLETS.

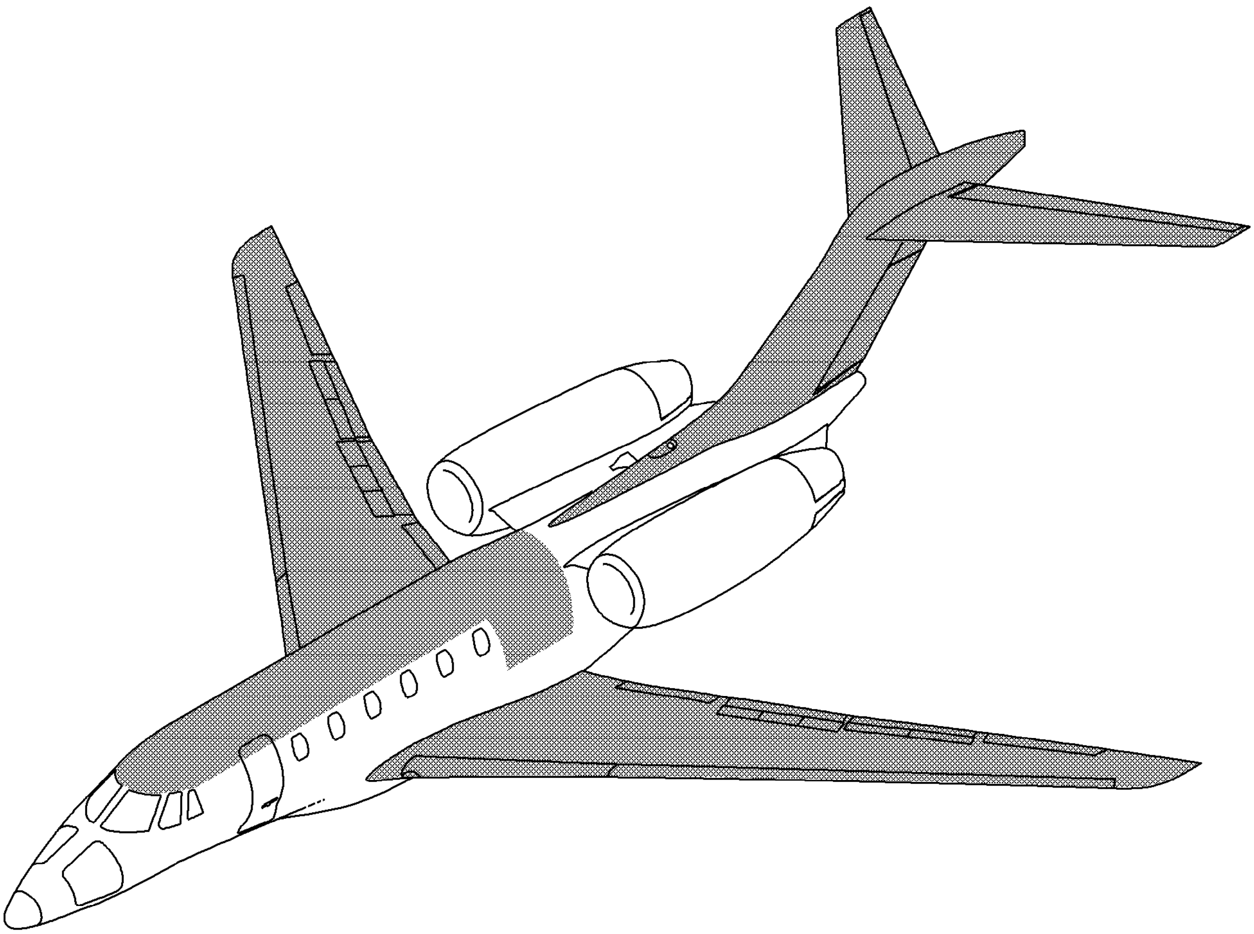

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Figure 4-6

SERVICING

FUEL

A variety of fuels can be used in the airplane. The approved fuels are: Jet A, Jet A-1, JET B, NO. 3 (GB6537-94), JP-4 (NATO F40), JP- 5 (NATO F43 or F44), and JP-8 (NATO F34 or F35).

The use of anti-ice additive in the Model 750 airplane is required if fuel tank temperature below -35°C is anticipated. Although the use of anti-ice additive is not, therefore, in all cases required it has been demonstrated by operational experience that the approved anti-ice additive is biocidal, controlling micro-organisms of bacteria and fungi, and that its use on a continuing basis is beneficial. Airplanes being serviced with fuel without anti-ice additive on a continual basis should have a program established for controlling micro-organisms of bacteria and fungi; refer to Airplane Maintenance Manual, Chapter 12, for servicing.

Fueling is accomplished through a single-point pressure refueling receptacle on the right side of the fuselage, just forward of the wing leading edge. It may also be accomplished over the wing through refueling ports in the top of each wing. It will necessarily be accomplished over the wing if anti-icing inhibitor must be added to the fuel while fueling. When overwing refueling is being performed, fuel must be introduced through both left and right wing fuel fillers. The right fuel filler is utilized to refuel the center wing fuel tank via a control handle operated center wing refuel valve. The center wing refuel valve handle is located under an access door on the lower surface of the fuselage fairing. With the center wing refuel valve open (control handle pulled downward), the center wing fuel tank will be refueled by gravity flow during refueling of the right wing fuel tank only. The handle operated center wing refuel valve must be closed prior to flight to prevent gravity flow from the right tank to center wing.

To control micro-organisms in the fuel tanks if not using fuel premixed with anti-ice additive, start refueling while simultaneously applying the fuel additive. Assure that additive is directed into the flowing fuel stream for proper mixing. Additive flow should be started after fuel flow begins and stopped before fuel flow ends. Do not allow concentrated additive to contact coated interior of fuel tank or airplane painted surfaces. Follow the instructions concerning the minimum and maximum amount of anti-ice additive under “Procedure for Checking Fuel Additive” in this section. Insufficient additive concentrations may result in the growth of damaging micro-organisms in the fuel system. Excessive additive may cause fuel tank damage or erroneous fuel quantity indications.

When refueling, do not operate radios, radar or other electronic equipment, and ensure the fuel truck and the airplane are both grounded, and that a bond wire is connected to the airplane from the truck. A fuel ground plug attachment point is located on the lower surface of each wing adjacent to the fuel filler cap.

It is not necessary to maintain fuel balance during refueling. Maximum intentional asymmetric fuel differential for flight is 400 pounds; however, the airplane can accommodate as much as 800 pounds differential in an in-flight emergency, for return to landing.

Operation of the onboard auxiliary power unit (APU) is permitted during refueling. Unmonitored operation of the APU is not authorized.

ENGINE OIL

An oil quantity sight gage is located on the rear of the oil tank located on the lower right side of each engine. Access to the gage and to the oil tank is through a small door on the lower cowl. The oil quantity may also be checked by means of the EICAS system, if electrical power is on the airplane. It is possible to service the oil through the access door, but to prevent spillage it may be preferable to open or remove the cowling.

WARNING

PERSONS WHO HANDLE ENGINE OIL ARE ADVISED TO MINIMIZE SKIN CONTACT WITH USED OIL, AND PROMPTLY REMOVE ANY USED OIL FROM THEIR SKIN. A LABORATORY STUDY, WHILE NOT CONCLUSIVE, FOUND SUBSTANCES WHICH MAY CAUSE CANCER IN HUMANS. THOROUGHLY WASH USED OIL OFF SKIN AS SOON AS POSSIBLE WITH SOAP AND WATER. DO NOT USE KEROSENE, THINNERS OR SOLVENTS TO REMOVE USED ENGINE OIL. IF WATERLESS HAND CLEANER IS USED, ALWAYS APPLY SKIN CREAM AFTER USING.

NOTE

The AE-3007C engine will perform best on MIL-L-23699D type oil. Use of MIL-L-7808K type oil should be limited to only those times when operating in extreme cold without preheat capability (-40°C to -54°C or -40°F to -65°F) or when MIL-L-7808K is the only available oil.

The engines must be serviced with only the approved oils listed in Section One (Limitations) of this manual. The type oil used in each airplane is noted in the engine logbook as well as on a placard inside the filler access door.

CAUTION

- DO NOT MIX MIL-23699D AND MIL-L-7808K TYPES OF OIL.
- IF BRANDS OF OIL ARE CHANGED, IT SHOULD BE ACCOMPLISHED GRADUALLY USING THE “TOP OFF” METHOD.

The On Board Auxiliary Power Unit has a sight glass, located on the right side of the unit, for checking the oil level. The sight glass is accessed by opening a small door located on the lower right side of tail cone. Full service is indicated by a ball floating within a red circle inside the round sight window. A larger access door on the left side of the tail cone, approximately opposite the sight glass door, is used to gain access for servicing the oil. The On Board Auxiliary Power Units are serviced with MIL-L-23699D type oil. Oils meeting this description are: Mobil Jet Oil II (Type II), Exxon/Esso 2380 Turbo Oil (Type II), and Castrol 5000 (Type II). Oils that are of a different type should not be mixed with MIL-L-23699D type oil.

The two Environmental Control Unit assemblies (ECUs) are mounted in tandem in the lower tail cone. They are equipped with two sight glasses and two filler plugs, one for each Environmental Control Unit package. The sight glasses and filler plugs are located on the lower side, but are not readily accessible for flight crew inspection. Access is gained by lowering the door located at the bottom aft center of the tail cone below and aft of the baggage compartment.

HYDRAULIC

Servicing the hydraulic reservoir requires equipment capable of delivering hydraulic fluid under pressure (an external hydraulic service unit), or it may be serviced by a hand pump through a quarter-inch flareless fitting, which is located at the lower front of the hydraulic service panel. Servicing is normally performed by maintenance personnel. The reservoir should be serviced with only the fluid listed in Section One (Operating Limitations) of this manual or in the Limitations Section of the FAA Approved Airplane Flight Manual.

OXYGEN

The oxygen filler valve is located inside the right door in the nose compartment. Oxygen servicing should be done by maintenance personnel using only the approved breathing oxygen listed in Section One (Operating Limitations) of this manual. Reference the cockpit gage while servicing to prevent overfill.

Oxygen pressure will vary with ambient temperature. In very cold ambient temperatures the oxygen pressure indication may appear low, but may in actuality be appropriate for the temperature condition.

NOTE

Refer to Chapter 12 of the Airplane Maintenance Manual, Oxygen Fill Pressure for Various Fahrenheit Temperatures Table.

FIRE BOTTLES

Underserviced fire bottles must be exchanged by authorized maintenance facilities. There is no gage to check fire bottle service; low bottle service is indicated by illumination of the cyan FIRE BOTTL LOW L-R and FIR BOTTL LOW - APU digital annunciator on the EICAS display.

LANDING GEAR AND BRAKE PNEUMATIC SYSTEM

The emergency landing gear and brake bottles should be serviced with dry nitrogen according to the pressure/temperature chart affixed to the left forward nose avionics compartment door. Servicing is accomplished through charging valves which are located in the nose avionics compartment on the left side of the forward pressure bulkhead and on the left side of the forward section of the nose avionics compartment. Temperature has an effect on indicated pressure of the bottle. After cold soak at altitude, the indicated pressure may be low. Allow storage bottles to warm to ambient hangar temperature before servicing.

TIRES

The main gear tire pressures should be maintained at 180 ±5 PSIG with the airplane on the jacks. A four percent increase should be allowed for if the airplane is on the ground. The nose gear tire pressures should be maintained at 130 ±5 PSIG with the airplane on the jacks. A four percent increase should also be allowed for if the airplane is on the ground.

Since tire pressure will decrease as the temperature drops, a slight overinflation can be used to compensate for cold weather. Main and nose tires inflated at 70°F (21°C) should be overinflated 1.0 percent for each 5°F (3°C) drop in temperature anticipated at the coldest airport of operation. Conversely, if higher temperatures are anticipated main and nose tires inflated at 70°F (21°C) may be underinflated 1.0 percent for each 5°F (3°C) rise in temperature anticipated at the warmest airport of operation.

EXTERNALLY SERVICEABLE TOILET

The externally serviceable toilet may be commercially serviced by means of a toilet ground service cart, such as that manufactured by Tronair of Holland Ohio. Servicing the toilet is accomplished through the service port located low on the right side of the aft fuselage, just aft of the battery compartment door. The service port has connections for draining and removing waste and for charging the system with water and required chemicals.

To correctly service the toilet refer to the “Servicing Toilet” checklist in Chapter 12 of the Airplane Maintenance Manual. A list of suggested chemicals and servicing equipment is also included in Chapter 12. The toilet should be serviced during routine ground maintenance of the airplane following any usage. It is more convenient and efficient to service the toilet on a regular basis than to wait until the tank is filled to capacity.

To ensure operation of the toilet recirculation system during freezing weather, ethylene glycol base anti-freeze containing an anti-foam agent may be added to the flush fluid.

AIRPLANE CLEANING AND CARE

PAINTED SURFACE

The exterior of a new airplane is painted with a polyurethane two-component topcoat which, unlike early coatings, does not require exposure to air for complete cure to occur. the care required by the finish will not change as the paint ages.

The finish should be cleaned only by washing with clean water and mild soap, followed by rinse water and drying with a soft cloth or chamois.

Minimize flying through rain, hail or sleet.

To help prevent development of corrosion, particularly filiform corrosion, the airplane should be spray-washed at least every two or three weeks (especially in warm, damp, and salty environments) and waxed with a good grade of water repellent wax to help keep water from accumulating in skin joints and around countersinks. A heavier coating of wax on the leading edge, on the vertical tail and on the engine nose cones help reduce abrasions encountered in these areas.

Polyurethane topcoats are designed with UV inhibitors to slow the degradation caused by exposure. The inhibitors concentrate near the surface of the coating during the initial stages of cure. Care must be taken during any buffing, polishing, or power waxing so that this surface layer is disturbed only to the smallest extent necessary. With special care, however, buffing, polishing or power waxing is acceptable. Wax products containing silicones should be avoided as they contribute to the buildup of P-static, especially if the surface is well buffed to produce a shine.

ENGINES

The engine compartments should be cleaned using a suitable solvent. Most efficient cleaning is done using a spray-type cleaner. Before spray cleaning, ensure protection is afforded for components which might be adversely affected by the solvent. Refer to the Airplane Maintenance Manual for proper lubrication of components after engine cleaning.

INTERIOR CARE

To remove dust and loose dirt from the upholstery, headliner and carpet, clean the interior regularly with a vacuum cleaner.

Blot up any spilled liquid promptly with cleansing tissue or rags. Don't pat the spot; press the blotting material firmly and hold it for several seconds. Continue blotting until no more liquid is taken up. Scrape off sticky materials with a dull knife, then spot-clean the area.

Oily spots may be cleaned with household spot removers, used sparingly. Before using any solvent, read the instructions on the container and test it on an obscure place on the fabric to be cleaned. Never saturate the fabric with a volatile solvent; it may damage the padding and backing materials.

WARNING

- **USE ALL CLEANING AGENTS IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.**
- **THE USE OF TOXIC OR FLAMMABLE CLEANING AGENTS IS DISCOURAGED. IF THESE CLEANING AGENTS ARE USED, ENSURE ADEQUATE VENTILATION IS PROVIDED TO PREVENT HARM TO THE USER AND/OR DAMAGE TO THE AIRPLANE.**

Soiled upholstery and carpet may be cleaned with normal cleaning materials, used according to the manufacturer's instructions. To ensure that the cleaning materials or chemicals will not harm the fabric or leather to be cleaned, test it on a hidden part of the material to be cleaned before proceeding.

The plastic trim, instrument panel and control knobs need only be wiped with a damp cloth. Oil and grease on the control wheel and control knobs can be removed with a cloth moistened with kerosene. Volatile solvents, such as mentioned in paragraphs on care of the windshield, must never be used since they soften and craze the acrylic.

WINDOWS AND WINDSHIELDS

The glass windshields and forward (fixed) cockpit side windows, and the acrylic aft (openable) cockpit windows, and the cabin windows should be kept clean at all times. Recommended products and materials for washing and protecting the windows and windshields are listed in Chapter Twelve of the Airplane Maintenance Manual. The acrylic windows should be kept waxed with a coat of good quality commercial wax. Do not wax or polish the windshield and forward cockpit side windows. To prevent scratches wash the windshield and windows carefully with plenty of mild soap and water, using the palm of the hand to feel and dislodge dirt and mud. A soft cloth, chamois, or sponge may be used, but only to carry water to the surface. Rinse the glass windshields and forward windows thoroughly, then dry with a clean, moist chamois. Rubbing the surface of the acrylic cockpit and cabin windows with a dry cloth builds up an electrostatic charge which attracts dust particles in the air. For that reason, after the acrylic windows are washed, they should be allowed to air dry.

(Continued Next Page)

WINDOWS AND WINDSHIELDS (Continued)

Remove oil and grease with a cloth lightly moistened with kerosene. Never use gasoline, benzine, acetone, carbon tetrachloride, fire extinguisher fluid, lacquer thinner or glass cleaner. These materials will soften the plastic of the windows and may cause it to craze. Strong chemicals and abrasives should not be used on the windshields and cockpit side windows. They can scratch and otherwise damage the repellent surface.

After removing dirt and grease, if the plastic side window surface is not badly scratched, it should be waxed with a good grade of commercial wax. The wax will fill in minor scratches and help prevent further scratching. Apply a thin, even coat of wax and bring it to a high polish by rubbing lightly with a clean, dry soft flannel cloth. Do not use a power buffer; the heat generated by the buffing pad may soften the acrylic, and circular streaks can cause glare rings.

Do not use a canvas cover on the windshield unless freezing rain or sleet is anticipated. Canvas covers may scratch the repellent coating on the surface.

OXYGEN MASKS

The crew masks are permanent-type masks which contain a microphone for radio transmissions. The passenger masks are oro-nasal type which forms around the mouth and nose area. All masks can be cleaned with alcohol. Do not allow solution to enter microphone or electrical connections. Apply talcum powder to external surfaces of passenger mask rubber face-piece.

SECTION IV

OPERATING INFORMATION

CONTENTS

OPERATING PROCEDURES

Operating procedures in this manual are organized into NORMAL, ABNORMAL, and EMERGENCY procedures. The Abnormal and Emergency procedures are organized with reference to EICAS (Engine Instrument and Crew Alerting System) messages, Primus 2000 system messages, and separate annunciators.

NORMAL PROCEDURES

Normal procedures are those recommended for normal preflight, flight, and postflight operation. Some checks, as noted in the Limitations Section of this operating manual are required to ensure proper system integrity.

The Normal Procedures Section also includes white Crew Alerting System (CAS) messages and expanded systems information and procedures. White CAS messages are advisory information about normal systems status.

The Normal Procedures Section also includes a Special Procedures Section. In it particular equipment and procedures are discussed, and suggested techniques are provided. These procedures and techniques have been gained from experience by Cessna flight test pilots in particular operations. They are provided with the intent of providing safe, smooth, efficient, and comfortable operation of the airplane.

NORMAL PROCEDURES

This section presents an expanded form of the abbreviated cockpit checklist provided with each Model 750. Should any conflict exist between this information and the checklist in the FAA Approved Airplane Flight Manual, the flight manual shall take precedence. Any implied technique presented assumes that proper pilot skill and judgment are exercised.

PREFLIGHT INSPECTION

PRELIMINARY EXTERIOR INSPECTION

1. Engine/Pitot/APU Covers - REMOVED.
2. APU Inlets, Exhaust and Oil (if starting APU before preflight) - CHECK.
3. Batteries - CONNECTED (left and right).
4. Flaps/Slats - CHECK POSITION.

COCKPIT/CABIN INSPECTION

WARNING

SLATS, LANDING GEAR, SPEED BRAKES, ROLL SPOILERS, FLIGHT CONTROLS AND THE LEFT THRUST REVERSER WILL OPERATE IF THE "A" SYSTEM AUXILIARY HYDRAULIC PUMP IS ON. THE UPPER RUDDER IS POWERED AND FLAPS WILL MOVE IF ELECTRICAL POWER IS ON. USE CAUTION FOR PERSONNEL OUTSIDE THE AIRPLANE WHEN MOVING COCKPIT CONTROLS.

NOTE

- If operating from or to extreme cold surface temperature or airport above 8,000 feet MSL, special additional procedures apply. Refer to Normal Procedures, EXTREME COLD WEATHER OPERATIONS.
- Prior to cockpit inspection, check tailcone to ensure the battery is connected.

1. Documents, manuals and charts - ONBOARD AND CURRENT.
   a. To be displayed in airplane at all times:
      (1) Airworthiness and Registration Certificates.
      (2) Transmitter License(s).
   b. To be carried in the airplane at all times:
      (1) FAA Approved Airplane Flight Manual.
      (2) Honeywell P2000 Integrated Avionics System Pilot's Manual for the Citation X.
      (3) Honeywell FMZ Series Flight Management System, Pilot's Operating Manual.
      (4) Other applicable pilot's manuals as required in Section 1, under Operating Limitations or applicable AFM supplement.
2. Required Equipment - ONBOARD AND SERVICED.
3. Cabin - CHECK.
   a. Seats/Belts - CONDITION.
   b. Emergency Exit - SECURE/CLEAR/LOCK PIN REMOVED/COVER IN PLACE.
   c. Main Gear Manual Release - CONNECTED AND STOWED.

(Continued Next Page)

PREFLIGHT INSPECTION (Continued)

4. Circuit Breakers - IN.
5. Portable Fire Extinguisher (under copilot's seat) - SERVICED/SECURE.
6. Oxygen System - CHECK.
   a. Masks - TEST/100% SELECTED.
   b. Left and Right MIC SEL Switch - HEADSET.
   c. PASS OXY Knob - AUTO.
   d. Oxygen Pressure(s) - GREEN ARC (1600 to 1800 PSI).
   e. Smoke Goggles - STOWED.
7. Cockpit Switches and Controls - CHECK/SET.
   a. LH AHRS Switch (if installed) - SLV.
   b. EMERG LT Switch - ARM/CHECK INSIDE LIGHTS/OFF.
   c. DAY/NITE DIM Switch - AS REQUIRED.
   d. Fuel CROSSFEED Knob - OFF.
   e. GRVTY XFLOW Switch - OFF.
   f. CTR WING XFER Switches - NORM.
   g. LH and RH GEN Switches - GEN.
   h. BATT 1 and BATT 2 Switches - OFF.
   i. EXT POWER Switch - OFF.
   j. Avionics Switch - OFF.
   k. LH and RH FUEL BOOST Switches - NORM.
   l. LH and RH IGNITION Switches - NORM.
   m. LH and RH FADEC Switches - NORM.
   n. STBY PWR Switch - TEST/ON/OFF.
      1) Test and Hold - GREEN LIGHT illuminated.
      2) ON - AMBER LIGHT/STBY INST LIGHTS/STBY ENG INST VERIFY ON.
      3) OFF.
   o. Landing Gear Handle - DOWN.
   p. EMERG GEAR EXT Handle - IN.
   q. Nose Gear Uplock Manual Release Handle - STOWED.
   r. ANTI-ICE Switches - OFF/NORM.
   s. A AUX Switch - OFF.
   t. HYDRAULIC PUMPS “A” and “B” UNLOAD Switches - NORM.
   u. ANTISKID Switch - NORM.
   v. LIGHT Switches - OFF.
   w. CABIN DUMP Switch - Down/Cover Down.
   x. ISO VLV Switch - Down/Cover Down.
   y. MANUAL RATE Knob - MIN (full counterclockwise).
   z. ALT SEL/NORM Switch - NORM.
   aa. PAC BLEED SELECT Switch - NORM.
   ab. WEMAC BOOST Switch - OFF.
   ac. Pressurization RATE Knob - NORM (marks aligned).
   ad. CKPT and CABIN TEMP SEL Knobs - AS DESIRED.
   ae. PAC ISOL VALVE Knob - CLSD.
   af. CKPT and CAB PAC Knobs - ON.
   ag. L and R ENG BLD AIR Knobs - HP/LP.
   ah. RH AHRS Switch (if installed) - SLV.
   ai. APU Switches - OFF/NORMAL.
   aj. ELT Switch (if installed) - ARMED.
   ak. INTERIOR MASTER Switch - NORMAL/COVER DOWN.

(Continued Next Page)

PREFLIGHT INSPECTION (Continued)

al. Secondary Trim Switch - OFF/COVER DOWN.
am. SPEEDBRAKE Handle - ZERO (0).
an. Throttles - CUTOFF.
ao. Flap Handle - AGREES WITH FLAPS POSITION.
ap. GND IDLE Switch - NORM.
aq. ENG SYNC Knob - OFF.
ar. Taxi Light/Landing Light Switches - OFF.
as. IRS Mode Control Knobs (if installed) - OFF.
at. Pitch/Roll Disconnect Handle - DOWN/NORM.

8. BATT 1 and BATT 2 Switches - ON.

NOTE

- The Fault Light on the pressurization controller will momentarily illuminate.
- RMU 1 and Landing Gear Down Lock Lights are powered indicating that both the left and right emergency busses are powered.
- DC Power Bus 1 switch will indicate NORM, XTIE switch will indicate CLSD (for closed) and the DC Power Bus 2 switch will indicate NORM.

9. Emergency Bus (first flight of the day) - CHECK.

NOTE

This check is to verify operation of the DC BUS 1 and BUS 2 and crosstie relay.

a. BATT 1 Switch - OFF.

NOTE

- The Left Emergency Bus remains powered as indicated by RMU 1 remaining powered.
- The BUS 1, XTIE and BUS 2 switches remain powered as indicated by NORM, CLSD and NORM being illuminated.

b. DC Power BUS 1 Switch - PUSH (EMER).

NOTE

- RMU 1 will lose power as indicated by the unit blanking. This shows that the emergency bus relay is functioning.
- BUS 1 and XTIE switches lose power as indicated by the switch faces going blank.
- BUS 2 switch remains powered as indicated by NORM being illuminated.

(Continued Next Page)

PREFLIGHT INSPECTION (Continued)

c. BATT 1 Switch - ON.

NOTE

- The Left Emergency Bus will be powered as indicated by RMU 1 remaining powered.
- The BUS 1, XTIE and BUS 2 switches will be powered as indicated by NORM, CLSD and NORM being illuminated.

d. BATT 2 Switch - OFF.

NOTE

- The Right Emergency Bus remains powered as indicated by the Landing Gear Down Lock Lights remaining powered.
- The BUS 1, XTIE and BUS 2 switches remain powered as indicated by NORM, CLSD and NORM being illuminated.

e. DC Power BUS 2 Switch - PUSH (EMER).

NOTE

- Landing Gear Down Lock Lights will lose power as indicated by the green lights extinguishing. This shows that the emergency bus relay is functioning.
- BUS 2 switch loses power as indicated by the switch face going blank.
- BUS 1 and XTIE switches remain powered as indicated by NORM and CLSD being illuminated.

f. BATT 2 Switch - ON.

NOTE

- Landing Gear Down Lock Lights will be powered as indicated by the green lights being illuminated.
- DC Power BUS 2 switch will indicate NORM.

10. Gear Handle - DOWN/3 GREEN LIGHTS.
11. External Power/APU - AS REQUIRED.
    a. If External Power - EXT POWER PLUG IN; Verify AVAIL illuminated, then EXT PWR Switch - PUSH (verify ON illuminated).
    b. If APU - Refer to APU start checklist.
12. Avionics Switch - ON.
13. Flaps - SET 15°/CHECK.
14. Stabilizer, Slat, Speed Brakes - CHECK INDICATIONS.

NOTE

If preflight behind the slats is desired, the slats can be extended by turning on the ”A“ auxiliary hydraulic pump.

15. Fuel Quantity/Balance - CHECK.

(Continued Next Page)

PREFLIGHT INSPECTION (Continued)

al. Secondary Trim Switch - OFF/COVER DOWN.
am. SPEEDBRAKE Handle - ZERO (0).
an. Throttles - CUTOFF.
ao. Flap Handle - AGREES WITH FLAPS POSITION.
ap. GND IDLE Switch - NORM.
aq. ENG SYNC Knob - OFF.
ar. Taxi Light/Landing Light Switches - OFF.
as. IRS Mode Control Knobs (if installed) - OFF.
at. Aileron Latch Handle - DOWN.
at. Pitch/Roll Disconnect Handle - DOWN/NORM.

8. BATT 1 and BATT 2 Switches - ON.

NOTE

- The Fault Light on the pressurization controller will momentarily illuminate.
- RMU 1 and Landing Gear Down Lock Lights are powered indicating that both the left and right emergency busses are powered.
- DC Power Bus 1 switch will indicate NORM, XTIE switch will indicate CLSD (for closed) and the DC Power Bus 2 switch will indicate NORM.

9. Emergency Bus (first flight of the day) - CHECK.

NOTE

This check is to verify operation of the DC BUS 1 and BUS 2 and crosstie relay.

a. BATT 1 Switch - OFF.

NOTE

- The Left Emergency Bus remains powered as indicated by RMU 1 remaining powered.
- The BUS 1, XTIE and BUS 2 switches remain powered as indicated by NORM, CLSD and NORM being illuminated.

b. DC Power BUS 1 Switch - PUSH (EMER).

NOTE

- RMU 1 will lose power as indicated by the unit blanking. This shows that the emergency bus relay is functioning.
- BUS 1 and XTIE switches lose power as indicated by the switch faces going blank.
- BUS 2 switch remains powered as indicated by NORM being illuminated.

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PREFLIGHT INSPECTION (Continued)

c. BATT 1 Switch - ON.

NOTE

- The Left Emergency Bus will be powered as indicated by RMU 1 remaining powered.
- The BUS 1, XTIE and BUS 2 switches will be powered as indicated by NORM, CLSD and NORM being illuminated.

d. BATT 2 Switch - OFF.

NOTE

- The Right Emergency Bus remains powered as indicated by the Landing Gear Down Lock Lights remaining powered.
- The BUS 1, XTIE and BUS 2 switches remain powered as indicated by NORM, CLSD and NORM being illuminated.

e. DC Power BUS 2 Switch - PUSH (EMER).

NOTE

- Landing Gear Down Lock Lights will lose power as indicated by the green lights extinguishing. This shows that the emergency bus relay is functioning.
- BUS 2 switch loses power as indicated by the switch face going blank.
- BUS 1 and XTIE switches remain powered as indicated by NORM and CLSD being illuminated.

f. BATT 2 Switch - ON.

NOTE

- Landing Gear Down Lock Lights will be powered as indicated by the green lights being illuminated.
- DC Power BUS 2 switch will indicate NORM.

10. Gear Handle - DOWN/3 GREEN LIGHTS.
11. External Power/APU - AS REQUIRED.
    a. If External Power - EXT POWER PLUG IN; Verify AVAIL illuminated, then EXT PWR Switch - PUSH (verify ON illuminated).
    b. If APU - Refer to APU start checklist.
12. Avionics Switch - ON.
13. Flaps - SET 15°/CHECK.
14. Stabilizer, Slat, Speed Brakes - CHECK INDICATIONS.

NOTE

If preflight behind the slats is desired, the slats can be extended by turning on the ”A“ auxiliary hydraulic pump.

15. Fuel Quantity/Balance - CHECK.

(Continued Next Page)

PREFLIGHT INSPECTION (Continued)

16. Hydraulic Quantities - CHECK.

NOTE

Hydraulic reservoir servicing level can be checked at the reservoir or on the EICAS. Normal quantity as displayed on the EICAS will typically be 50% to 75%. 100% is full, 16% or below will cause a HYD VOLUME LOW Amber CAS message and Master Caution.

17. PITOT/STATIC Anti-Ice Switches - ON/CHECK, EICAS CLEARS/OFF.

WARNING

DO NOT LEAVE ON FOR EXTENDED PERIODS. INJURY TO PERSONS AND/OR DAMAGE TO PROBES MAY OCCUR.

NOTE

- The RAT will normally not heat on the ground. If physical inspection is desired, placing the rotary test switch to the WS TEMP position will enable RAT heat on the ground.
- RAT, PITOT/STATIC and AOA HEAT FAIL CAS messages should not be on.

18. Exterior/Interior/EMERG Light Switches - ON/CHECK/OFF, or AS REQUIRED (leave on if not seen from cockpit or verified by a second crew member outside).
    a. Emergency Lights - ILLUMINATED.
    b. Landing Lights - ILLUMINATED.
    c. Taxi Lights - ILLUMINATED.
    d. RH Wing Inspection/Overwing Exit/NAV/Strobe/Wing Tip Lights - ILLUMINATED.
    e. RH Tail Flood Light (if installed) - ILLUMINATED.
    f. Ground Recognition Light - ILLUMINATED.
    g. Aft Nav Light - ILLUMINATED.
    h. LH Tail Flood Light (if installed) - ILLUMINATED.
    i. LH Wing Inspection/NAV/Strobe/Wing Tip Lights - ILLUMINATED.
    j. Exterior/Interior/EMERG Lights - AS REQUIRED.

NOTE

Exterior lights not verifiable from the cockpit should be checked by external walk-around. Expedite if using battery power.

19. Avionics/BATT 1/2 Switches - AS REQUIRED.

PREFLIGHT INSPECTION (Continued)

EXTERIOR INSPECTION

WARNING

PITOT TUBES, RAT PROBES AND AOA PROBES MAY STILL BE HOT.

NOTE

- In cold weather and/or icing conditions, refer to Normal Procedures, EXTREME COLD WEATHER OPERATIONS and Section IV, GROUND DEICE/ANTI-ICE OPERATIONS. Give particular attention to engine inlets, fan blades, wheel wells, wing trailing edge, (forward of flaps) and behind slats for ice/slush from previous landing.
- During inspection, make a general check for security condition, and cleanliness of the airplane and components. Check particularly for damage, fuel, oil and hydraulic leakage, security of access panels and doors, and removal of keys from locks.

LEFT FORWARD FUSELAGE

1. Cabin Door/Seals - CONDITION. Check both primary and secondary seals for fraying, wear, and cuts, etc. Damaged door seals may cause pressurization loss or difficulty in achieving cabin pressurization; therefore, it is important that both seals be carefully checked for condition.
2. Fairing Vent - CLEAR.
3. RAT Probe - CLEAR.
4 AOA Probe - ROTATES FREELY. Slots open.
5. Static Ports - CLEAR.
6. Drain Lines - CLEAR.
7. Static Drain - CLOSED.
8. Pitot Tube - CLEAR.

LEFT NOSE COMPARTMENT

1. Emergency Gear and Brake Pressures - CHECK PER PLACARD.
2. Nose Wheel Steering Accumulator precharge pressure - CHECK PER PLACARD (Bleed to precharge if required).
3. Standby Battery - TEST CHARGE AND HEATER.
4. Oxygen Bottle (if installed) - VALVE WIRED OPEN.
5. Air Data and Rain Removal Hoses - CONNECTED.
6. Nose Compartment Door - SECURE/LOCKED. Check Latches closed and properly engaged. For additional security, the door should be key locked and the key removed.

NOSE GEAR

1. Taxi Lights - CONDITION.
2. Wheels/Tires/Strut - CONDITION/SCISSORS PIN INSTALLED. Nose strut extension should be between 3.25 and 7.0 inches. Temperature and airplane weight will cause the extension of the nose gear strut to vary. The dimensions given are nominal values. Chine and tread of nose tires must be in good condition and tires must be properly inflated to meet the water/slush runway operating limitation. Approved nose tires must be inflated to 130 PSIG, +5 or -5 PSIG (unloaded) or 135 PSIG, +5 or -5 PSIG (unloaded). Visually inspect the nose landing gear assembly, power steering mechanism, wheel well area and doors for damage and security. Proper oleo strut extension of a fully fueled airplane is five to seven inches.
3. Wheel Well - CONDITION.

PREFLIGHT INSPECTION (Continued)

RIGHT FORWARD FUSELAGE

1. Radome - CONDITION/SECURE.
2. Pitot Tube - CLEAR.
3. Nose Compartment Door - SECURE/LOCKED. Check latches closed and properly engaged.
4. Oxygen Blowout Disc(s) - INTACT. Disc(s) should be in place and intact, or the oxygen bottle may be empty. Cause of a missing disc(s) must be determined.
5. Static Drain - CLOSED.
6. Static Ports - CLEAR.
7. Standby Pitot Tube - CLEAR.
8. AOA Probe - ROTATES FREELY.
9. RAT Probe - CLEAR.
10. Fairing Vent - CLEAR.
11. Single Point Fuel Door - PRECHECK LEVERS DOWN/CAP SECURE/DOOR SECURE.
12. Fuel Tank Transfer Access Door - SECURE.
13. Upper/Lower Antennas - CONDITION.

RIGHT WING

1. Landing Light - CONDITION.
2. Engine Inlet Duct/Fan - CLEAR/CONDITION. Assume a position forward of the wing that will provide maximum visibility of the engine inlet, and visually check for obstructions or damage.
3. Emergency Exit - CONDITION.
4. Fuel Quick Drains - DRAIN/CHECK FOR CONTAMINATION. Prior to the first flight of the day, drain a fuel sample from each quick drain and check for water or contamination. Push straight up on the drains when taking fuel samples, as the drain may lock open if it is rotated.
   a. Fuel Quick Drains:
      1 - Forward Tank
      1 - Center Tank
      1 - RH Wing/Mid-Chord/Inboard
      2 - 1 per Each Hopper Tank
5. Fuel Quantity Dipsticks (2) - SECURE.

NOTE

- The center tank dipstick is located near the right wing root and the right wing dipstick is located approximately half span.
- A second center tank dipstick is accessible through an access panel in the belly fairing (not normal preflight item).

6. Wing Leading Edge/Slat/Anti-ice Exit - CONDITION.

NOTE

The slat anti-ice air exit slots should periodically be checked for blockage caused by polishing agents, etc. Blockage can reduce anti-ice protection.

(Continued Next Page)

PREFLIGHT INSPECTION (Continued)

7. Fuel Filler Cap - SECURE. Check locking latch closed and directed aft. Check cover closed and secured.
8. Fuel Tank Pressure Relief Valve - CLOSED/NO LEAKS.
9. Fuel Tank Vent Inlet Scoop - CLEAR.
10. NAV/Anti-Collision/Wing Tip Lights - CONDITION.
11. Static Wicks (5) - CHECK.

NOTE

A maximum of two static wicks (entire airframe) and no two consecutive adjacent wicks, may be damaged or missing.

12. Aileron/Flaps/Spoilers/Trailing Edge - CONDITION.
13. Fuel Tank Vents - CLEAR.
    a. Bottom of inboard flap island.
    b. Lower wing skin forward of inboard flap.
14. Main Landing Gear Door/Wheels/Tires/Brakes/Strut/Wheel Well - CONDITION and SECURE.

NOTE

- Main gear strut extension should be between 1.8 and 3.5 inches.
- Check brake wear indicators on both brake housings.

Temperature and airplane weight will cause the extension of the nose gear strut to vary. The dimensions given are nominal values. Check tires for wear and inflation. Tire inflation pressure is 180 +5 or -5 PSIG (unloaded) or 187 +5 or -5 PSIG (loaded). Refer to Tires, Servicing in this section. Check brake wear indicators on both brake housings. Visually inspect doors and taxi light for security. Inspect wheel well area for damaged or broken lines and electrical wiring for condition. Check actuator and oleo for damage, leaks and proper attachment.

RIGHT NACELLE/PYLON

1. Generator/Alternator Cooling Air Inlet/Exhaust - CLEAR.
2. Drain Lines - CLEAR.
3. Oil Level - CHECK (minimum quantity 4 quarts low). Sight gage is located inside door located on the bottom of the nacelle.
4. Thrust Reversers - CONDITION/STOWED.
5. Engine Exhaust/Bypass Ducts - CLEAR.
6. Cowling/Latches - SECURE/ALL LATCHES LATCHED.
7. Rudder Standby Hydraulic Service Door - SECURE.

NOTE

Rudder standby system hydraulic pressure is monitored by EICAS. If the system is cycling rapidly or the RUD STBY SYS FAIL amber CAS message is displayed, electrical power should be turned off to check accumulator pressure (per placard). The accumulator must be discharged to the precharge level by cycling the rudder until RSS pressure is zero to verify the accumulator precharge.

(Continued Next Page)

PREFLIGHT INSPECTION (Continued)

8. Precooler Exhaust Doors - CLOSED. Lower door (visible in bottom of pylon) should be closed on the ground. Upper door should also be closed, but it is not visible on walk-around.
9. Hydraulic Reservoir Access Door - SECURE.

RIGHT AFT FUSELAGE

1. Vents - CLEAR.
2. Antennas - SECURE.
3. External Power Receptacle Door (unless in use) - SECURE.
4. Battery Compartment - BATTERY CONNECTED/DOOR SECURE.
5. Toilet Service Door - SECURE.
6. “B” Hydraulic System Main Accumulator Pressure - CHECK PER PLACARD/DOOR SECURE.

EMPENNAGE

1. Ground Air Door - AS REQUIRED.
2. PAC Heat Exchanger Exhaust - CLEAR.
3. Tail Stand Door - SECURE.
4. APU Drain - CHECK.
5. APU Oil Level - CHECK/DOOR SECURE.
6. APU Inlets and Exhaust - CLEAR.
7. Horizontal Stabilizer - CONDITION/POSITION (LH SIDE).
8. Elevators - CONDITION.
9. Static Wicks (8) - CHECK.

NOTE

Three (3) each static wicks are on each elevator, one (1) each on each horizontal stabilizer tip. A maximum of two static wicks (entire airframe) and no two consecutive adjacent static wicks, may be damaged or missing.

10. Top Stinger/Light - CONDITION.
11. Rudders - CONDITION.

NOTE

The upper rudder YAW DAMPER is disabled on the ground. Oscillatory movement of the upper rudder with airplane electrical power or ground power on is evidence of possible landing gear squat switch failure.

12. APU Service Door - CHECK.
13. Tailcone - CHECK/DOOR SECURE (no red latches).

NOTE

Check general condition of tailcone and tailcone equipment. Ensure ski box door is closed, tailcone access door is closed and all latches secured.

(Continued Next Page)

PREFLIGHT INSPECTION (Continued)

LEFT AFT FUSELAGE

1. “A” Hydraulic System Main Accumulator Pressure - CHECK PER PLACARD/DOOR SECURE.
2. Battery Compartment - BATTERY CONNECTED/DOOR SECURE.

AFT BAGGAGE COMPARTMENT

1. Ladder and Baggage - SECURE.
2. Air Inlets/Outlets - CLEAR.
3. Baggage Light - OFF.
4. Door Seal - CONDITION. Inspect door seals for wear, cuts, tears, etc.
5. Access Door - SECURE/CHECK HANDLE AND PIN INDICATORS.

LEFT NACELLE/PYLON

1. Hydraulic Reservoir Access Door - SECURE.

NOTE

Hydraulic reservoir servicing level can be checked at the reservoir or on the EICAS. Normal quantity as displayed on the EICAS will typically be 50% to 75%. 100% is full, 16% or below will cause an amber CAS message, HYD VOLUME LOW and Master Caution.

2. Precooler Exhaust Doors - CLOSED. Lower door (visible in bottom of pylon) should be closed on the ground. Upper door should also be closed, but it is not visible on walk-around.
3. Engine Exhaust/Bypass Ducts - CLEAR.
4. Thrust Reversers - CONDITION/STOWED.
5. Oil Level - CHECK (minimum quantity 4 quarts low). Sight gage is located inside door on the bottom of the nacelle.
6. Drain Lines - CLEAR.
7. Generator/Alternator Cooling Air Inlet/Exhaust - CLEAR.
8. Cowling/Latches - SECURE/ALL LATCHES LATCHED.

LEFT WING

1. Main Landing Gear Door/Wheels/Tires/Brakes/Strut/Wheel Well - CONDITION and SECURE.

NOTE

- Main gear strut extension should be between 1.8 and 3.5 inches.

- Check brake wear indicators on both brake housings.

Check tires for wear and inflation. Tire inflation pressure is 173 +5, or -5 PSIG. Refer to Tires under Servicing in this section. Check brake wear indicators on both brake housings. Visually inspect doors and taxi light for security. Inspect wheel well area for damaged or broken lines and electrical wiring for condition. Check actuator and oleo for damage, leaks and proper attachment.

(Continued Next Page)

PREFLIGHT INSPECTION (Continued)

2. Fuel Tank Vents - CLEAR.
   a. Bottom of inboard flap island.
   b. Lower wing skin forward of inboard flap.
3. Ailerons/Flaps/Spoilers/Trailing Edge - CONDITION.
4. Static Wicks (5) - CHECK.

NOTE

A maximum of two static wicks (entire airframe) and no two consecutive adjacent static wicks, may be damaged or missing.

5. NAV/Anti-Collision/Wing Tip Lights - CONDITION.
6. Fuel Tank Vent Inlet Scoop - CLEAR.
7. Fuel Filler Cap - SECURE. Check locking latch closed and directed aft. Check cover closed and secured.
8. Fuel Tank Pressure Relief Valve - CLOSED/NO LEAKS.
9. Wing Leading Edge/Slat/Anti-Ice Exit - CONDITION.

NOTE

The slat anti-ice air exit slots should periodically be checked for blockage caused by polishing agents, etc. Blockage can reduce anti-ice protection.

10. Fuel Quantity Dipstick - SECURE (left wing half span).
11. Left Wing Fuel Quick Drain - DRAIN/CHECK.
12. Landing Light - CONDITION.
13. Engine Inlet Duct/Fan - CLEAR/CONDITION. Assume a position forward of the wing that will provide maximum visibility of the engine inlet, and visually check for obstructions or damage.
14. Dorsal Fin Air Inlet - CLEAR (can be viewed from cabin steps).

COCKPIT PREPARATION

1. Preflight Inspection - COMPLETE.
2. Cockpit Switches - VERIFY/SET.
   a. EMERG LT Switch - ARM.
   b. DAY/NITE DIM Switch - AS REQUIRED.
   c. LH and RH GEN Switches - GEN.
   d. LH/RH FUEL BOOST Switches - NORM.
   e. LH/RH FADEC Switches - NORM.
   f. LH/RH IGNITION Switches - NORM.
   g. STBY Gyro - CAGED.
   h. STBY PWR Switch - ON.
   i. Exterior Lights - AS REQUIRED.
   j. Pressurization Control Switches - AS REQUIRED.
   k. Bleed/Environmental Control Knobs - SET.
   l. All Other Switches - AS REQUIRED.

(Continued Next Page)

COCKPIT PREPARATION (Continued)

NOTE

The windshield anti-ice can be operated continuously during most ground and flight operations. It will also aid cockpit warming. Do not leave windshield anti-ice switches on during extended ground operations due to reduced controller cooling capability.

WARNING

SLATS, LANDING GEAR, SPEED BRAKES, ROLL SPOILERS, FLIGHT CONTROLS AND THE LEFT THRUST REVERSER WILL OPERATE IF THE “A” SYSTEM AUXILIARY HYDRAULIC PUMP IS ON. THE UPPER RUDDER IS POWERED AND FLAPS WILL MOVE IF ELECTRICAL POWER IS ON. USE CAUTION FOR PERSONNEL OUTSIDE THE AIRPLANE WHEN MOVING COCKPIT CONTROLS.

3. BATT 1 and BATT 2 Switches - ON.
4. DC Power BUS 1 and BUS 2 Switches - VERIFY NORM.
5. DC Power XTIE Switch - VERIFY CLSD.
6. Avionics Switch - ON.
7. Parking Brake - SET.

NOTE

Turn the “A” auxiliary hydraulic pump on and allow “A” system pressure to reach approximately 2000 PSI, then set the brake and turn the “A” auxiliary hydraulic pump OFF.

8. APU - START or GPU - CONNECTED. Refer to Normal Procedures, APU GROUND OR IN-FLIGHT START.

CAUTION

THE APU IS NOT APPROVED FOR UNATTENDED GROUND OPERATION.

9. DC Battery Ammeters (if APU generator ON or external power ON) - VERIFY BOTH ARE CHARGING (Forward of Pilot's CB Panel).
10. IRS (if installed) - ALIGN/NAV.
    IRS alignment will take approximately 4-6 minutes depending on global position.
11. FMS (if IRS installed) - INSERT PRESENT POSITION.
12. Fuel Transfer/Crossfeed - CHECK/OFF.
    a. FUEL CROSSFEED Switch - LH TANK (FUEL XFEED OPEN, FUEL BOOST ON, L white CAS message ON).
    b. FUEL CROSSFEED Switch - RH TANK (FUEL XFEED OPEN, FUEL BOOST ON, R white CAS message ON).
    c. FUEL CROSSFEED Switch - OFF.
    d. CTR WING XFER Switches - NORM/AS REQUIRED.

(Continued Next Page)

COCKPIT PREPARATION (Continued)

NOTE

- If there is to be a delay before flight with the APU operating, position the CTR WING XFER switches to OFF. LH boost pump pressure will activate the center tank transfer and could result in a fuel spill if the automatic shut-off fails. If the delay is prolonged, the fuel imbalance, due to APU fuel burn, can be reduced by selecting the crossfeed switch to RH TANK and the LH Fuel Boost switch to OFF.

- The FUEL MOTV FAIL L-R amber CAS message for the selected tank may momentarily illuminate when crossfeed is selected.

13. FLT CONTROL SHUTOFF Switch Annunciators - ALL EXTINGUISHED.
14. Warning Systems - CHECK/OFF.

WARNING

IF THE SLATS ARE UP AND EITHER HYDRAULIC SYSTEM IS PRESSURIZED, SLATS WILL EXTEND AND RETRACT DURING THE AOA TEST. ENSURE PERSONNEL ARE CLEAR.

NOTE

The rotary test knob must remain in the AOA position until the AOA test is completed; which in turn tests both the AUTO SLAT FAIL function and the MINIMUM SPEED function.

15. Cockpit Voice Recorder - TEST.
16. Aileron and Rudder Trim - CHECK/SET FOR TAKEOFF.
17. Flight Guidance Computer/Stabilizer Trim/Yaw Dampers - CHECK/SET.
    a. Secondary Trim - CHECK/OFF/COVER DOWN.

NOTE

Trim clacker will sound if trim is activated for more than three seconds.

    b. Primary Stabilizer Trim (pilot and copilot) - CHECK/SET FOR TAKEOFF.
    c. FGC - Verify mach trim and yaw damper are engaged in either "A" or "B".
    d. Upper Yaw Damper - VERIFY “A” or “B” is engaged.

NOTE

- Lower YD and Mach trim (M TRIM) can be selected ON (not deselected).

- FGCs will automatically switch between A or B on alternating flights and will automatically switch back to the sequenced FGC the first time a manual switch is attempted. Subsequent manual switches will be allowed to change the selected FGC.

- Do not check individual halves of trim switches for more than 20 seconds. FGC monitors will trip.

(Continued Next Page)

COCKPIT PREPARATION (Continued)

NOTE (Continued)

- Do not make rapid primary trim reversals when setting stabilizer. FGC monitors may trip.

- Nominal stabilizer trim range is +1.2 to -12 degrees. It is possible that normal rig tolerance could be slightly outside these values. The EICAS trim display will be amber outside the nominal range. There may be up to 0.5 degrees difference in indicated stabilizer position when switching between primary and secondary trim.

HORIZONTAL STABILIZER POSITION FOR TAKEOFF

EXAMPLE:
TAKEOFF FLAPS - 15,
HORIZONTAL STABILIZER SETTING AT 23% MAC = -6.2 DEGREES

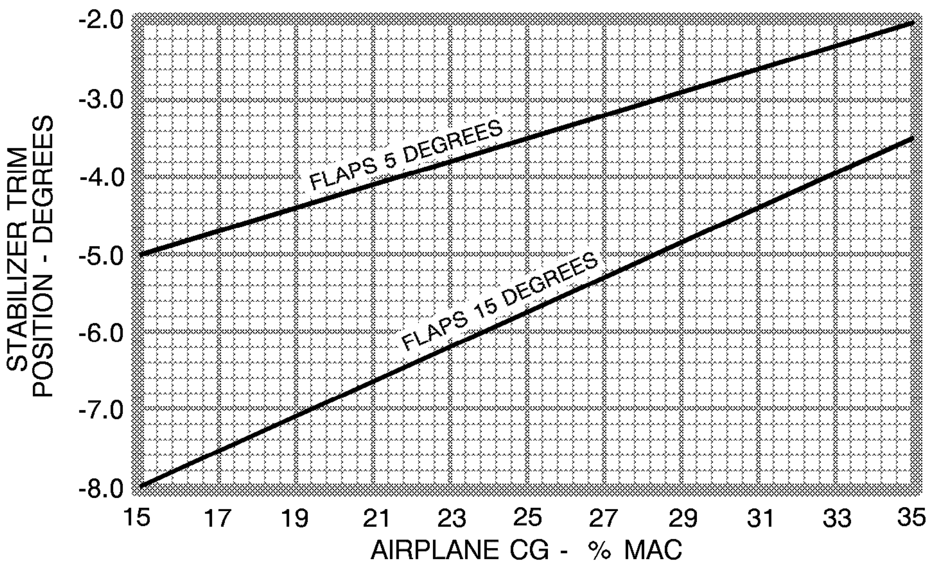

Figure 4-2

DELAY BEFORE FLIGHT WITHOUT APU/GPU

1. IRS (if installed) - OFF.
2. STBY PWR Switch - OFF.
3. EMERG LT Switch - OFF.
4. Avionics Switch - OFF.
5. BATT 1 and BATT 2 Switches - OFF.

BEFORE START

1. If Delay - Without APU/GPU.
   a. STBY PWR Switch - ON.
   b. EMERG LT Switch - ARM.
   c. BATT 1 and BATT 2 Switches - ON.
   d. DC Power BUS 1 and BUS 2 Switches - VERIFY NORM.
   e. DC Power XTIE Switch - VERIFY CLSD.
   f. APU-START (Refer to Normal Procedures, APU GROUND OR IN-FLIGHT START) or GPU-CONNECT/EXT POWER Switch - PUSH (ON).
   g. Avionics Switch - ON.
   h. IRS (if installed) - ALIGN/NAV.
   i. FMS (if IRS installed) - INSERT PRESENT POSITION.
2. Parking Brake - VERIFY SET.
3. Wheel Chocks - REMOVED.
4. Cabin Door - CLOSE/LOCK.
   Check the ten window indicators for proper door pin positions and the handle lock indicator for handle lock. Check CAS for door indications.

NOTE

Electric power must be on when the cabin door is being closed in order to detect proper sequencing as the door is closed.

5. Passenger Briefing - COMPLETED.
   Ensure that passengers are informed of the escape routes from the airplane, and are informed of the location and use of emergency equipment. that is onboard the airplane.
6. Seats/Belts/Harnesses/Pedals - ADJUST/SECURE.
   Check seats locked in the desired position. Check seat belts snug and shoulder harnesses latched to the buckle. Rudder pedals adjust individually by depressing the tab on the inboard side and moving fore or aft. Three positions are available. Check locked in the desired position.
7. Cockpit Side Windows - CLOSED/LATCHED.
8. Exterior Lights - AS REQUIRED.
9. EICAS - CHECK. Verify EICAS operating properly.
   Check for failure abnormal indications before starting engines.
10. ATIS/Clearance/FMS - AS REQUIRED. Program FMS.
11. Flight Instruments/Avionics - CHECK/SET.
    Set course bugs and pointers as required for departure. COMM/NAV/ADF radios tuned and verified. Transponders set to STBY.
12. Fuel Quantity/Balance - CHECK.
    Maximum intentional fuel quantity imbalance is 400 lbs., however, for takeoff, fuel should be balanced since imbalance will affect performance.
13. CTR WING XFER Switches - NORM/AS REQUIRED.
14. V-Speeds - SET (Confirm from Section IV, Performance, of the FAA Approved Airplane Flight Manual).

(Continued Next Page)

BEFORE START (Continued)

SIMPLIFIED CRITERIA - FLAPS 15° TAKEOFF

WEIGHT RANGE - POUNDS	23,000 - 27,000	27,001 - 30,000	30,001 - 33,000	33,001 - 35,700
V_1	114	116	125	133
V_R	116	119	128	134
V_2	129	127	132	137
RUNWAY LENGTH - FEET (MINIMUM)	4500	5000	6000	7000
V_{REF} (FLAPS FULL)	118	126	* 136	* 142
V_{APP}	124	131	* 142	* 147

* For use in an emergency landing. Maximum design landing weight is 31,800 pounds. Landing at weights above 30,000 pounds may exceed the Landing Brake Energy.

NOTE

The above criteria apply only to takeoff with flaps 15°, at or below 2000 feet MSL, and temperatures at or below 30°C. Refer to the FAA Approved Airplane Flight Manual, Section IV, Performance, TAKEOFF PERFORMANCE, for other restrictions on use of simplified criteria and takeoff data for other conditions.

STARTING ENGINES

1. APU (or Ground Air Service) BLEED AIR Switch - ON (check start duct pressure).
2. PAC ISOL VALVE Knob - CLOSED.

NOTE

- Start duct pressure prior to engine start should normally be at least 30 PSI. At high elevation airports the APU may not achieve this pressure. Minimum start pressure for high elevation start may decrease to 25 PSI.
- If restarting a warm engine, allow ITT to drop below 200°C (150°C above 8,000 feet pressure altitude) before attempting a start. A hung start may result from high residual ITT.
- For cold weather operations (below -15°C), refer to Normal Procedures, EXTREME COLD WEATHER OPERATIONS.

3. Right Engine - START.

NOTE

- Abort the start for any of the following conditions: no oil pressure indication within 15 seconds after N_2 rotation, no N_1 rotation, compressor surge, or ITT rapidly approaches 800°C. Refer to Abnormal Procedures, ENGINE START MALFUNCTION.
- Abort the start for hung start (no acceleration for 15 seconds) or N_2 stagnation 45-55%. Refer to Abnormal Procedures, ENGINE START MALFUNCTION.

(Continued Next Page)

STARTING ENGINES (Continued)

NOTE (Continued)

- Abort the start if the engine reaches starter cutout speed (approximately 56% N_2), then rolls back. Do not re-engage the starter, as starter shaft may shear. Refer to Abnormal Procedures, ENGINE START MALFUNCTION.

- If a third attempt is necessary, it is recommended to use a ground cart with at least 5 PSI more duct pressure than the APU. No more than three start attempts are recommended.

a. ENGINE START BUTTON - PRESS (confirm START button and DISENGAGE button illuminate).
b. Throttle - IDLE (by 10% N_2 RPM).

NOTE

- The throttle lever may be moved out of cut-off after engine N_2 rotation begins. Start sequence will begin at 10% N_2. Positioning the throttle to idle before engine start will display CAS messages inhibited by shutdown logic.

- The FADEC will turn on ignition at approximately 14% N_2 RPM and initiate start fuel at 33% N_2 RPM or 10 seconds after ignition is turned on. Fuel flow will indicate 140 PPH when the throttle lever is advanced to idle, but actual fuel flow does not begin until 33% N_2 RPM or 10 seconds after ignition is turned on.

c. N_1 Rotation - CONFIRM.
d. Oil Pressure - CHECK.
e. ITT - MONITOR.
f. Start Termination - CONFIRM BY 57% N_2 (START and DISENGAGE lights extinguished).

4. Hydraulic Pressure - VERIFY.

NOTE

Prior to start, the RUD STBY SYS FAIL amber CAS message will not be illuminated, indicating normal operation of the “B” rudder standby system. Starting the right engine first allows the following hydraulic system checks. As the right engine is started, the “B” system pressure will increase to 3000 PSI, and the PTU will begin cycling the “A” system pressure between approximately 1500 and 2700 PSI. If PTU noise is objectionable, the auxiliary pump may be turned on once PTU operation is confirmed. The auxiliary pump should be turned off after the left engine is started. The “A” system pressure will then increase to 3000 PSI when the left engine is started. If the left engine is started first, the “A” system must be unloaded after right engine start to ensure the PTU is operational (first flight of day).

5. Left Engine - START (same as right, except if a third attempt is necessary, it is recommended to use the cross bleed start method or a ground unit with at least 5% more duct pressure than the APU).
6. Hydraulic Pressure - VERIFY.

(Continued Next Page)

STARTING ENGINES (Continued)

7. Generators - CHECK DC AMPS/VOLTS.

NOTE

- Battery charge may be checked on the battery ammeters (located forward of pilot's CB panel).
- The APU generator will drop off line when the right engine generator comes on-line.

8. DC Power XTIE Switch - VERIFY OPEN after second generator comes on-line.
9. Ground Air Service/GPU (if used) - DISCONNECT.
10. APU Bleed Air Switch - OFF (check bleed sources).
    a. Select EICAS SYS, ENG on the MFD (duct pressure is from right engine).
    b. R ENG BLD AIR Knob - OFF (pressure should be zero).
    c. PAC ISOL VALVE Knob - OPEN (pressure is from left engine).
    d. L ENG BLD AIR Knob - OFF (pressure should be zero).
    e. L ENG BLD AIR Knob - HP/LP (check pressure).
    f. PAC ISOL VALVE Knob - CLOSED (pressure should be zero).
    g. R ENG BLD AIR Knob - HP/LP (check pressure).
11. APU BLEED AIR Switch - AS DESIRED.

NOTE

If the APU is installed and operational, it is recommended that it remain operating through initial climb, with bleed on, to provide emergency restart and generator capability.

STARTING SECOND ENGINE: CROSS BLEED METHOD

CAUTION

HIGH EXHAUST VELOCITIES CAN CAUSE DAMAGE TO OTHER AIRCRAFT AND EQUIPMENT. ENSURE THE AREA BEHIND THE AIRPLANE IS CLEAR.

1. PAC ISOL VALVE Knob - OPEN.
2. PAC BLEED SELECT Switch - HP.
3. Opposite ENG BLD AIR Knob - HP/LP.
4. Opposite Engine - ADJUST to achieve and maintain 30 PSI minimum start pressure (approximately 55% N_1).
5. Engine - START.
    a. ENGINE START BUTTON - PRESS (confirm START button and DISENGAGE button illuminate).
    b. Throttle - IDLE (by 10% N_2 RPM).

(Continued Next Page)

STARTING SECOND ENGINE: CROSS BLEED METHOD (Continued)

NOTE

- The throttle lever may be moved out of cut-off after engine N_2 rotation begins. Start sequence will begin at 10% N_2. Positioning the throttle to idle before engine start will display CAS messages inhibited by shutdown logic.
- The FADEC will turn on ignition at approximately 14% N_2 RPM and initiate start fuel at 33% N_2 RPM or 10 seconds after ignition is turned on. Fuel flow will indicate 140 PPH when the throttle lever is advanced to idle, but actual fuel flow does not begin until 33% N_2 RPM or 10 seconds after ignition is turned on.

c. N_1 Rotation - CONFIRM.
d. Oil Pressure - CHECK.
e. ITT - MONITOR.
f. Start Termination - CONFIRM BY 57% N_2 (START and DISENGAGE lights extinguished).

6. Opposite Engine - IDLE.
7. Hydraulic Pressure - VERIFY.
8. Generators - CHECK DC AMPS/VOLTS.

NOTE

Battery charge may be checked on the battery ammeters (located forward of the pilot's CB panel).

9. DC Power XTIE Switch - VERIFY OPEN after second generator comes on-line.
10. PAC BLEED SELECT Switch - NORMAL.
11. PAC ISOL VALVE Knob - CLOSED.

BEFORE TAXI

1. Flight Controls - FREE/CORRECT EICAS INDICATIONS.

NOTE

Verify 100% rudder travel available on the CAS CTRL POS page. Upper rudder will not move with flaps selected up.

a. FLT CONTROL SHUTOFF Switch Annunciators - EXTINGUISHED.

2. Flaps/Slats Lever - UP.
3. Rudder Control/EICAS - VERIFY UPPER RUDDER REMAINS CENTERED WITH FLAPS UP (first flight of the day).
4. Flaps/Slats - SET FOR TAKEOFF/CHECK EICAS INDICATIONS.
5. Speed Brakes - CHECK/STOWED/EICAS INDICATIONS.
6. AHRS or IRS - ALIGNED/NO FLAGS.
7. EICAS - CHECK (all messages either normal or resolved).
8. Standby Gyro - UNCAGED.
9. Anti-Ice Systems - AS REQUIRED.

(Continued Next Page)

BEFORE TAXI (Continued)

10. Pressurization - SET (to takeoff or landing field elevation).
11. Passenger Advisory Lights - PASS SAFETY.
12. Seats/Seat Belts/Shoulder Harnesses/Aft Divider Sliding Doors - CHECK/SECURE/LATCHED OPEN (if belted toilet seat occupied).

TAXI

1. Exterior Lights - AS REQUIRED.
2. Brakes - APPLY and HOLD.
3. Parking Brake - RELEASE.
4. Brakes - CHECK.
5. Nose Wheel Steering - CHECK.
6. Thrust Reversers - CHECK/STOWED (the following thrust reverser check must be successfully completed).
   a. Thrust Reversers - DEPLOY (idle).
   b. ARM, UNLOCK, DEPLOY Lights - ILLUMINATED.
   c. STOW Switches - EMER.
      (1) Thrust Reversers - STOW.
      (2) UNLOCK and DEPLOY Lights - OUT.
      (3) ARM Light - REMAINS ILLUMINATED.
   d. Thrust Reversers - STOW.
      (1) ARM Light - REMAINS ILLUMINATED.
   e. STOW Switches - NORM.
      (1) Thrust Reversers - REMAIN STOWED.
      (2) All Thrust Reverser Lights - OUT.

NOTE

- Taxiing with the left thrust reverser deployed will reduce the need for braking at light weights. The right thrust reverser should not be used for extended taxi if the APU and APU bleed is on, due to ingestion of reversed exhaust gases. Exercise care when taxiing with deployed reversers over or near loose gravel or sand.
- If taxiing through slush/ice, taxi with slats/flaps up to preclude ice contamination of flaps or slats systems.

7. Flight Instruments - CHECK.

BEFORE TAKEOFF

1. Anti-Ice Systems (if required) - CHECK.
   a. LH/RH ENG/STAB/SLAT ANTI-ICE - ON/CHECK COLD MESSAGES (2-3 minutes).
   b. Throttles - APPROXIMATELY 40% N_1.
   c. Check EICAS COLD messages go out, no HOT or LEAK messages.

NOTE

The WING AI COLD, SLAT AI COLD, and STAB AI COLD messages are delayed 1.5 minutes and the ENG AI COLD message is delayed 3 minutes after being turned ON. ENG AI COLD and WING AI COLD messages will not illuminate if OAT is above 15°C $\pm$3°C. This check may need to be accomplished during climb if destination or enroute icing is expected.

(Continued Next Page)

BEFORE TAKEOFF (Continued)

d. ANTI-ICE Switches - AS REQUIRED. It is suggested that Pitot/Static Anti-Ice be employed for all flights. Observe ground operations limitations (maximum two minutes).

e. Throttles - IDLE.

2. Seats/Seat Belts/Shoulder Harnesses/Aft Divider Sliding Doors - CHECK/SECURE/LATCHED OPEN (if belted toilet seat occupied).
3. Flaps/Slats - SET FOR TAKEOFF.
4. Speed Brakes - RETRACTED (0%).
5. Trims (3) - SET FOR TAKEOFF.

HORIZONTAL STABILIZER POSITION FOR TAKEOFF

EXAMPLE:
FLAPS 15°
HORIZONTAL STABILIZER SETTING AT 23% MAC:= -6.2 DEGREES

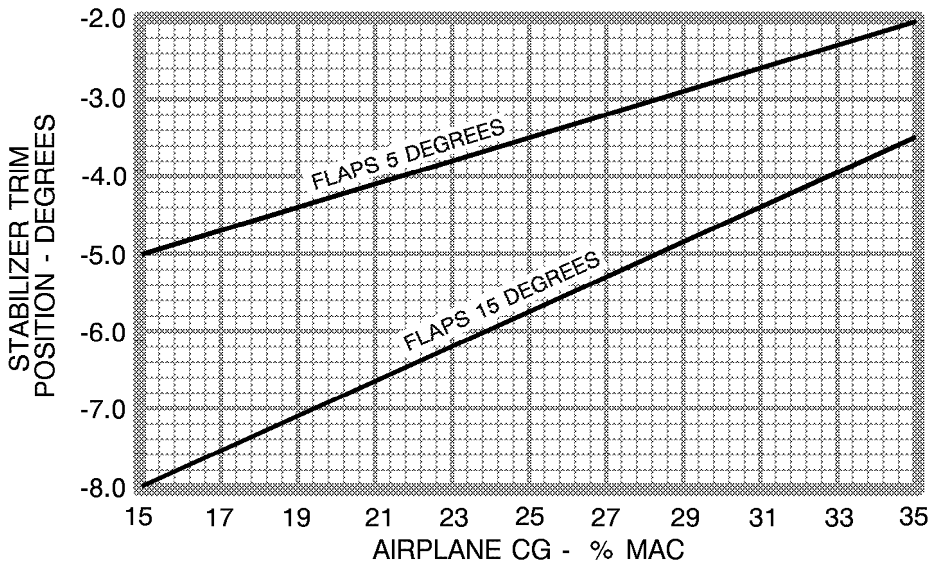

Figure 4-3

6. Yaw Damper and Mach Trim - CHECK ON.
7. Crew Briefing - COMPLETE. It is suggested that the pilot brief the copilot and crew, if applicable, on takeoff procedures at this point. The briefing may consist of discussion concerning crew coordination with respect to: flap settings, use of anti-ice, review of throttle procedures, V-speeds, and planned action(s) in event of emergency, and other applicable procedures.

CLEARED FOR TAKEOFF

BEFORE TAKEOFF (Continued)

8. Radar - AS REQUIRED.
9. Transponder - TA/RA.
10. LH and RH PITOT STATIC Anti-Ice Switches - BOTH ON.
11. Anti-Ice Systems - AS REQUIRED.
    Systems ON which may have been turned off due to ground operating limitations as well as any additional requirements.
12. Exterior Lights - AS REQUIRED.
    Do not operate the anti-collision lights in conditions of fog, clouds, or haze as the reflection of the light beam can cause disorientation or vertigo.
13. Engine Instruments - CHECK.
    Select NORM EICAS menu page and check electrical system 28-29 volts, hydraulic systems 3000 PSI, oil temperature and pressure in the normal range.
14. EICAS - CHECK.
    Check EICAS messages clear or indicating normal condition.

TAKEOFF

1. Throttles - TO/MC DETENT (FADEC mode indicator - green T/O).
2. Brakes - RELEASE.
3. EICAS - CHECK NORMAL INDICATIONS, N_1 matches command.
4. Elevator Control - ROTATE AT V_R to achieve 13° initial pitch.

NOTE

- The brakes may be released prior to setting TO thrust on rolling takeoffs. The required runway length will be longer than the normal takeoff distance.
- Use of the flight director TO command is recommended for initial pitch attitude reference.

AFTER TAKEOFF/CLIMB

1. Landing Gear - UP.
   After establishing a positive rate-of-climb, pull the gear handle out and place it to the UP position. The green GEAR DOWN lights will extinguish and the red UNLOCK light will illuminate until the gear reaches up-and-locked position. Gear transition takes approximately six seconds.

   NOTE

   When operating from airports with precipitation conditions (standing water) on runways, it is recommended that retracting of the landing gear be delayed a sufficient amount of time to clear any accumulated moisture in the brakes and wheel assemblies.

2. Flaps/Slats - UP (airspeed above 170 KIAS).
   After reaching a comfortable altitude and an airspeed above 170 KIAS with wings level, push the flap handle in and move it full forward to the UP detent. Observe that the flaps position indicator in the EICAS moves to a FLAPS UP indication. Airspeed in excess of the minimum retraction airspeed will accentuate the pitch change during retraction.
3. Throttles - CLB DETENT.
   It is recommended that power be reduced to climb thrust within 5 minutes after takeoff.

   NOTE

   - Takeoff Thrust (TO/MC detent) with ITT in the amber range (851°C to 888°C) is limited to 5 minutes.
   - Thrust must be reduced to the Climb (CLB) detent within 5 minutes after takeoff.
   - Use of Climb Thrust (CLB detent) during normal operations beyond 10 minutes after reaching cruise altitude will significantly decrease engine life and increase operator costs.

4. Anti-Ice Systems - AS REQUIRED.

   NOTE

   - Windshield anti-ice may be on continuously during most ground and all flight operations to aid in cockpit heating.
   - When climbing with bleed air anti-ice on, the throttles may be placed in the TO/MC detent, if ITT remains ≤850°C, to improve climb performance.

5. ENG SYNC Knob - AS DESIRED.
6. Pressurization - CHECK.
   Verify that the cabin is pressurizing according to proper schedule.
7. Passenger Advisory Lights - AS REQUIRED.
8. Altimeters (transition level) - SET.
   Set altimeters to 29.92 Hg. (or 1013 Mb) at transition altitude (18,000 feet in the U.S.) and crosscheck. Set standby altimeter, if desired.
9. Exterior Lights (FL180) - AS DESIRED. Turn off exterior/recognition lights that are not required.
10. APU (prior to climb above FL310) - OFF. Refer to Normal Procedures, APU SHUTDOWN.

CRUISE

1. Throttles - CRU detent or AS REQUIRED.
   Upon level-off climb thrust is normally maintained while accelerating to the desired cruise speed. Thrust is then adjusted to maintain the desired airspeed per the airplane cruise performance charts. If the engine RPM does not automatically synchronize at the desired cruise setting, turn off the engine synchronizer, roughly synchronize the engines with the throttles, and turn the synchronizer switch back to FAN or TURB.

   NOTE

   - It is recommended that throttles be reduced to the CRU detent or below within 10 minutes after reaching desired altitude.
   - For maximum range thrust required to maintain the optimum angle-of-attack (maximum lift vs drag condition) diminishes with fuel burn-off due to lower gross weights. Maximum range performance therefore requires a gradually diminishing airspeed and power setting schedule.
   - For flight in rough air, refer to Normal Procedures, TURBULENT AIR PENETRATION.

2. Pressurization - CHECK.
   Verify that the pressurization system is maintaining the selected pressurization schedule.
3. Oxygen Mask (when required) - DON/NORM.
4. Fuel Transfer - VERIFY.

   NOTE

   - The center-to-wing transfer system, CTR WING XFER switches in NORM, will automatically start center tank to wing transfer at approximately 3250 to 3500 pounds of fuel in each wing and maintain approximately that level in the wings until the center tank is empty. Exact wing fuel level will vary with pitch attitude.
   - EICAS control position page may not show the surface positions at “zero” due to variations in the aerodynamic loads, this is considered normal.

(Continued Next Page)

AFTER TAKEOFF/CLIMB

1. Landing Gear - UP.
   After establishing a positive rate-of-climb, pull the gear handle out and place it to the UP position. The green GEAR DOWN lights will extinguish and the red UNLOCK light will illuminate until the gear reaches up-and-locked position. Gear transition takes approximately six seconds.

   NOTE

   When operating from airports with precipitation conditions (standing water) on runways, it is recommended that retracting of the landing gear be delayed a sufficient amount of time to clear any accumulated moisture in the brakes and wheel assemblies.

2. Flaps/Slats - UP (airspeed above 170 KIAS).
   After reaching a comfortable altitude and an airspeed above 170 KIAS with wings level, push the flap handle in and move it full forward to the UP detent. Observe that the flaps position indicator in the EICAS moves to a FLAPS UP indication. Airspeed in excess of the minimum retraction airspeed will accentuate the pitch change during retraction.
3. Throttles - CLB DETENT.
   It is recommended that power be reduced to climb thrust within 5 minutes after takeoff.

   NOTE

   - Takeoff Thrust (TO/MC detent) with ITT in the amber range (851°C to 888°C) is limited to 5 minutes.
   - Thrust must be reduced to the Climb (CLB) detent within 5 minutes after takeoff.
   - It is acceptable to use the TO/MC detent when climbing with bleed air anti-ice on. Maximum allowable ITT is 850°C. Thrust must be reduced to the Climb (CLB) detent upon reaching cruise altitude.
   - Use of Climb Thrust (CLB detent) during normal operations beyond 10 minutes after reaching cruise altitude will significantly decrease engine life and increase operator costs.

4. Anti-Ice Systems - AS REQUIRED.

   NOTE

   - Windshield anti-ice may be on continuously during most ground and all flight operations to aid in cockpit heating.
   - When climbing with bleed air anti-ice on, the throttles may be placed in the TO/MC detent, if ITT remains ≤850°C, to improve climb performance.

5. ENG SYNC Knob - AS DESIRED.
6. Pressurization - CHECK.
   Verify that the cabin is pressurizing according to proper schedule.
7. Passenger Advisory Lights - AS REQUIRED.
8. Altimeters (transition level) - SET.
   Set altimeters to 29.92 Hg. (or 1013 Mb) at transition altitude (18,000 feet in the U.S.) and crosscheck. Set standby altimeter, if desired.
9. Exterior Lights (FL180) - AS DESIRED. Turn off exterior/recognition lights that are not required.
10. APU (prior to climb above FL310) - OFF. Refer to Normal Procedures, APU SHUTDOWN.

CRUISE

1. Throttles - CRU detent or AS REQUIRED.
   Upon level-off climb thrust is normally maintained while accelerating to the desired cruise speed. Thrust is then adjusted to maintain the desired airspeed per the airplane cruise performance charts. If the engine RPM does not automatically synchronize at the desired cruise setting, turn off the engine synchronizer, roughly synchronize the engines with the throttles, and turn the synchronizer switch back to FAN or TURB.

   NOTE

   - It is recommended that throttles be reduced to the CRU detent or below within 10 minutes after reaching desired altitude.
   - For maximum range thrust required to maintain the optimum angle-of-attack (maximum lift vs drag condition) diminishes with fuel burn-off due to lower gross weights. Maximum range performance therefore requires a gradually diminishing airspeed and power setting schedule.
   - For flight in rough air, refer to Normal Procedures, TURBULENT AIR PENETRATION.

2. Pressurization - CHECK.
   Verify that the pressurization system is maintaining the selected pressurization schedule.
3. Oxygen Mask (when required) - DON/NORM.
4. Fuel Transfer - VERIFY.

   NOTE

   - The center-to-wing transfer system, CTR WING XFER switches in NORM, will automatically start center tank to wing transfer at approximately 3250 to 3500 pounds of fuel in each wing and maintain approximately that level in the wings until the center tank is empty. Exact wing fuel level will vary with pitch attitude.
   - EICAS control position page may not show the surface positions at “zero” due to variations in the aerodynamic loads, this is considered normal.

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DESCENT

1. LH and RH WINDSHIELD ANTI-ICE Switches - BOTH ON.
2. Side Window Vent Knobs - CLOSED.
3. Pressurization - CHECK/SET LANDING ELEVATION.
4. ANTI-ICE Switches - AS REQUIRED.

NOTE

- Cabin pressure may not be maintained at high altitude while at idle with all anti-ice on. Adjust throttles as required to maintain cabin pressure.
- Minimum airspeed for sustained flight in icing conditions (except approach and landing) is 200 KIAS, with slats retracted.

5. APU - AS DESIRED.
   a. Altitude below FL310 Airspeed $\leq$ 300 KIAS.
   b. Altitude below FL200 Airspeed $\leq$ 350 KIAS.
6. Exterior Lights (FL180) - AS REQUIRED. Turn on desired external lights, recognition lights etc. to facilitate visual contact by other aircraft at lower altitudes.
7. Altimeters (transition level) - SET.
   Set altimeters before passing transition altitude (18,000 feet in the U.S.).

NOTE

If landing at airport elevation above 8000 feet MSL, refer to the FAA Approved Flight Manual, Section III, Normal Procedures, HIGH ALTITUDE AIRPORT OPERATIONS.

APPROACH

1. Landing Data - CONFIRM.
   Determine landing data by consulting appropriate charts in the FAA Approved Flight Manual, Section IV, Performance. Gross weight, runway available, ambient temperature, wind, runway gradient, pressure altitude, and runway surface condition must be considered.
   a. Airspeed - V_{APP}/V_{REF}.
   b. Landing Distance.

SIMPLIFIED CRITERIA - FLAPS FULL LANDING

WEIGHT POUNDS	23,000	24,000	26,000	28,000	30,000	31,800
V_{REF} - KIAS	108	110	115	121	126	132
V_{APP} - KIAS	113	116	121	126	131	136

Runway length - 4500 feet or longer.

NOTE

The above criteria apply only to landings with full flaps, at or below 2000 feet MSL, and temperatures at or below 45°C. Refer to the FAA approved Flight Manual, Section IV, Performance, APPROACH AND LANDING, for other restrictions on use of simplified criteria and landing data for other conditions.

2. Crew Briefing - COMPLETE.
   Brief copilot/crew on desired duties, missed approach procedures, etc.
3. Avionics/Flight Instruments - CHECK/SET.
   Check NAV receivers on proper frequency and required heading and course information set. Cross check flight instruments for correct indications. Set COMM transceivers to sequential frequencies intended to be used.
4. Minimums - SET (RA/BARO).
   Set the radio altimeter to the decision height, minimum descent altitude, or other applicable altitude reference.
5. FUEL CROSSFEED Switch - OFF.
   Fuel crossfeed should be terminated before landing to clear the EICAS annunciations and, in the case of interwing transfer, to assure adequate fuel supply to the engines in case of a go-around.
6. Exterior Lights - AS REQUIRED.
7. Flaps/Slats - AS REQUIRED (V_{FE} 5°/250 KIAS; 15°/210 KIAS).
8. Passengers - BRIEF.
9. Seats/Seat Belts/Shoulder Harnesses/Aft Divider Sliding Doors - CHECK/SECURE/LATCHED OPEN (if belted toilet seat occupied).
10. Passenger Advisory Lights - PASS SAFETY.
    Illuminates NO SMOKING, FASTEN SEAT BELT, and EMERGENCY EXIT signs.
11. LH and RH IGNITION Switches - NORM.
    The NORM position provides automatic engine relight capability, in case of a flameout caused by a bird strike or other foreign object ingestion.
12. Pressurization - ZERO DIFFERENTIAL at touchdown.
13. ENG SYNC Knob - OFF.

BEFORE LANDING

1. Landing Gear - DOWN and LOCKED (3 green lights); V_{LO}/V_{LE} 210 KIAS.
   Pull the gear handle out and place it to the DOWN position. The red UNLOCK light will illuminate while the gear extends. Check the three GREEN, GEAR DOWN lights illuminated and UNLOCK light extinguished when gear is full down.
2. Flaps - AS REQUIRED (V_{FE} 15°/210 KIAS; V_{FE} FULL/180 KIAS).
3. Speed Brakes - RETRACTED (0%).
4. EICAS - CHECK.
5. Airspeed - V_{REF}.
6. Autopilot - OFF above minimum use height.
   The autopilot must be off for landing. Observe the autopilot minimum use height in accordance with the FAA Approved Flight Manual, Section II, Limitations. The yaw damper may continue to be used to touchdown at which time the weight-on-wheels switch will override it.

LANDING

Consistently comfortable and safe landings are best achieved from a stabilized approach. The point at which the airplane should be stabilized with airspeed at V_{REF} to V_{REF} +10, full flaps, and the desired descent rate is normally coincident with commencing the final descent to landing. Under instrument conditions, this usually occurs at the final approach fix inbound. During visual approaches, this would be a point approximately where a turn to base leg would be initiated, adjusted for traffic pattern altitude.

After passing the initial approach fix or nearing the airport traffic area, airspeed should be reduced below 210 KIAS and the flaps extended to the 15-degree position. Approaching the final instrument fix inbound (one dot from glideslope interception on an ILS), or at a downwind position abeam the touchdown point, extend the landing gear below 210 KIAS. At the point where final descent to landing is begun, reduce airspeed below 180 KIAS and extend FULL flaps, establish the desired descent rate, and adjust power to maintain V_{REF} to V_{REF} +10 indicated airspeed.

For maneuvering prior to final approach, minimum airspeeds of V_{REF} +30, V_{REF} +20 and V_{REF} +10 should be maintained clean, flaps 15 degrees, and flaps FULL down, respectively, to provide an adequate margin above stall.

Speed control on final should be precise for optimum landing performance. This is best accomplished by establishing V_{REF} airspeed well before crossing the threshold. In gusty wind conditions, it is recommended that one-half the gust factor in excess of 5 knots be added to V_{REF}.

Power management during the approach/landing phase is relatively easy in the Model 750 because an N_1 setting in the 60 to 65 percent range will normally result in desired indicated airspeeds for the various configurations. Depending on air traffic control requirements, thrust necessary for the entire approach can often be set during descent, keeping in mind that fan (N_1) RPM will decrease very slightly for a fixed throttle setting with a decrease in altitude or indicated airspeed.

(Continued Next Page)

LANDING (Continued)

Using a sea level airport with zero wind at a typical landing weight (27,000 pounds), a throttle setting that results in approximately 60 percent N_1 will give approximate level flight indicated airspeeds of 170 knots clean and 150 with flaps 15 degrees. With gear extended and flaps FULL down (35°), initiating an average descent (500 FPM) will result in approximately V_{REF} airspeed. Higher field elevations, landing gross weights, and/or a headwind component will require a higher power setting.

Approaching within approximately 50 feet of airport elevation, power should be gradually reduced to counter the acceleration induced by ground effect. Wind velocity and direction will dictate the rate at which the throttles are retarded. In very high surface headwind conditions, as an example, it may be necessary to maintain at or near approach power until close to touchdown. With a tailwind, a fairly rapid power reduction may be necessary in the final descent to landing phase for accurate speed control. In ground effect, where induced drag is reduced, leaving approach power on will cause the airplane to float to a longer touchdown than desired. Retarding the throttles gradually in the final descent will normally result in idle thrust being reached just before touchdown.

CROSSWIND LANDING TECHNIQUE

Consistent crosswind landings should be accomplished using a “crab” technique. Due to its long span, and highly swept wing, the airplane should not be flown using the wing-down sideslip technique. Final approach should be flown in a crab with wings level. As the airplane is transitioned into a flare attitude, smoothly apply rudder to approximately align the airplane for touchdown while maintaining wings level with aileron control. Depending on the crosswind velocity, full runway alignment may not be practical due to resulting drift. Allow the airplane to touchdown in a crab. Do not attempt to hold it off the runway. As the airplane touches, deploy the speed brakes and smoothly apply and hold forward elevator control to lower the nose to the ground. Use nose wheel steering through the rudder pedals for directional control, transitioning to the tiller as speed reduces. After touchdown, it will be necessary to apply and maintain aileron control into the wind to keep the upwind wing from lifting during rollout.

Refer to Figure 4-4 for roll-pitch restrictions regarding wingtip and tailcone ground clearance during landing.

LANDING (WITH THRUST REVERSERS)

Touchdown, preceded by a slight flare, should occur on the main wheels. Check thrust at idle, extend the speed brakes, lower the nose wheel to the runway, and apply the wheel brakes. Maintain nose wheel ground contact with forward elevator pressure and deploy the thrust reversers. Check thrust reverser DEPLOY annunciators are illuminated before adding reverse thrust.

(Continued Next Page)

LANDING (Continued)

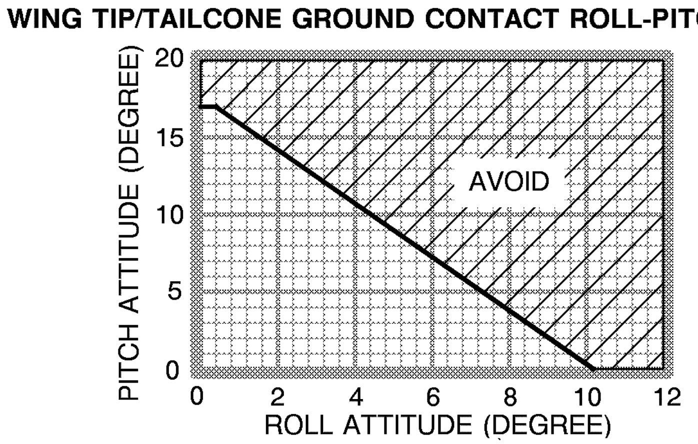

Figure 4-4

CAUTION

EXCESSIVE ROLL AND/OR PITCH ATTITUDE, WITH THE MAIN GEAR ON THE GROUND DURING TAKEOFF OR LANDING, CAN RESULT IN TAILCONE AND/OR WINGTIP GROUND CONTACT.

There is a slight nose up pitch associated with the deployment of the thrust reversers. Therefore, light forward pressure should be used during the thrust reverser deployment, especially at high speeds such as an aborted takeoff or a no flaps landing. The nose wheel must be on the ground before adding reverse power to eliminate the possibility of foreign object damage and to improve directional control.

CAUTION

- DO NOT ATTEMPT TO RESTOW REVERSERS AND TAKEOFF ONCE REVERSERS HAVE STARTED TO DEPLOY.
- IF THE REVERSERS ARE DEPLOYED AND THE AIRPLANE SKIPS, THE REVERSERS WILL AUTO-STOW AND THEN REDEPLOY ON THE SUBSEQUENT TOUCHDOWN. IF THE REVERSERS HAVE FULLY DEPLOYED AND REVERSE THRUST HAS BEEN INCREASED ABOVE IDLE PRIOR TO THE SKIP, REVERSE (OR FORWARD) THRUST WILL NOT BE AVAILABLE DURING THE SUBSEQUENT ROLLOUT, UNLESS THE THROTTLE LEVERS ARE AT OR RETURNED TO IDLE PRIOR TO ATTEMPTING THRUST INCREASE.

Once the thrust reversers are deployed, move the thrust reverser levers aft to obtain maximum reverse thrust. The FADECs will prevent the pilot from exceeding the takeoff thrust rating. This allows the pilot to keep his attention on the landing rollout instead of diverting his attention to the reverse power settings. The thrust reverser levers should be placed in idle reverse at 70 knots to prevent foreign object damage to the engine.

(Continued Next Page)

LANDING (Continued)

1. Throttles - IDLE.
2. Speed Brakes - EXTEND at touchdown (100%).
3. Elevator Control - FORWARD PRESSURE at touchdown.
4. Brakes - APPLY after nose wheel ground contact.

NOTE

- Speed brakes and thrust reversers cause a nose up pitch when deployed. This characteristic is more noticeable as the center-of-gravity approaches the light weight aft limit. Maintain forward elevator control pressure.

- For most normal landings, when runway length is not critical, brakes may be delayed. Refer to The FAA Approved Flight Manual, Section IV, Performance, APPROACH and LANDING for procedures used to obtain scheduled performance.

5. Thrust Reversers - DEPLOY after nose wheel ground contact.

CAUTION

- IF REVERSERS ARE DEPLOYED AND THE AIRPLANE SKIPS, THE REVERSERS WILL AUTO-STOW AND THEN REDEPLOY ON THE SUBSEQUENT TOUCHDOWN. IF THE REVERSERS HAVE FULLY DEPLOYED AND REVERSE THRUST HAS BEEN INCREASED ABOVE IDLE PRIOR TO THE SKIP, REVERSE (OR FORWARD) THRUST WILL NOT BE AVAILABLE DURING THE SUBSEQUENT ROLLOUT UNLESS THE THROTTLES ARE AT OR RETURNED TO IDLE PRIOR TO ATTEMPTING THRUST INCREASE.
- IF LANDING WITH A SINGLE REVERSER ON A SLIPPERY RUNWAY OR WITH NOSE WHEEL STEERING INOPERATIVE, REDUCE THRUST TO IDLE BY 70 KIAS.

6. Thrust Reversers - IDLE BY 65 KIAS.
   Use of reverse thrust below 65 KIAS increases the possibility of foreign object damage to the engines.

LANDING (WITHOUT USE OF THRUST REVERSERS)

Touchdown, preceded by a slight flare, should occur on the main wheels. Check thrust at idle and extend the speed brakes while lowering the nosewheel. With the nose wheel on the runway, braking should be commenced according to runway length available to reduce brake wear. Apply smooth, gradually increasing pressure until a comfortable turn off speed is reached. If maximum braking performance is desired, do not modulate brake pedals. The antiskid system is most effective with continuous brake pedal pressure.

NOTE

Antiskid system "dropout" occurs at approximately 10 knots where braking reverts to straight power brake mode.

LANDING (Continued)

WING TIP/TAILCONE GROUND CONTACT ROLL-PITCH ENVELOPE

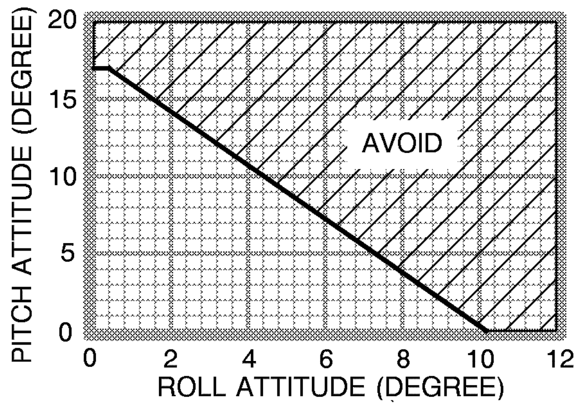

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Figure 4-4

CAUTION

EXCESSIVE ROLL AND/OR PITCH ATTITUDE, WITH THE MAIN GEAR ON THE GROUND DURING TAKEOFF OR LANDING, CAN RESULT IN TAILCONE AND/OR WINGTIP GROUND CONTACT.

There is a slight nose up pitch associated with the deployment of the thrust reversers. Therefore, light forward pressure should be used during the thrust reverser deployment, especially at high speeds such as an aborted takeoff or a no flaps landing. The nose wheel must be on the ground before adding reverse power to eliminate the possibility of foreign object damage and to improve directional control.

CAUTION

- DO NOT ATTEMPT TO RESTOW REVERSERS AND TAKEOFF ONCE REVERSERS HAVE STARTED TO DEPLOY.
- IF THE REVERSERS ARE DEPLOYED AND THE AIRPLANE SKIPS, THE REVERSERS WILL AUTO-STOW AND THEN REDEPLOY ON THE SUBSEQUENT TOUCHDOWN. IF THE REVERSERS HAVE FULLY DEPLOYED AND REVERSE THRUST HAS BEEN INCREASED ABOVE IDLE PRIOR TO THE SKIP, REVERSE (OR FORWARD) THRUST WILL NOT BE AVAILABLE DURING THE SUBSEQUENT ROLLOUT, UNLESS THE THROTTLE LEVERS ARE AT OR RETURNED TO IDLE PRIOR TO ATTEMPTING THRUST INCREASE.

Once the thrust reversers are deployed, move the thrust reverser levers aft to obtain maximum reverse thrust. The FADECs will prevent the pilot from exceeding the takeoff thrust rating. This allows the pilot to keep his attention on the landing rollout instead of diverting his attention to the reverse power settings. The thrust reverser levers should be placed in idle reverse at 60 knots to prevent foreign object damage to the engine.

(Continued Next Page)

LANDING (Continued)

1. Throttles - IDLE.
2. Speed Brakes - EXTEND at touchdown (100%).
3. Elevator Control - FORWARD PRESSURE at touchdown.
4. Brakes - APPLY after nose wheel ground contact.

NOTE

- Speed brakes and thrust reversers cause a nose up pitch when deployed. This characteristic is more noticeable as the center-of-gravity approaches the light weight aft limit. Maintain forward elevator control pressure.

- For most normal landings, when runway length is not critical, brakes may be delayed. Refer to The FAA Approved Flight Manual, Section IV, Performance, APPROACH and LANDING for procedures used to obtain scheduled performance.

5. Thrust Reversers - DEPLOY after nose wheel ground contact.

CAUTION

- IF REVERSERS ARE DEPLOYED AND THE AIRPLANE SKIPS, THE REVERSERS WILL AUTO-STOW AND THEN REDEPLOY ON THE SUBSEQUENT TOUCHDOWN. IF THE REVERSERS HAVE FULLY DEPLOYED AND REVERSE THRUST HAS BEEN INCREASED ABOVE IDLE PRIOR TO THE SKIP, REVERSE (OR FORWARD) THRUST WILL NOT BE AVAILABLE DURING THE SUBSEQUENT ROLLOUT UNLESS THE THROTTLES ARE AT OR RETURNED TO IDLE PRIOR TO ATTEMPTING THRUST INCREASE.
- IF LANDING WITH A SINGLE REVERSER ON A SLIPPERY RUNWAY OR WITH NOSE WHEEL STEERING INOPERATIVE, REDUCE THRUST TO IDLE BY 70 KIAS.

6. Thrust Reversers - IDLE BY 60 KIAS.
   Use of reverse thrust below 60 KIAS increases the possibility of foreign object damage to the engines.

LANDING (WITHOUT USE OF THRUST REVERSERS)

Touchdown, preceded by a slight flare, should occur on the main wheels. Check thrust at idle and extend the speed brakes while lowering the nosewheel. With the nose wheel on the runway, braking should be commenced according to runway length available to reduce brake wear. Apply smooth, gradually increasing pressure until a comfortable turn off speed is reached. If maximum braking performance is desired, do not modulate brake pedals. The antiskid system is most effective with continuous brake pedal pressure.

NOTE

Antiskid system "dropout" occurs at approximately 10 knots where braking reverts to straight power brake mode.

ALL ENGINE GO-AROUND

1. Go-Around Button - PRESS.

NOTE

The flight director go-around mode is recommended to establish the climb pitch attitude reference. Pressing the throttle mounted go-around button disengages the autopilot, if on, and engages the flight director to wings level, +10 degrees pitch up go-around mode.

2. Throttles - TO/MCT.
3. Airplane Pitch Attitude - POSITIVE ROTATION TO +10° (go around pitch command) or AS REQUIRED.

NOTE

If the landing gear is retracted before the flaps reach 15°, the landing gear warning will sound briefly.

4. Flaps - 15° (or 5° if 15° flap landing).
5. Landing Gear (Positive Climb and Flaps $\leq$15°) - UP.
6. Flaps - AS REQUIRED.
7. Climb Speed - AS REQUIRED.
8. Throttles - AS REQUIRED.

AFTER LANDING

1. Thrust Reversers - STOW.
   Do not advance throttles from idle until the thrust reverser UNLOCK lights are out.
2. Speed Brakes - RETRACTED (0%).
3. Flaps/Slats - UP/AS REQUIRED.

NOTE

When landing/taxiing in slush/ice, leave flaps at 15° until post flight inspection of slats, flaps and wing trailing edge.

4. Radar - OFF.
   The weight-on-wheels (squat) switch will prevent the radar from transmitting on the ground, however, it is better practice not to taxi into parking with the radar on.
5. Transponder - STANDBY.
6. PITOT/STATIC Anti-Ice - OFF.
7. Anti-Ice Systems - ENGINES - AS REQUIRED; SLAT and STABILIZER - OFF.

NOTE

In humid conditions the windshield anti-ice may be left on for external defogging, however, it should not be left on for an extended period of time because of reduced cooling of the controllers on the ground. Observe ground operating limitations.

(Continued Next Page)

AFTER LANDING (Continued)

8. Exterior Lights - AS REQUIRED.
   The anti-collision lights are extremely bright and should be turned OFF when clear of the runway, in consideration of other airplanes and ground personnel, if not otherwise required.

NOTE

If taxiing with one engine shutdown or one generator off, the DC POWER XTIE switch must be selected to CLSD.

9. APU - AS DESIRED.

SHUTDOWN

1. Parking Brake - SET.
   Pressing both brake pedals down and pulling up on the parking brake T-handle located at the aft end of the center pedestal will set the parking brakes. Recharge the hydraulic accumulator by momentarily operating the “A” AUX Hydraulic Pump. Do not leave the airplane unattended without chocks or the parking brake set.

NOTE

If the brakes are very hot do not set the parking brakes.

2. Anti-Ice Systems - ALL OFF.
3. Throttles - CUTOFF.
   When ITT has stabilized, place throttles to cutoff.

NOTE

The ENGINE FAIL and GEN FAIL red CAS messages may be momentarily displayed during normal engine shutdown if both engines are shut down in rapid succession.

4. IRS Mode Control Knobs (if installed) - OFF (allow 10 seconds before turning off STBY PWR).
5. Passenger Advisory Lights - OFF.
6. Standby Gyro - CAGED.
   The standby gyro is caged by pulling the knob and rotating it clockwise.
7. STBY PWR - OFF.
8. AVIONICS POWER/EICAS - OFF.
9. EMERG LT - OFF.
10. GRVTY XFLOW Switch - OFF.
11. APU - OFF. Refer to Normal Procedures, APU SHUTDOWN.
12. Exterior Lights - OFF.
13. BATT 1 and BATT 2 Switches - OFF.

NOTE

- If the brakes are hot, release the parking brake after wheel chocks are in place.
- If ambient temperature is below 0°C, refer to Normal Procedures, EXTREME COLD WEATHER OPERATIONS.

(Continued Next Page)

ALL ENGINE GO-AROUND

1. Go-Around Button - PRESS.

NOTE

The flight director go-around mode is recommended to establish the climb pitch attitude reference. Pressing the throttle mounted go-around button disengages the autopilot, if on, and engages the flight director to wings level, +13 degrees pitch up go-around mode.

2. Throttles - TO/MCT.
3. Airplane Pitch Attitude - POSITIVE ROTATION TO +10° initially. When target airspeed is achieved, increase pitch to +13° or AS REQUIRED.

NOTE

If the landing gear is retracted before the flaps reach 15°, the landing gear warning will sound briefly.

4. Flaps - 15° (or 5° if 15° flap landing).
5. Landing Gear (Positive Climb and Flaps ≤15°) - UP.
6. Flaps - AS REQUIRED.
7. Climb Speed - AS REQUIRED.
8. Throttles - AS REQUIRED.

AFTER LANDING

1. Thrust Reversers - STOW.
   Do not advance throttles from idle until the thrust reverser UNLOCK lights are out.
2. Speed Brakes - RETRACT.
3. Flaps/Slats - UP.

NOTE

When landing/taxiing in slush/ice, leave flaps at 15° until post flight inspection of slats, flaps and wing trailing edge.

4. Radar - OFF.
   The weight-on-wheels (squat) switch will prevent the radar from transmitting on the ground, however, it is better practice not to taxi into parking with the radar on.
5. Transponder - STANDBY.
6. PITOT/STATIC Anti-Ice - OFF.
7. Anti-Ice Systems - ENGINES - AS REQUIRED; SLAT and STABILIZER - OFF.

NOTE

In humid conditions the windshield anti-ice may be left on for external defogging, however, it should not be left on for an extended period of time because of reduced cooling of the controllers on the ground. Observe ground operating limitations.

(Continued Next Page)

AFTER LANDING (Continued)

8. Exterior Lights - AS REQUIRED.
   The anti-collision lights are extremely bright and should be turned OFF when clear of the runway, in consideration of other airplanes and ground personnel, if not otherwise required.

NOTE

If taxiing with one engine shutdown or one generator off, the DC POWER XTIE switch must be selected to CLSD.

9. APU - AS DESIRED.

SHUTDOWN

1. Parking Brake - SET.
   Pressing both brake pedals down and pulling up on the parking brake T-handle located at the aft end of the center pedestal will set the parking brakes. Recharge the hydraulic accumulator by momentarily operating the “A” AUX Hydraulic Pump. Do not leave the airplane unattended without chocks or the parking brake set.

NOTE

If the brakes are very hot do not set the parking brakes.

2. Anti-Ice Systems - ALL OFF.
3. Throttles - CUTOFF.
   When ITT has stabilized, place throttles to cutoff.

NOTE

The ENGINE FAIL and GEN FAIL red CAS messages may be momentarily displayed during normal engine shutdown if both engines are shut down in rapid succession.

4. IRS Mode Control Knobs (if installed) - OFF (allow 10 seconds before turning off STBY PWR).
5. Passenger Advisory Lights - OFF.
6. Standby Gyro - CAGED.
   The standby gyro is caged by pulling the knob and rotating it clockwise.
7. STBY PWR - OFF.
8. AVIONICS POWER/EICAS - OFF.
9. EMERG LT - OFF.
10. GRVTY XFLOW Switch - OFF.
11. APU - OFF. Refer to Normal Procedures, APU SHUTDOWN.
12. Exterior Lights - OFF.
13. BATT 1 and BATT 2 Switches - OFF.

NOTE

- If the brakes are hot, release the parking brake after wheel chocks are in place.
- If ambient temperature is below 0°C, refer to Normal Procedures, EXTREME COLD WEATHER OPERATIONS.

(Continued Next Page)

SHUTDOWN (Continued)

For quick deplaning at night, either battery switch may remain ON to make available all cabin lighting until passengers and cabin baggage are disembarked. Turning the ANTI-ICE WING INSP light switch on provides additional illumination in front of the cabin door. An illuminated two-position courtesy light switch located on the forward door post is wired to the hot battery bus and turns on the emergency exit lights, which can be used for entry and exit.

When securing the airplane, install the engine covers and pitot tube covers. Check the battery, passenger advisory and courtesy light switches are OFF. Closing the door extinguishes the integral courtesy light. All doors and the nose compartment can be key locked. A locking pin can be installed in the internal emergency exit door handle to prevent access from the outside. This pin must be removed prior to flight. In conditions of blowing or drifting snow, install engine covers after shutdown as soon as the engines have cooled.

To preclude possible oxygen loss due to leakage through the oxygen masks, it is recommended that the crew oxygen masks be unplugged between flights.

SHUTDOWN (QUICK TURN)

1. Parking Brake - SET.
2. APU - START. Refer to Normal Procedures, APU GROUND OR IN-FLIGHT START.

CAUTION

THE APU IS NOT APPROVED FOR UNATTENDED GROUND OPERATION.

3. Anti-Ice Systems - OFF.
4. Throttles - CUTOFF.
5. DC POWER BUS 1/XTIE/DC POWER BUS 2 - VERIFY NORM/CLSD/NORM.
6. Passenger Advisory Lights - OFF.
7. Exterior Lights - AS REQUIRED.
8. Return to Normal Procedures, BEFORE START.

APU GROUND OR IN-FLIGHT START

1. BATT 1 AND BATT 2 Switches - ON.
2. DC POWER BUS 1 AND BUS 2 Switches - NORM.
3. LH FUEL BOOST Switch - NORM.

NOTE

If the APU will be left operating on the ground for an extended period with fuel in the center tank, select the LH CTR WING XFER switch to NORM to minimize fuel imbalance. The APU can be fed from the right wing by selecting crossfeed from the right tank and selecting the left boost pump OFF.

4. APU STARTER DISENGAGE Switch - NORMAL.
5. APU MASTER Switch - ON.
6. APU TEST - PUSH.
7. APU GENERATOR Switch - ON.
8. APU BLEED AIR Switch - OFF.
9. APU DC VOLTS - CHECK (22 volts minimum).

(Continued Next Page)

APU GROUND OR IN-FLIGHT START (Continued)

10. APU - START.

NOTE

Hold APU START switch up until APU RELAY ENGAGED light illuminates. Up to 5 seconds may be required to enable start logic.

11. APU RELAY ENGAGED Light - ON, then OFF before READY TO LOAD light ON.
12. READY TO LOAD Light - ON.
13. GPU - DISCONNECT/CLEAR (if used).
14. APU Ammeter - CHECK (300 amps maximum/ground; 200 amps maximum in flight).

NOTE

The APU generator will not come on line if the right engine generator is on line.

15. DC Power XTIE Switch - CLSD (on ground and left generator is off).
16. APU BLEED AIR Switch - ON (for engine start); AS REQUIRED (for PAC bleed).

APU SHUTDOWN

1. APU START Switch - STOP.
2. APU BLEED AIR Switch - OFF.
3. READY TO LOAD Light - OFF.
4. APU MASTER Switch - OFF.

TURBULENT AIR PENETRATION

Flight through severe turbulence should be avoided if possible. The following procedures are recommended for flight in severe turbulence.

1. Maximum airspeed 300 KIAS or .90 MACH, whichever is less. Do not chase airspeed.
2. Maintain a constant attitude without chasing the altitude. Avoid sudden large control movements.
3. If Autopilot is on - ALTITUDE HOLD, DISENGAGE.
4. Passenger Advisory Lights - PASS SAFETY.

ADVERSE FIELD CONDITIONS

All flight manual field length data assumes a dry, hard surface runway except where otherwise noted. Precipitation-covered runway conditions will degrade braking effectiveness and will require significantly greater actual takeoff abort and landing field lengths.

Considerations for landing on a precipitation-covered runway are similar to those for short field operations where velocity and speed are minimized and maximum roll out distance is made available. Runway composition, condition and construction, the amount of precipitation and the depth of main landing gear tire tread remaining affect the magnitude of braking degradation, so it is impossible to apply a fixed factor to cover all conditions. Please refer to the FAA Approved Airplane Flight Manual, Section VII, Advisory Information, for data that will permit estimation of the minimum runway required under various precipitation-covered runway conditions. Again, maximizing roll out runway available and touching down at minimum safe speed will provide the greatest possible margin.

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ADVERSE FIELD CONDITIONS (Continued)

With precipitation cover on the runway, braking should be very judicious. If runway length permits, delay braking slightly until some aerodynamic deceleration has taken place. Under normal braking conditions, the antiskid system is very effective in preventing skids and producing minimum stopping distances. However, on a precipitation-covered runway, the phenomena of hydroplaning may greatly reduce the antiskid effectiveness due to the possibility of the airplane wheels not rotating up to a speed equal to the airplane ground speed. With 180 PSI main gear tire inflation the minimum dynamic hydroplaning initiating ground speed may occur at speeds above approximately 94 knots.

Since ground speed is the critical factor, landing on precipitation-covered runways with any tailwind component should be avoided. Good tread depth tends to relieve hydrodynamic pressure under the tire on wet runways, and inflation is important because a low tire pressure lowers the minimum hydroplaning speed. Anticipated operation on precipitation-covered runways dictates close monitoring of tire condition and pressure.

Use of the thrust reversers on precipitation-covered runways is the same as that for a landing on a normal or dry runway. Cockpit visibility is not hampered by blowing rain, snow or ice thrown forward by the thrust reverser. Single engine reversing during crosswind landings on precipitation-covered runways should be used with discretion.

After landing on ice or slush, a complete check of the airplane, including overboard vents and control surfaces, should be conducted.

WHEEL FUSIBLE PLUG CONSIDERATIONS

Brake application reduces the speed of an airplane by means of friction between the brake stack components. The friction generates heat, which increases the temperature of the brakes and wheel assembly, resulting in an increased tire pressure. Each main wheel incorporates fuse plugs, which melt at a predetermined temperature, to prevent a possible tire explosion due to excessively high tire pressure. Flight crews must take precautions when conducting repetitive traffic circuits, including multiple landings/or multiple rejected takeoffs, to prevent overheating the brakes, which could melt the fuse plug and cause loss of all tire pressure and possible tire and wheel damage. During such operations, available runway permitting, minimize brake usage, and consider cooling the brakes in flight with the landing gear extended. Maximizing use of reverse thrust and extending speed brakes will assist in bringing the airplane to a stop.

DATA FOR WET, SLUSH, SNOW AND ICE COVERED RUNWAYS

The most accurate and practical guidance material available for adverse runway operations is found in the FAA Approved Airplane Flight Manual, Section VII, Advisory Information. This advisory information is not FAA approved.

BUDDY START PROCEDURE

In situations where additional air pressure from another airplane is needed in the STARTING ENGINES procedure, a Buddy Start system can be used. Only the Buddy Start Hose (P/N 0043-0028-1) manufactured by Kaiser Electroprecision is recommended for the Buddy Start procedure.

1. BEFORE START procedure - COMPLETE.
2. Both donor and starting airplanes should be situated within the 60-foot length of the Buddy Start Hose so that the quick-disconnect couplings can be secured and exhaust blast minimized.
3. Connect the Buddy Start Hose to the ground air start nipple on both airplanes.

CAUTION

WHEN CONNECTING OR DISCONNECTING THE BUDDY START HOSE TO EITHER AIRPLANE WITH AN ENGINE OR APU RUNNING, ENSURE THAT ALL BLEED AIR SOURCES ARE TURNED OFF (L ENG BLD AIR AND R ENG BLD AIR SWITCHES - OFF ON MODEL 750).

4. CKPT PAC and CAB PAC switches - OFF.
5. APU BLEED AIR MAX COOL switch - OFF.
6. PAC off and APU valves closed on donor airplane.
7. Start the donor airplane normally and maintain 55% N_1 according to STARTING SECOND ENGINE: CROSS BLEED METHOD in this section.
8. The starting airplane should follow the remaining STARTING ENGINES sequence in this section.
9. Disconnect Buddy Start Hose from both airplanes.

WARNING

THE BUDDY START HOSE CONNECTIONS AND NOZZLE HANDLES WILL BE HOT. ALWAYS USE PROTECTIVE CLOTHING AND GLOVES BEFORE HANDLING THE CONNECTIONS.

NOTE

Donor airplanes other than the Model 750 may be used, but manufacturer’s procedures for engine starting must be followed. The operator should determine the proper bleed configuration and engine speed to provide a minimum receiving aircraft motoring N_2 of 30%.

FUEL ANTI-ICE ADDITIVES

Fuel anti-ice additives are not required for fuel system ice protection; however, fuel anti-ice additives control bacteria and fungi. The anti-ice additives EGME (MIL-I-27686)/DIEGME (MIL-I-85470) have shown, through service experience, that they provide acceptable protection from microorganisms such as bacteria and fungi that can rapidly multiply and cause serious corrosion in tanks and may block filters, screens and fuel metering equipment. If used, the concentration should be 0.10 to 0.15% by volume. BIOFOR JF, in concentrations not to exceed 270 PPM, is also approved for the control of microorganisms. A corrosion/lubricity additive found in qualified Product List of MIL-I-25017 may also be used.

PROCEDURE FOR ADDING FUEL ANTI-ICING ADDITIVE

For single point refueling, anti-ice additive must be preblended or mixed at the fuel truck.

When the airplane is being refueled through the over wing ports, use the following procedure to blendanti-icing additive to nontreated fuel:

1. Attach additive to refuel nozzle, making sure blender tube discharges in the refueling stream.

2. Start refueling (minimum 30 gallons per minute, maximum 60 gallons per minute) while simultaneously fully depressing and slipping ring over trigger of blender (rate of less than 30 gallons per minute may be used when "topping off").

WARNING

ANTI-ICING ADDITIVES CONTAINING ETHYLENE GLYCOL MONOMETHYL ETHER (EGME) ARE HARMFUL IF INHALED, SWALLOWED OR ABSORBED THROUGH THE SKIN, AND WILL CAUSE EYE IRRITATION. IT IS ALSO COMBUSTIBLE. BEFORE USING THIS MATERIAL, REFER TO ALL SAFETY INFORMATION ON THE CONTAINER.

CAUTION

- DIETHYLENE GLYCOL MONOMETHYL ETHER (DIEGME) IS SLIGHTLY TOXIC IF SWALLOWED AND MAY CAUSE EYE REDNESS, SWELLING AND IRRITATION. IT IS ALSO COMBUSTIBLE. BEFORE USING THIS MATERIAL, REFER TO ALL SAFETY INFORMATION ON THE CONTAINER.

- ASSURE THE ADDITIVE IS DIRECTED INTO THE FLOWING FUEL STREAM WITH THE ADDITIVE FLOW STARTED AFTER THE FUEL FLOW STARTS AND IS STOPPED BEFORE FUEL FLOW STOPS. DO NOT ALLOW CONCENTRATED ADDITIVE TO CONTACT COATED INTERIOR OF FUEL TANK OR AIRPLANE PAINTED SURFACE.

- USE NOT LESS THAN 20 FLUID OUNCES OF ADDITIVE PER 156 GALLONS OF FUEL OR MORE THAN 20 FLUID OUNCES OF ADDITIVE PER 104 GALLONS OF FUEL.

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FUEL ANTI-ICE ADDITIVES (Continued)

PROCEDURE FOR CHECKING FUEL ADDITIVES

Prolonged storage of the airplane will result in a water buildup in the fuel which "leaches out" the additive. An indication of this is when an excessive amount of water accumulates in the fuel tank sumps. The concentration of additive can be checked using an anti-icing additive concentration test kit available from Cessna Aircraft Company, Citation Marketing Division, Wichita, KS 67277. It is imperative that the instructions for the test kit be followed explicitly when checking the additive concentration. The concentrations by volume for EGME/DIEGME shall be 0.10 percent minimum and 0.15 percent maximum, either individually or mixed in a common tank. Fuel, when added to the tank, should have a minimum concentration of 0.10 percent by volume.

ENGINE ANTI-ICE

The importance of proper system use cannot be overemphasized as serious engine damage can result from ice ingestion. Engine anti-ice function is preventative in nature and flight into visible moisture with a ram air temperature of below +10°C should be anticipated so that the system is operational when icing conditions are encountered. Even though the engine compressor section will not ice, due to inlet temperature rise, turning the engine anti-ice on after ice has accumulated could conceivably result in ice from the inboard wing leading edge being freed and ingested by the engine. Ice will normally form on the fan spinner, the aft side of the fan blades and the fan stators. This ice will result in an audible engine vibration. When this vibration is noticed, the ice can be cleared by cycling the throttle approximately 20% N_1 a few times until the vibration clears. By design, this ice will all pass through the fan bypass duct. No engine damage will occur. It may be necessary to accomplish this engine clearing procedure at five to ten minute intervals in heavy icing conditions.

In descent, the engine anti-ice should be turned on well before entering an icing environment to ensure that sufficient time is available for all system parameters to be met.

Ice formation observed on the wing cannot be used as a valid indication of possible engine icing. The ENGINE ANTI-ICE Switch should be ON and operating any time the airplane is being operated in visible moisture at a temperature of below +10°C.

FLIGHT INTO ICING

Flight into known icing is the intentional flight into icing conditions that are known to exist by either visual observation or pilot weather report information. Icing conditions exist when indicated RAT is +10°C or below, and visible moisture in any form is present (such as clouds, fog with visibility of one mile or less, rain, snow, sleet or ice crystals). Icing conditions also exist when RAT on the ground and for takeoff is +10°C or below when operating on ramps, taxiways or runways where surface snow, ice, standing water or slush may be ingested by the engines, or freeze on the engines, nacelles, or engine sensor probes. Cessna Citations, equipped with properly operating anti-ice equipment, are approved to operate in maximum intermittent and maximum continuous icing conditions as defined by FAR 25, Appendix C, when that equipment is in operation. The equipment has not been designed or certified, to provide protection against freezing rain or severe conditions of mixed or clear ice. During all operations, the pilot is expected to exercise good judgement and be prepared to alter the flight plan, i.e., exit icing, if conditions exceed the capability of the airplane and equipment.

(Continued next page)

FLIGHT INTO ICING (Continued)

Ice accumulations significantly alter the shape of airfoils and increase the weight of the airplane. Flight with ice accumulated on the airplane will increase stall speeds and alter the speeds for optimum performance. Flight at high angle-of-attack (low airspeed) can result in ice building on the underside of the wings and the horizontal stabilizer aft of areas protected by leading edge anti-ice systems. Minimum airspeed for sustained flight in icing conditions (except approach and landing) is 200 KIAS. Prolonged flight in icing conditions with the flaps and/or landing gear extended is prohibited. Trace or light amounts of icing on the horizontal stabilizer can alter airfoil characteristics which will affect stability and control of the airplane.

Freezing rain and clear ice will be deposited in layers over the entire surface of the airplane and can "run back" over control surfaces before freezing. Rime ice is an opaque, granular and rough deposit of ice that usually forms on the leading edges of wings, tail surfaces, pylons, engine inlets antennas, etc.

EXTREME COLD WEATHER OPERATIONS

Remove EROS crew oxygen masks, if temperature will be less than -10°C, and drain all cabin fluids.

When the airplane is parked in any conditions of falling or blowing snow, regardless of temperature, the engine, APU and pitot covers should be installed. The airplane should be parked with slats and flaps retracted. Prior to flight, the airplane must be cleared of snow and if wing, empennage or control surfaces are frosted, they must be deiced. Refer to the FAA Approved Flight Manual, Section VII, DEICING PROCEDURES.

If the airplane is to be parked outside for more than a few hours at temperatures below -15°C, the following special considerations are advised:

The airplane batteries should be removed to a warm environment or battery heaters installed and connected. Below -20°C, nicad batteries may be inert and will not charge or discharge.

Hydraulic accumulators, pneumatic storage bottles, and oxygen cylinders will indicate a lower pressure because of the temperature drop. Refer to the appropriate temperature charge placards. It should be noted that hydraulic and pneumatic systems are more prone to leaks in extreme cold. A significantly lower charge may indicate a leak. Prior to preflight, the flaps should be extended to allow inspection of the wing trailing edge for hydraulic leaks.

The APU should be started as soon as possible or external power used to supply electrical and avionics power and cabin heat. The APU should start normally using external power or warm batteries provided that the airplane has not been cold soaked below -40°C. Preheating will be required if the cold soak was below -40°C. To facilitate cabin warming, select PACs to HI, PAC isolation valve OPEN and both PACs to MANUAL, full hot. APU max cool bleed may be used provided the APU does not cycle on the overtemp limit.

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EXTREME COLD WEATHER OPERATIONS (Continued)

Some electrical systems and avionics computers and displays may be slow to warm up. The glare shield auxiliary panel lighting should be turned on and allowed to reach full brightness. Cabin fluorescent lighting will also be slow to illuminate and should be turned on if its use is anticipated. The IACs may be slow to warm up and may result in slightly distorted displays. Failures of the FGC, the yaw damper, the mach trim, and the primary stabilizer trim may also occur until the computers are warmed up. LCD displays in the RMUs, aileron/rudder trim indicator, standby engine instruments and optional AOA indicators may require several minutes to reach full brightness. FMS computers may require several minutes to give accurate initial position. Typically, warmup may take 20 minutes or more.

NOTE

Dispatch is prohibited until all required avionics systems are verified to be functioning properly.

Prior to engine start, the rudder control should be cycled to ensure proper operation of the rudder standby system. Cold temperature may result in low pressure excursions and the RUD STBY SYS FAIL message. If the message is displayed, once it is verified that RSS pressure is cycling normally, the message and pressure display can be cleared by selecting the SG REV switch to SG1 (approximately 5 seconds), NORM (approximately 5 seconds), SG2 (approximately 5 seconds), and back to NORM.

NOTE

If this procedure is conducted too quickly, it will clear V-speeds if they have been set and cause both engines' FADEC to be in ADC reversionary mode. V-speeds and FADEC must be reset.

The right engine should be started first. Following right engine start, flight controls should be exercised to verify that the PTU will maintain "A" system hydraulic pressure. Following left engine start, all flight controls, slats and speed brakes should be cycled through full travel several times to verify that all controls reach full travel and operate normally. Hydraulic quantity should be monitored (EICAS) prior to takeoff to verify that no system leaks have occurred.

NOTE

Dispatch is prohibited following cold soak unless it is verified (EICAS), and visually confirmed by comparing deflection of adjacent panels, that all flight controls operate normally and that all speed brake and roll spoiler panels fully extend and retract normally. Several cycles of the controls may be required to verify proper operation.

Engine preheat is required if the engine oil temperature is below -40°C. Engine oil temperature as displayed in EICAS, is a good indicator of cold soak. Engine starts using ground or APU air should be normal except that the exhaust will smoke initially and engine oil pressure will be high. Engine oil pressure above 95 PSI is normal during cold starts. The engine may not be operated above idle until oil pressure is at or below 95 PSI. Once engine oil pressure is in normal limits, the engine may be operated above idle, but cannot exceed 40% N_1 until the engine fuel temperature is in normal limits, $\geq$4°C. This process should take only a few minutes.

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FLIGHT INTO ICING (Continued)

Ice accumulations significantly alter the shape of airfoils and increase the weight of the airplane. Flight with ice accumulated on the airplane will increase stall speeds and alter the speeds for optimum performance. Flight at high angle-of-attack (low airspeed) can result in ice building on the underside of the wings and the horizontal stabilizer aft of areas protected by leading edge anti-ice systems. Minimum airspeed for sustained flight in icing conditions (except approach and landing) is 200 KIAS. Prolonged flight in icing conditions with the flaps and/or landing gear extended is prohibited. Trace or light amounts of icing on the horizontal stabilizer can alter airfoil characteristics which will affect stability and control of the airplane.

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Remove EROS crew oxygen masks, if temperature will be less than -10°C, and drain all cabin fluids.

When the airplane is parked in any conditions of falling or blowing snow, regardless of temperature, the engine, APU and pitot covers should be installed. The airplane should be parked with slats and flaps retracted. Prior to flight, the airplane must be cleared of snow and if wing, empennage or control surfaces are frosted, they must be deiced. Refer to the FAA Approved Flight Manual, Section VII, DEICING PROCEDURES.

If the airplane is to be parked outside for more than a few hours at temperatures below -15°C, the following special considerations are advised:

The airplane batteries should be removed to a warm environment or battery heaters installed and connected. Below -20°C, nicad batteries may be inert and will not charge or discharge.

Hydraulic accumulators, pneumatic storage bottles, and oxygen cylinders will indicate a lower pressure because of the temperature drop. Refer to the appropriate temperature charge placards. It should be noted that hydraulic and pneumatic systems are more prone to leaks in extreme cold. A significantly lower charge may indicate a leak. Prior to preflight, the flaps should be extended to allow inspection of the wing trailing edge for hydraulic leaks.

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EXTREME COLD WEATHER OPERATIONS (Continued)

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Dispatch is prohibited until all required avionics systems are verified to be functioning properly.

Prior to engine start, the rudder control should be cycled to ensure proper operation of the rudder standby system. Cold temperature may result in low pressure excursions and the RUD STBY SYS FAIL message. If the message is displayed, once it is verified that RSS pressure is cycling normally, the message and pressure display can be cleared by selecting the SG REV switch to SG1 (approximately 5 seconds), NORM (approximately 5 seconds), SG2 (approximately 5 seconds), and back to NORM.

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The right engine should be started first. Following right engine start, flight controls should be exercised to verify that the PTU will maintain "A" system hydraulic pressure. Following left engine start, all flight controls, slats and speed brakes should be cycled through full travel several times to verify that all controls reach full travel and operate normally. Hydraulic quantity should be monitored (EICAS) prior to takeoff to verify that no system leaks have occurred.

NOTE

Dispatch is prohibited following cold soak unless it is verified (EICAS), and visually confirmed by comparing deflection of adjacent panels, that all flight controls operate normally and that all speed brake and roll spoiler panels fully extend and retract normally. Several cycles of the controls may be required to verify proper operation.

Engine preheat is required if the engine oil temperature is below -40°C. Engine oil temperature as displayed in EICAS, is a good indicator of cold soak. Engine starts using ground or APU air should be normal except that the exhaust will smoke initially and engine oil pressure will be high. Engine oil pressure above 90 PSI is normal during cold starts. The engine may not be operated above idle until oil pressure is at or below 90 PSI. Once engine oil pressure is in normal limits, the engine may be operated above idle, but cannot exceed 40% N_1 until the engine fuel temperature is in normal limits, $\geq$4°C. This process should take only a few minutes.

EXTREME COLD WEATHER OPERATIONS (Continued)

Fuel tank temperature limits for the type of fuel being used must be observed. Refer to Operating Limitations, FUEL LIMITATIONS.

NOTE

> If tank fuel temperature is below -31°C, engine fuel temperature may fall below 4°C when power is increased for takeoff. Make a static run to about 60% N_1 to allow the engine oil temperature to increase and engine fuel temperature to return to normal limits prior to takeoff.

When fuel tank temperature is lower than approximately -30°C, engine fuel temperatures may briefly fall below 4°C (with accompanying FUEL TEMP L-R message) when takeoff thrust is applied. Engine fuel temperature of 4°C or above at takeoff thrust must be obtained prior to initiating the takeoff roll. When fuel temperature is cold, failure of sump drains to drain may indicate the presence of frozen water in the sump.

PASSENGER COMFORT

When parked during daylight in hot weather, it is suggested that the cabin window shades be closed to reduce solar heat transfer. An optional exterior windshield cover performs the same function for the cockpit and is very effective. To circulate cool air in the interior, either engine or the onboard auxiliary power unit may be started, the isolation valve opened and the CKPT and CAB PAC switches positioned to HIGH. Temperature is then controlled with the CKPT and CABIN TEMP SEL, hot/cold switches. Closing unused overhead outlets will direct airflow to the occupied seats. Increased air circulation is available by turning on the WEMAC BOOST. Operating either engine (preferably the right) above idle RPM will increase airflow and environmental control unit efficiency. Operation of the onboard auxiliary power unit will run the environmental control unit without the need to start the airplane engines.

The abbreviated checklist is designed to enable the crew to perform all prestart functions in advance. This permits items, such as the warning test, to be completed before passenger boarding, and acceleates the ramp departure without compromising safety or thoroughness.

Leaving the chocks, brake checks can be done lightly and smoothly. If heavy braking is required on landing roll, the use of a minimum amount of nose down control pressure counters the apparent nose down pitching moment so that deceleration feel in the cabin is less abrupt. Back pressure, however, which could result in raising the airplane nose and/or increase the possibility of a blown tire, is not recommended.

The pressurization system procedures outlined in this chapter may at first appear complex, but thorough understanding of the controller and indicators coupled with minimal practical experience greatly simplifies operation. Optimum system performance in terms of passenger comfort is best achieved by slow, smooth selection of altitudes and rates and reducing the variables when setting the controller by not making power changes simultaneously. Lightweight takeoffs and/or rolling takeoffs in cold ambient conditions may cause pressurization oscillations (bumps) as the airplane lifts off because the cabin did not have sufficient time to pre-pressurize. Cabin pressure oscillations can be prevented by taking the time to allow the pre-pressurization to begin before the brakes are released. This procedure will allow the cabin to correctly pre-pressurize prior to lift off and will provide a smooth transition to pressurized flight.

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PASSENGER COMFORT (Continued)

Power management has an impact on cabin comfort and changes should be made smoothly and symmetrically. An approximate estimate of synchronization can be made by observing the RPM gages and exact adjustments made with the engine synchronizer. Although the higher pitched turbine sound is generally more noticeable in the cockpit, the lower pitched, fan out-of-synchronization condition is usually more prevalent in the area of the rear seats.

Good crew coordination and smooth operation of the controls and systems serves the best interests of safety, economy and passenger comfort.

NAVIGATION/COMMUNICATION

Distance Measuring Equipment (DME) ground speed or time to station readouts are only accurate when the airplane is proceeding directly to or from the selected station. Since it is slant range that is computed, ground speed or time to station accuracy increases with distance from the station. The GSPD readouts on the primary flight displays (PFDs) can be considered reasonably close to actual speed when distance from the station in miles is equal to or greater than the airplane altitude in thousands of feet.

For proper system operation the long range navigation system (flight management systems - FMSs) require operation of the distance measuring equipment sets (DMEs). The DMEs are normally in operation any time electrical power is on the airplane and the system self-tests have been satisfactorily completed, however, failure of a DME set can affect the calculations of its respective FMS, since DME/DME function is the method of choice, when available, for the FMS to use in its position calculations. Caution should be exercised when very high frequency omnidirectional radio range (VOR) navigation is desired. When a long range navigation system (FMS 1 or FMS 2) is selected on the SC-840 source controller, electronic horizontal situation indicator (EHSI) and electronic attitude director indicator (EADI) azimuth information (if programmed) will be FMS course data. Always check the GC-810 Flight Guidance Controller in APR for VOR or instrument landing system (ILS) approaches.

When tuning the automatic direction finder (ADF), identification is best received when ANT (antenna) function is selected. Relative bearing information is available only when ADF function is selected. When ADF is not required for navigation, select ANT to eliminate excessive radio magnetic indicator (RMI) needle seeking.

During ground operation, radio transmissions can be blocked by surrounding terrain or structures. This may possibly be overcome by using the other COMM, because of airplane antenna location. The COMM 1 antenna is on top of the fuselage and the COMM 2 antenna is on the bottom. Flying through dry precipitation, it is possible for static electricity to build-up to cause very high frequency communication systems to automatically squelch to a point where reception range is greatly reduced. Disabling the squelch by depressing the SQ button on the RMU bezel will cause background static in the speaker or headset, but normal reception range will be restored. If the headset microphone fails to function properly, check the appropriate instrument subpanel MIC SEL switch in the HEAD SET position.

GROUND DEICE/ANTI-ICE OPERATIONS

During cold weather operations, flight crews are responsible for ensuring the aircraft is free of ice contaminants.

Ground icing may occur whenever there is high humidity with temperatures of +10°C or colder. Type I deice, and Type II or Type IV anti-ice fluids may be used sequentially to ensure compliance with FAA regulations (clean wing concept) requiring critical component airframe deicing and anti-icing.

NOTE

It is recommended that flight crews refamiliarize themselves seasonally with the following publications for expanded deice and anti-ice procedures:

- Cessna Maintenance Manual Chapter 12.
- FAA Advisory Circular AC 120-58 (large aircraft), dated September 30, 1992 or later.
- FAA Advisory Circular AC 135-17 (small aircraft), dated December 14, 1994 or later.
- Cessna Citation Service Letter SL750-30-03, dated May 5, 1998, or later.

DEICING/ANTI-ICING PROCEDURES (TYPE I, TYPE II, AND TYPE IV FLUIDS)

ONE STEP DEICING - Type I fluid is used to remove ice, slush and snow from the airplane prior to departure, and to provide minimal anti-icing protection, as provided in the Type I holdover timetable (refer to applicable service letter).

TWO STEP DEICE/ANTI-ICE - May be used to ensure the airplane remains clean after deicing. Type II or Type IV fluid is used to provide longer term anti-icing protection, as provided in the Type II or Type IV holdover timetable (refer to applicable service letter).

CAUTION

TYPE I, TYPE II, AND TYPE IV FLUIDS ARE NOT COMPATIBLE AND MAY NOT BE MIXED. ADDITIONALLY, MOST MANUFACTURERS PROHIBIT MIXING OF BRANDS WITHIN A TYPE.

Line personnel should be supervised by the PIC or SIC to ensure proper application of deice or anti-ice, fluids. Refer to Figures 4-5 and 4-6.

NOTE

The first area to be deiced/anti-iced should be easily visible from the cabin/cockpit and should be used to provide a conservative estimate for unseen areas of the airplane before initiating takeoff roll.

(Continued Next Page)

DEICING/ANTI-ICING PROCEDURES (TYPE I, TYPE II, AND TYPE IV FLUIDS) (Continued)

Holdover timetables (refer to applicable service letter) are only estimates and vary depending on many factors which include temperature, precipitation type, wind and airplane skin temperature. Holdover times are based on mixture ratio. Times start when the last application begins.

Guidelines for holdover times anticipated by SAE Type I, Type II, or Type IV, and ISO Type I, Type II, or TYPE IV fluid mixtures are a function of weather conditions and outside air temperature (OAT).

CAUTION

- AIRPLANE OPERATORS ARE SOLELY RESPONSIBLE FOR ENSURING HOLDOVER TIMETABLES CONTAIN CURRENT DATA.
- TABLES ARE FOR USE IN DEPARTURE PLANNING ONLY AND THEY SHOULD BE USED IN CONJUNCTION WITH PRETAKEOFF CONTAMINATION CHECK PROCEDURES.

NOTE

- Tables do not apply to other than SAE or ISO Type I, Type II or Type IV FPD fluids.
- The responsibility for the application of this data remains with the user.
- The freezing point of Type I, Type II, and Type IV fluid mixture must be at least 10°C (18°F) below the current OAT.

SPRAYING TECHNIQUE - TYPE I FLUID

Type I fluid should be sprayed on the airplane (with engines off) in a manner which minimizes heat loss to the air. If possible, fluid should be sprayed in a solid cone pattern of large coarse droplets at a temperature of 160° to 180°F. The fluid should be sprayed as close as possible to the airplane surfaces, but not closer than 10 feet if a high pressure nozzle is used. Refer to Figures 4-5 and 4-6 for essential areas to be deiced and anti-iced.

SPRAYING TECHNIQUE - TYPE II FLUID

Application techniques for Type II fluid are the same as for Type I, except that since the airplane is already clean, the application should last only long enough to properly coat the airplane surfaces. Refer to Figures 4-5 and 4-6 for essential areas to be deiced/anti-iced.

Type II, fluid should be applied cold to a "clean" airplane. It is, however, sometimes heated and sprayed as a deicing fluid. For this case, it should be considered a Type I fluid, as the heat may change the characteristics of the thickening agents in the fluid. Type II fluid, therefore, applied in this manner, will not be as effective as if it were applied cold.

(Continued Next Page)

DEICING/ANTI-ICING PROCEDURES (TYPE I, TYPE II, AND TYPE IV FLUIDS) (Continued)

SPRAYING TECHNIQUE - TYPE IV FLUID

Application techniques for Type IV fluid are the same as for Type I, except that since the airplane is already clean, the application should last only long enough to properly coat the airplane surfaces. Refer to Figures 4-5 and 4-6 for essential areas to be deiced/anti-iced.

Type IV, fluid should be applied cold to a "clean" airplane. It is, however, sometimes heated and sprayed as a deicing fluid. For this case, it should be considered a Type I fluid, as the heat may change the characteristics of the thickening agents in the fluid. Type IV fluid, therefore, applied in this manner, will not be as effective as if it were applied cold.

NOTE

- Holdover time starts when last application has begun.
- Some Type IV fluids could form a thick or high-strength gell during "dry-out" and when rehydrated form a slippery film.
- Some Type IV fluids exhibit poor aerodynamic elimination (flow-off) qualities at colder temperatures.
- Heated areas of aircraft (i.e.; heated leading edge) should be avoided due to the fact that fluid may "dry-out" into hard globular nodules.
- Type IV fluid should not be used undiluted below -24°C (-11°F).

PRETAKEOFF CONTAMINATION CHECK - GROUND ICING CONDITIONS

When ground icing conditions are present, a pretakeoff contamination check should be conducted by the PIC/SIC within 5 minutes prior to takeoff, preferably just prior to taxiing onto the active runway. Critical areas of the airplane such as empennage, wing, windshield and control surfaces should be checked to ensure they are free of ice, slush and snow or that the deice/anti-ice fluids are still protecting the airplane.

AIRPLANE DEICING

MINIMUM DIRECT SPRAY AREAS:	ENGINE INLETS AND EXHAUSTS, ENGINE PYLON, RAM AIR INLETS, BRAKES, PITOT HEADS, STATIC PORTS, WINDSHIELD, CABIN WINDOWS, AND AOA VANES.

NOTE: SHADED AREAS INDICATE ESSENTIAL AREAS TO BE DEICED.

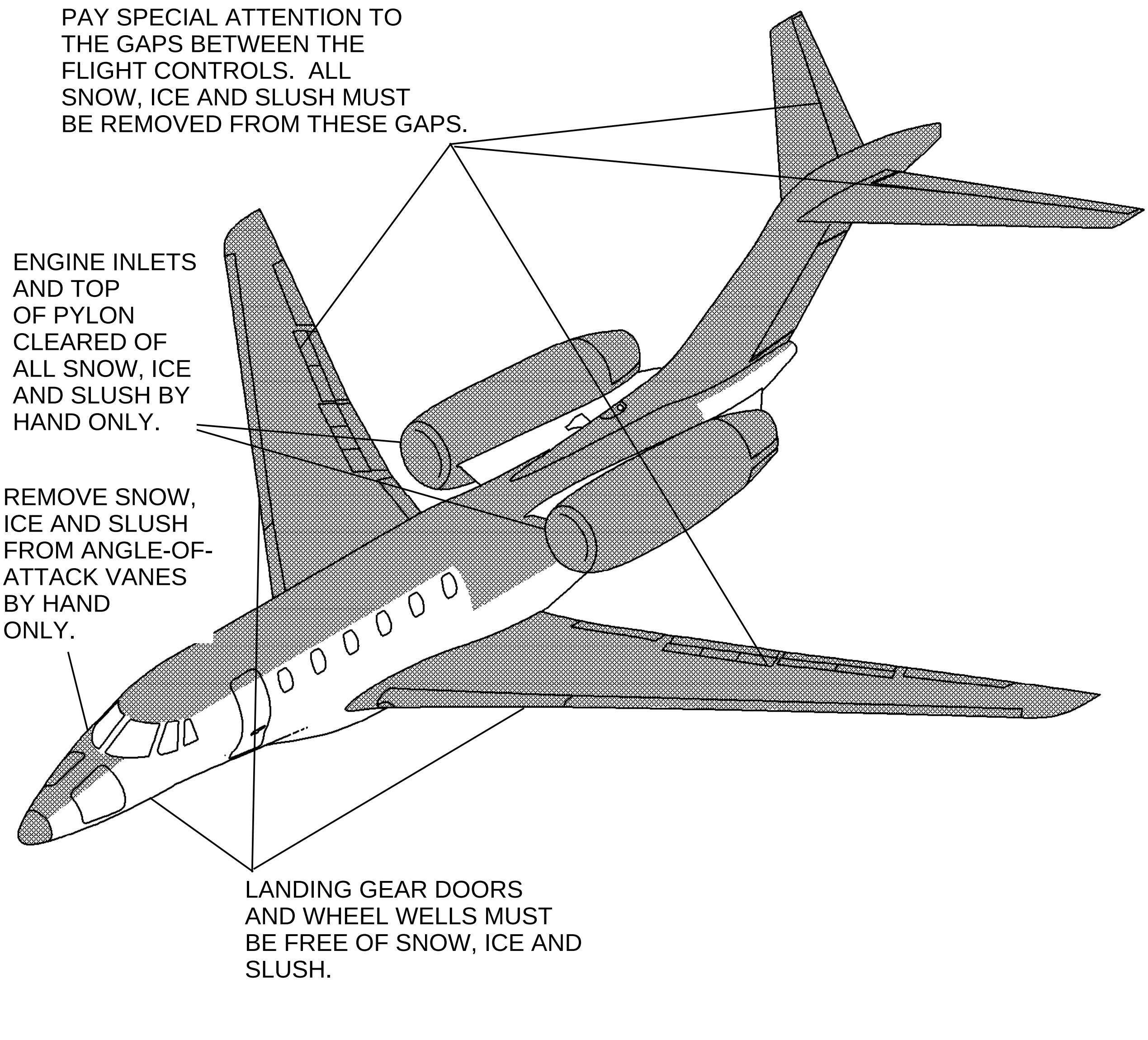

Figure 4-5

AIRPLANE ANTI-ICING

MINIMUM DIRECT SPRAY AREAS:	ENGINE INLETS AND EXHAUSTS, ENGINE PYLON, RAM AIR INLETS, BRAKES, PITOT HEADS, STATIC PORTS, WINDSHIELD, CABIN WINDOWS, AND AOA VANES.

NOTE: THE SHADED AREAS INDICATE AREAS WHERE ANTI-ICE FLUID IS APPLIED. UPPER FUSELAGE IS ANTI-ICED TO PRECLUDE ICE FORMATION WHICH COULD BE INGESTED INTO ENGINE INLETS.

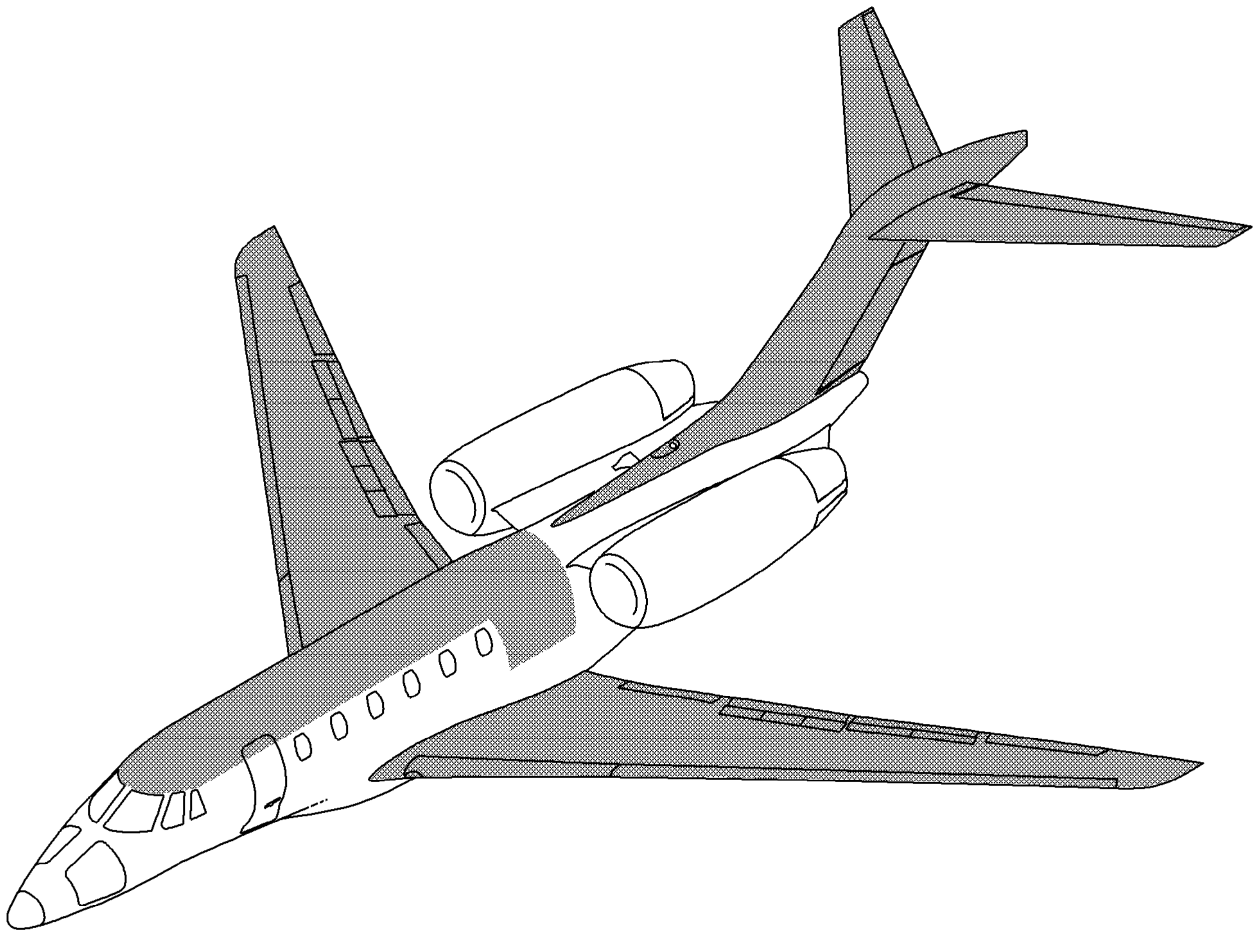

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Figure 4-6

SERVICING

FUEL

A variety of fuels can be used in the airplane. The approved fuels are: Jet A, Jet A-1, JET B, NO. 3 (GB6537-94), JP-4 (NATO F40), JP-5 (NATO F43 or F44), and JP-8 (NATO F34 or F35).

The use of anti-ice additive in the Model 750 airplane is required if fuel tank temperature below -35°C is anticipated. Although the use of anti-ice additive is not, therefore, in all cases required it has been demonstrated by operational experience that the approved anti-ice additive is biocidal, controlling micro-organisms of bacteria and fungi, and that its use on a continuing basis is beneficial. Airplanes being serviced with fuel without anti-ice additive on a continual basis should have a program established for controlling micro-organisms of bacteria and fungi; refer to Airplane Maintenance Manual, Chapter 12, for servicing.

Fueling is accomplished through a single point pressure refueling receptacle on the right side of the fuselage, just forward of the wing leading edge. It may also be accomplished over the wing through refueling ports in the top of each wing. It will necessarily be accomplished over the wing if anti-icing inhibitor must be added to the fuel while fueling. When overwing refueling is being performed, fuel must be introduced through both left and right wing fuel fillers. The right fuel filler is utilized to refuel the center wing fuel tank via a control handle operated center wing refuel valve. The center wing refuel valve handle is located under an access door on the lower surface of the fuselage fairing. With the center wing refuel valve open (control handle pulled downward), the center wing fuel tank will be refueled by gravity flow during refueling of the right wing fuel tank only. The handle operated center wing refuel valve must be closed prior to flight to prevent gravity flow from the right tank to center wing.

To control micro-organisms in the fuel tanks if not using fuel premixed with anti-ice additive, start refueling while simultaneously applying the fuel additive. Assure that additive is directed into the flowing fuel stream for proper mixing. Additive flow should be started after fuel flow begins and stopped before fuel flow ends. Do not allow concentrated additive to contact coated interior of fuel tank or airplane painted surfaces. Follow the instructions concerning the minimum and maximum amount of anti-ice additive under “Procedure for Checking Fuel Additive” in this section. Insufficient additive concentrations may result in the growth of damaging micro-organisms in the fuel system. Excessive additive may cause fuel tank damage or erroneous fuel quantity indications.

When refueling, do not operate radios, radar or other electronic equipment, and ensure the fuel truck and the airplane are both grounded, and that a bond wire is connected to the airplane from the truck. A fuel ground plug attachment point is located on the lower surface of each wing adjacent to the fuel filler cap.

It is not necessary to maintain fuel balance during refueling. Maximum intentional asymmetric fuel differential for flight is 400 pounds; however, the airplane can accommodate as much as 800 pounds differential in an in-flight emergency, for return to landing.

Operation of the onboard auxiliary power unit (APU) is permitted during refueling. Unmonitored operation of the APU is not authorized.

ENGINE OIL

An oil quantity sight gage is located on the rear of the oil tank located on the lower right side of each engine. Access to the gage and to the oil tank is through a small door on the lower cowl. The oil quantity may also be checked by means of the EICAS system, if electrical power is on the airplane. It is possible to service the oil through the access door, but to prevent spillage it may be preferable to open or remove the cowling.

WARNING

PERSONS WHO HANDLE ENGINE OIL ARE ADVISED TO MINIMIZE SKIN CONTACT WITH USED OIL, AND PROMPTLY REMOVE ANY USED OIL FROM THEIR SKIN. A LABORATORY STUDY, WHILE NOT CONCLUSIVE, FOUND SUBSTANCES WHICH MAY CAUSE CANCER IN HUMANS. THOROUGHLY WASH USED OIL OFF SKIN AS SOON AS POSSIBLE WITH SOAP AND WATER. DO NOT USE KEROSENE, THINNERS OR SOLVENTS TO REMOVE USED ENGINE OIL. IF WATERLESS HAND CLEANER IS USED, ALWAYS APPLY SKIN CREAM AFTER USING.

NOTE

The AE-3007C engine will perform best on MIL-L-23699D type oil. Use of MIL-L-7808K type oil should be limited to only those times when operating in extreme cold without preheat capability (-40°C to -54°C or -40°F to -65°F) or when MIL-L-7808K is the only available oil.

The engines must be serviced with only the approved oils listed in Section One (Limitations) of this manual. The type oil used in each airplane is noted in the engine logbook as well as on a placard inside the filler access door.

CAUTION

- DO NOT MIX MIL-L-23699D AND MIL-L-7808K TYPES OF OIL.
- IF BRANDS OF OIL ARE CHANGED, IT SHOULD BE ACCOMPLISHED GRADUALLY USING THE “TOP OFF” METHOD.

The On Board Auxiliary Power Unit has a sight glass, located on the right side of the unit, for checking the oil level. The sight glass is accessed by opening a small door located on the lower right side of tailcone. Full service is indicated by a ball floating within a red circle inside the round sight window. A larger access door on the left side of the tail cone, approximately opposite the sight glass door, is used to gain access for servicing the oil. The On Board Auxiliary Power Units are serviced with MIL-L-23699D type oil. Oils meeting this description are: Mobil Jet Oil II (Type II), Exxon/Esso 2380 Turbo Oil (Type II), and Castrol 5000 (Type II). Oils that are of a different type should not be mixed with MIL-L-23699D type oil.

The two Environmental Control Unit Assemblies (ECUs) are mounted in tandem in the lower tailcone. They are equipped with two sight glasses and two filler plugs, one for each Environmental Control Unit package. The sight glasses and filler plugs are located on the lower side, but are not readily accessible for flight crew inspection. Access is gained by lowering the door located at the bottom aft center of the tailcone below and aft of the baggage compartment.

HYDRAULIC

Servicing the hydraulic reservoir requires equipment capable of delivering hydraulic fluid under pressure (an external hydraulic service unit), or it may be serviced by a hand pump through a quarter-inch flareless fitting, which is located at the lower front of the hydraulic service panel. Servicing is normally performed by maintenance personnel. The reservoir should only be serviced with the fluid listed in Section One (Operating Limitations) of this manual or in the Limitations Section of the FAA Approved Airplane Flight Manual.

OXYGEN

The oxygen filler valve is located inside the right door in the nose compartment. Oxygen servicing should be done by maintenance personnel using only the approved breathing oxygen listed in Section One (Operating Limitations) of this manual. Reference the cockpit gage while servicing to prevent overfill.

Oxygen pressure will vary with ambient temperature. In very cold ambient temperatures the oxygen pressure indication may appear low, but may in actuality be appropriate for the temperature condition.

NOTE

Refer to Chapter 12 of the Airplane Maintenance Manual, Oxygen Fill Pressure for Various Fahrenheit Temperatures Table.

FIRE BOTTLES

Underserviced fire bottles must be exchanged by authorized maintenance facilities. There is no gage to check fire bottle service; low bottle service is indicated by illumination of the cyan FIRE BOTTL LOW L-R and FIR BOTTL LOW - APU digital annunciator on the EICAS display.

LANDING GEAR AND BRAKE PNEUMATIC SYSTEM

The emergency landing gear and brake bottles should be serviced with dry nitrogen according to the pressure/temperature chart affixed to the left forward nose avionics compartment door. Servicing is accomplished through charging valves which are located in the nose avionics compartment on the left side of the forward pressure bulkhead and on the left side of the forward section of the nose avionics compartment. Temperature has an effect on indicated pressure of the bottle. After cold soak at altitude, the indicated pressure may be low. Allow storage bottles to warm to ambient hangar temperature before servicing.

TIRES

The main gear tire pressures should be maintained at 180 ±5 PSIG with the airplane on the jacks. A four percent increase should be allowed for if the airplane is on the ground. The nose gear tire pressures should be maintained at 130 ±5 PSIG with the airplane on the jacks. A four percent increase should also be allowed for if the airplane is on the ground.

Since tire pressure will decrease as the temperature drops, a slight overinflation can be used to compensate for cold weather. Main and nose tires inflated at 70°F (21°C) should be overinflated 1.0 percent for each 5°F (3°C) drop in temperature anticipated at the coldest airport of operation. Conversely, if higher temperatures are anticipated main and nose tires inflated at 70°F (21°C) may be underinflated 1.0 percent for each 5°F (3°C) rise in temperature anticipated at the warmest airport of operation.

EXTERNALLY SERVICEABLE TOILET

The externally serviceable toilet may be commercially serviced by means of a toilet ground service cart, such as that manufactured by Tronair of Holland Ohio. Servicing the toilet is accomplished through the service port located low on the right side of the aft fuselage, just aft of the battery compartment door. The service port has connections for draining and removing waste and for charging the system with water and required chemicals.

To correctly service the toilet refer to the “Servicing Toilet” checklist in Chapter 12 of the Airplane Maintenance Manual. A list of suggested chemicals and servicing equipment is also included in Chapter 12. The toilet should be serviced during routine ground maintenance of the airplane following any usage. It is more convenient and efficient to service the toilet on a regular basis than to wait until the tank is filled to capacity.

To ensure operation of the toilet recirculation system during freezing weather, ethylene glycol base anti-freeze containing an anti-foam agent may be added to the flush fluid.

AIRPLANE CLEANING AND CARE

PAINTED SURFACE

The exterior of a new airplane is painted with a polyurethane two-component topcoat which, unlike early coatings, does not require exposure to air for complete cure to occur. the care required by the finish will not change as the paint ages.

The finish should be cleaned only by washing with clean water and mild soap, followed by rinse water and drying with a soft cloth or chamois.

Minimize flying through rain, hail or sleet.

To help prevent development of corrosion, particularly filiform corrosion, the airplane should be spray-washed at least every two or three weeks (especially in warm, damp, and salty environments) and waxed with a good grade of water repellent wax to help keep water from accumulating in skin joints and around countersinks. A heavier coating of wax on the leading edge, on the vertical tail and on the engine nose cones help reduce abrasions encountered in these areas.

Polyurethane topcoats are designed with UV inhibitors to slow the degradation caused by exposure. The inhibitors concentrate near the surface of the coating during the initial stages of cure. Care must be taken during any buffing, polishing, or power waxing so that this surface layer is disturbed only to the smallest extent necessary. With special care, however, buffing, polishing or power waxing is acceptable. Wax products containing silicones should be avoided as they contribute to the buildup of P-static, especially if the surface is well buffed to produce a shine.

ENGINES

The engine compartments should be cleaned using a suitable solvent. Most efficient cleaning is done using a spray-type cleaner. Before spray cleaning, ensure protection is afforded for components which might be adversely affected by the solvent. Refer to the Airplane Maintenance Manual for proper lubrication of components after engine cleaning.

INTERIOR CARE

To remove dust and loose dirt from the upholstery, headliner and carpet, clean the interior regularly with a vacuum cleaner.

Blot up any spilled liquid promptly with cleansing tissue or rags. Don't pat the spot; press the blotting material firmly and hold it for several seconds. Continue blotting until no more liquid is taken up. Scrape off sticky materials with a dull knife, then spot-clean the area.

Oily spots may be cleaned with household spot removers, used sparingly. Before using any solvent, read the instructions on the container and test it on an obscure place on the fabric to be cleaned. Never saturate the fabric with a volatile solvent; it may damage the padding and backing materials.

WARNING

- **USE ALL CLEANING AGENTS IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.**
- **THE USE OF TOXIC OR FLAMMABLE CLEANING AGENTS IS DISCOURAGED. IF THESE CLEANING AGENTS ARE USED, ENSURE ADEQUATE VENTILATION IS PROVIDED TO PREVENT HARM TO THE USER AND/OR DAMAGE TO THE AIRPLANE.**

Soiled upholstery and carpet may be cleaned with normal cleaning materials, used according to the manufacturer's instructions. To ensure that the cleaning materials or chemicals will not harm the fabric or leather to be cleaned, test it on a hidden part of the material to be cleaned before proceeding.

The plastic trim, instrument panel and control knobs need only be wiped with a damp cloth. Oil and grease on the control wheel and control knobs can be removed with a cloth moistened with kerosene. Volatile solvents, such as mentioned in paragraphs on care of the windshield, must never be used since they soften and craze the acrylic.

WINDOWS AND WINDSHIELDS

The glass windshields and forward (fixed) cockpit side windows, and the acrylic aft (openable) cockpit windows, and the cabin windows should be kept clean at all times. Recommended products and materials for washing and protecting the windows and windshields are listed in Chapter Twelve of the Airplane Maintenance Manual. The acrylic windows should be kept waxed with a coat of good quality commercial wax. Do not wax or polish the windshield and forward cockpit side windows. To prevent scratches wash the the windshield and windows carefully with plenty of mild soap and water, using the palm of the hand to feel and dislodge dirt and mud. A soft cloth, chamois, or sponge may be used, but only to carry water to the surface. Rinse the glass windshields and forward windows thoroughly, then dry with a clean, moist chamois. Rubbing the surface of the acrylic cockpit and cabin windows with a dry cloth builds up an electrostatic charge which attracts dust particles in the air. For that reason, after the acrylic windows are washed, they should be allowed to air dry.

(Continued Next Page)

WINDOWS AND WINDSHIELDS (Continued)

Remove oil and grease with a cloth lightly moistened with kerosene. Never use gasoline, benzine, acetone, carbon tetrachloride, fire extinguisher fluid, lacquer thinner or glass cleaner. These materials will soften the plastic of the windows and may cause it to craze. Strong chemicals and abrasives should not be used on the windshields and cockpit side windows. They can scratch and otherwise damage the repellent surface.

After removing dirt and grease, if the plastic side window surface is not badly scratched, it should be waxed with a good grade of commercial wax. The wax will fill in minor scratches and help prevent further scratching. Apply a thin, even coat of wax and bring it to a high polish by rubbing lightly with a clean, dry soft flannel cloth. Do not use a power buffer; the heat generated by the buffing pad may soften the acrylic, and circular streaks can cause glare rings.

Do not use a canvas cover on the windshield unless freezing rain or sleet is anticipated. Canvas covers may scratch the repellent coating on the surface.

OXYGEN MASKS

The crew masks are permanent-type masks which contain a microphone for radio transmissions. The passenger masks are oral-nasal type which forms around the mouth and nose area. All masks can be cleaned with alcohol. Do not allow solution to enter microphone or electrical connections. Apply talcum powder to external surfaces of passenger mask rubber face-piece.

SECTION V

ABNORMAL PROCEDURES

CONTENTS

(Continued Next Page)

ABNORMAL PROCEDURES (Not Specific To CAS Messages) (Continued)

FLIGHT GUIDANCE (Continued)

HYDRAULICS/BRAKES

ABNORMAL LANDING

ABNORMAL PROCEDURES

For clarity, the following Abnormal Procedures are listed by system rather than with respect to a particular CAS or Primus message. They will normally be accompanied by one or more CAS or Primus messages and aural warnings. Procedures for specific CAS and Primus messages are listed separately and grouped by color.

■ ENGINE FAILURE/PRECAUTIONARY SHUTDOWN

NOTE

- This procedure may also be used for intentional training shutdown.
- Intentional training shutdown should be left engine inoperative to retain both hydraulic systems operating. The engine should be allowed to stabilize at least one minute at idle prior to shutdown.

1. AP/TRIM/NWS Disengage Button - PRESS.
2. Throttle (operating engine) - CLIMB DETENT (or as required).
3. Rudder and Aileron Trim - AS REQUIRED.
4. Airspeed - MAINTAIN (as required).
5. Throttle (affected engine) - CONFIRM, then CUTOFF.
6. Electrical Load - REDUCE as required.
7. TCAS - TA only.
8. PAC ISOL VALVE - OPEN (for improved ventilation).
9. Autopilot - AS DESIRED.
10. FUEL CROSSFEED - AS REQUIRED.
11. Land as soon as practical. Refer to Abnormal Procedures, INFLIGHT RESTART or SINGLE-ENGINE APPROACH AND LANDING.

- **IF IN ICING CONDITIONS**

1. WING X-OVER ANTI-ICE Switch - WING X-OVER.
2. Leave icing conditions as soon as possible.

Procedure completed

■ IN-FLIGHT RESTART (NORMAL OR REVERSIONARY MODE) - ONE ENGINE (Refer to Figure 5-1 for Airstart Envelope)

- **WITH STARTER ASSIST**

1. Throttle (affected engine) - CUTOFF.

NOTE

Throttle must be placed to cutoff to reset FADECs.

2. ENGINE FIRE Switch - CHECK OPEN (HYD F/W SHUTOFF and FUEL F/W SHUTOFF messages extinguished).
3. IGNITION - NORM.
4. FUEL BOOST - NORM.
5. PAC ISOL VALVE - OPEN or APU - ON/BLEED AIR - ON.
6. ENGINE, SLAT and STABILIZER Anti-ice - OFF, for start.

CAUTION

DO NOT ATTEMPT TO RESTART AN ENGINE IF IT IS POSSIBLE THAT ICE HAS FORMED IN THE ENGINE OR ENGINE INLET. SIGNIFICANT DAMAGE TO THE ENGINE CAN OCCUR.

(Continued Next Page)

IN-FLIGHT RESTART (NORMAL OR REVERSIONARY MODE) - ONE ENGINE (Refer to Figure 5-1 for Airstart Envelope) (Continued)

7. Opposite Engine - ADJUST, ITT 800°C or lower, for start.

CAUTION

EXCEPT IN AN EMERGENCY, DO NOT ATTEMPT A STARTER ASSISTED AIRSTART WITH THE OPPOSITE ENGINE ABOVE THE CLIMB DETENT. OPERATING ENGINE ITT MAY EXCEED LIMITS.

NOTE

- With anti-ice off, the opposite engine will normally provide enough bleed air start pressure at idle for a satisfactory start. If at low airspeed, high altitude, and the engine being started appears to not accelerate, increase the opposite engine approximately 10% N_2 above idle. Start time will be shorter if the operating engine N_2 is above 80% RPM.
- APU bleed pressure is satisfactory for engine start, ($\geq$ 25 PSI).
- During engine start, cabin pressure will momentarily decrease.
- Residual ITTs below 150°C increase the probability of successful starter assisted airstarts.

8. ENGINE START Button (affected engine) - PRESS momentarily if N_2 is $\leq$25% RPM.

CAUTION

STARTER ENGAGEMENT ABOVE 25% N_2 RPM MAY SHEAR THE AIR TURBINE STARTER DRIVE SHAFT.

9. Throttle (affected engine) - IDLE at approximately 10% N_2 RPM.

NOTE

Move the throttle to idle at 10% N_2 RPM. Do not allow N_2 to peak or stabilize prior to moving the throttle to idle. A lower (windmilling start) fuel schedule would be selected by the FADECs and the engine may not start.

10. Engine Instruments - MONITOR.
11. PAC ISOL VALVE - CLOSE.
12. Anti-Ice - AS REQUIRED.

NOTE

The engine start procedure is the same with the engine FADECs in reversionary mode.

(Continued Next Page)

IN-FLIGHT RESTART (NORMAL OR REVERSIONARY MODE) - ONE ENGINE (Refer to Figure 5-1 for Engine Airstart Envelope) (Continued)

● ENGINE WINDMILLING (10% N_2 RPM MINIMUM)

1. Throttle (affected engine) - CUTOFF.

NOTE

- Throttle must be placed to cutoff to reset FADECs.
- If N_2 is less than 10%, selecting the respective hydraulic pump switch to UNLOAD and increasing airspeed to 250 KIAS should result in a 10% N_2 windmill speed. Below 8000 feet MSL, start may be initiated as low as 240 KIAS if N_2 has not decreased below 10% RPM.
- Engine acceleration during windmilling airstarts will be considerably slower than during starter assisted starts, particularly at the low airspeed end of the start envelope. If N_2 is accelerating and ITT is within limits, allow the start to continue. ITT fluctuations from 500°C to 700°C during the start are normal.
- Starter assist airstarts must be used when stabilized N_2 RPM is below 10%.
- Do not attempt to engage the starter after initiating a windmilling start. This could prevent a successful start. If starter assist is needed, return the throttle to CUTOFF, then press the start button (below 25% N_2) and then advance the throttle to idle.

2. HYDRAULIC PUMP Switch (affected engine) - UNLOAD (if turbine speed is less than 10% N_2).
3. ENG FIRE Switch - CHECK OPEN (HYD F/W SHUTOFF and FUEL F/W SHUTOFF message extinguished).
4. IGNITION (affected engine) - NORM.
5. FUEL BOOST (affected engine) - NORM.
6. Throttle (affected engine) - IDLE at a minimum 10% N_2 RPM.
7. Engine Instruments - MONITOR (888°C ITT limit for windmilling start).
8. FUEL BOOST (affected engine) - OFF, then NORM after engine stabilizes at idle.

Procedure Completed

☐ IF ENGINE DOES NOT START

1. Throttle (affected engine) - CUTOFF.
2. FADEC Select Switch - SELECT OPPOSITE FADEC.
3. Throttle (affected engine) - IDLE at a minimum 10% N_2 RPM.
4. Engine Instruments - MONITOR (888°C ITT limit for windmilling start).
5. FUEL BOOST (affected engine) - OFF, then NORM after engine stabilizes at idle.

Procedure Completed

ENGINE AIRSTART ENVELOPE

NOTE

- Engine windmilling airstart requires a minimum turbine speed of 10% turbine RPM (N_2), otherwise starter assist is required.
- APU and/or opposite engine bleed air can be used for engine starts at or below FL250.
- Residual ITTs below 150°C increase the probability of successful starter assisted airstart.

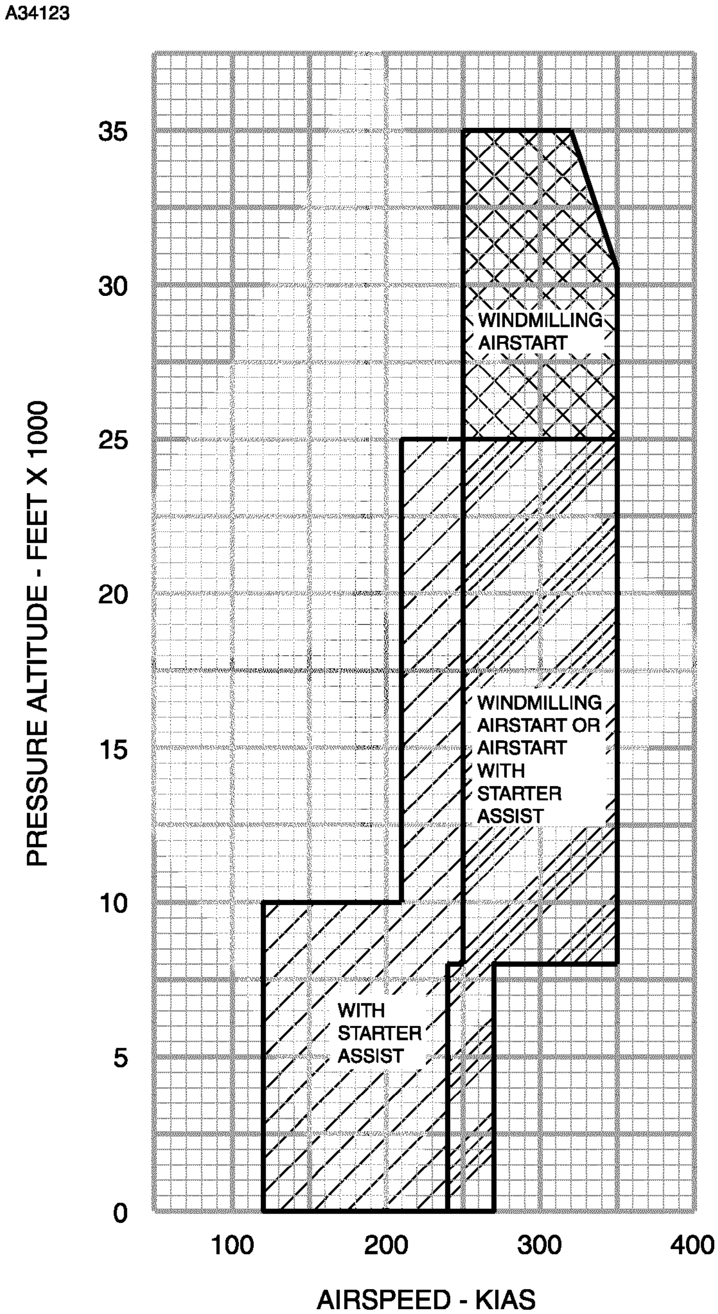

Figure 5-1

■ ENGINE START MALFUNCTION

1. Throttle (affected engine) - CUTOFF.
2. ENGINE START DISENGAGE Button - PRESS 15 seconds after throttle cutoff.

CAUTION

DO NOT ATTEMPT TO REENGAGE THE AIR TURBINE STARTER ABOVE 25% N_2. DOING SO MAY SHEAR THE STARTER DRIVE SHAFT.

■ HIGH ENGINE ITT

● DURING START OR GROUND SHUTDOWN

1. Throttle (affected engine) - CUTOFF.
2. ENGINE START Button (if start valve is not open) - PRESS momentarily if BELOW 25% N_2 RPM. (Requires bleed air from APU, ground cart, or opposite engine, PAC ISOL VALVE open if using opposite engine).

CAUTION

DO NOT ATTEMPT TO REENGAGE THE AIR TURBINE STARTER ABOVE 25% N_2. DOING SO MAY SHEAR THE STARTER DRIVE SHAFT.

3. ENGINE START DISENGAGE Button - PRESS after ITT returns to normal.

Procedure completed

● ENGINE RUNNING

1. Throttle (affected engine) - RETARD.

□ IF ITT CANNOT BE REDUCED

1. Throttle (affected engine) - CUTOFF.
2. Refer to Abnormal Procedures, ENGINE FAILURE/PRECAUTIONARY SHUTDOWN.

Procedure completed

■ N_1 OR N_2 OVERSPEED

1. Throttle (affected engine) - REDUCE.

● IF N_1 OR N_2 CANNOT BE CONTROLLED

1. Throttle (affected engine) - CUTOFF.
2. Refer to Abnormal Procedures, ENGINE FAILURE/PRECAUTIONARY SHUTDOWN.

NOTE

The FADEC will automatically shut the engine down at 105% N_1 or 105.6% N_2.

Procedure completed

■ THRUST REVERSER UNLOCK LIGHT ON IN FLIGHT (NO OTHER INDICATION OF DEPLOYMENT)

1. Stow Switch (affected thrust reverser) - EMER.
2. Thrust Reverser Levers - CHECK STOWED (down position).
3. Land as soon as practical. Refer to Normal Procedures, BEFORE LANDING.

Procedure completed

■ THRUST REVERSER ARM LIGHT ON IN FLIGHT

1. Thrust Reverser Levers - CHECK STOWED (down position).
2. STOW Switch (affected thrust reverser) - VERIFY NORM.

● **IF LIGHT REMAINS ILLUMINATED**

1. STOW Switch (affected thrust reverser) - EMER.

Procedure completed

● **IF T/R AUTOSTOW L-R AMBER CAS MESSAGE IS ON**

1. Throttle (affected engine) - IDLE, then NORMAL OPERATION.

NOTE

Affected throttle must be reduced to idle to reset the FADEC to regain normal throttle operation.

2. Land as soon as practical. Refer to Normal Procedures, BEFORE LANDING.

Procedure completed

■ OIL PRESSURE LOW LEFT OR RIGHT (NO CAS MESSAGE)

● **BELOW 34 PSI (NO OTHER EVIDENCE OF A PROBLEM EXISTS, OIL QUANTITY OR OIL TEMPERATURE)**

1. Land as soon as practical.

Procedure completed

● **BETWEEN 34 AND 49 PSI (SUSTAINED)**

1. Throttle (affected engine) - REDUCE, N_2 88% RPM.
2. Land as soon as practical.

Procedure completed

NOTE

Oil pressure in the transient (amber) range from 34 to 49 PSI is normal during ground idle, and in flight for a short period following reduction from high thrust to idle.

■ OIL PRESSURE HIGH (>90 PSI)

NOTE

Oil pressure above 90 PSI is normal following engine start in cold conditions, until the engine has warmed up. Refer to Normal Procedures, EXTREME COLD WEATHER OPERATIONS.

1. Throttle (affected engine) - RETARD to maintain oil pressure at or below 90 PSI.

● **IF THE INDICATION RESPONDS BUT PRESSURE IS ABOVE 90 PSI AT IDLE**

2. Monitor Oil Temperature and Quantity (EICAS ENG page for quantity).

☐ **IF OIL TEMPERATURE IS NORMAL AND QUANTITY DOES NOT DECREASE**

1. Throttle (affected engine) - AS REQUIRED, normal operations.
2. Land as soon as practical.

Procedure completed

■ OIL PRESSURE HIGH (>90 PSI) (Continued)

☐ **IF OIL TEMPERATURE INCREASES OR QUANTITY DECREASES**

1. Consider shutting the engine down to conserve oil for a later restart. Refer to Abnormal Procedures, ENGINE FAILURE/PRECAUTIONARY SHUTDOWN.
2. Land as soon as practical.

Procedure completed

■ OIL TEMPERATURE HIGH (>127°C)

1. Thrust - REDUCE.
2. Engine Parameters - MONITOR (fuel temperature, oil pressure and quantity).

Procedure completed

■ APU FAILS TO START

1. APU Master Switch - OFF.
2. APU Circuit Breakers (3) - RESET.
3. APU - ATTEMPT START AGAIN (refer to Normal Procedures).

NOTE

Observe APU start/cycle limitations.

Procedure completed

■ APU RELAY STUCK (APU RELAY ENGAGED LIGHT STAYS ON)

NOTE

The APU RELAY ENGAGED light will be on during APU start and will extinguish when the start is complete; then the READY TO LOAD light will illuminate. The APU RELAY ENGAGED light will illuminate again when the APU generator is on.

1. APU START Switch - STOP.
2. APU MASTER Switch - OFF.

Procedure completed

■ APU FAIL (APU FAIL ANNUNCIATOR ILLUMINATED)

Indicates failure of APU self-test or automatic shutdown. APU will not start.

● **ON GROUND**

1. APU Compartment - INSPECT prior to next start attempt.
2. APU MASTER Switch - OFF.
3. APU Circuit Breakers (3) - RESET.
4. APU MASTER Switch - ON.

☐ **IF APU FAIL ANNUNCIATOR STILL ILLUMINATED**

1. APU Master Switch- OFF.

Procedure completed

(Continued Next Page)

■ APU FAIL (APU FAIL ANNUNCIATOR ILLUMINATED) (Continued)

☐ **IF APU FAIL ANNUNCIATOR IS NOT ILLUMINATED**

1. APU - START. Refer to Normal Procedures.

Procedure completed

● **IN FLIGHT**

1. APU MASTER Switch - OFF.
2. Do not attempt APU start.

Procedure completed

■ OVERPRESSURIZATION

1. Pressurization MANUAL/NORM Switch - MANUAL.
2. UP-DOWN Manual Control - UP.
3. Manual RATE Control - INCREASE as required.

Procedure completed

● **STILL OVERPRESSURIZED**

1. CKPT or CABIN PAC Switch - OFF.
2. Engine Power - REDUCE as required (on side with operating PAC).
3. PAC BLEED SELECT Switch - SELECT LP.

Procedure completed

☐ **IF UNABLE TO CONTROL**

1. Oxygen Masks - DON and 100%.
2. Oxygen Microphone Switches - MIC OXY MASK.
3. Wheel Interphone Microphone Switches - INPH.
4. PASS OXY Switch - ON (assure passengers are receiving oxygen).
5. CABIN DUMP Switch - LIFT RED COVER/CABIN DUMP.
6. Remaining PAC Switch - OFF.
7. Descend as required. Consider minimum safe altitude, and oxygen duration.

Procedure completed

■ COCKPIT FORWARD OR SIDE WINDSHIELD CRACKED OR SHATTERED

1. Cabin Pressurization - ALT SEL/SET CABIN ALTITUDE TO 9500 FEET.
2. Altitude - AS REQUIRED.

NOTE

- If cabin altitude is above approximately 8500 feet, the CABIN ALTITUDE amber CAS message will illuminate. No action is required.
- Descend to the lowest practical altitude consistent with fuel range requirements; 41,000 feet or lower is recommended.
- Either windshield ply is structurally capable of maintaining cabin pressure.
- Refer to Operating Limitations, CRACKED WINDSHIELD.

(Continued Next Page)

■ COCKPIT FORWARD OR SIDE WINDSHIELD CRACKED OR SHATTERED (Continued)

3. Oxygen Masks - ONE PILOT (minimum) DON OXYGEN MASK (set regulator to normal).
4. Remain clear of or leave icing conditions.

Procedure completed

● IF EITHER FORWARD WINDSHIELD CRACKED/SHATTERED

1. WINDSHIELD ANTI-ICE - BOTH SWITCHES OFF.
2. Land as soon as practical.

Procedure completed

● IF A SIDE WINDSHIELD CRACKED/SHATTERED

1. WINDSHIELD ANTI-ICE - TURN OPPOSITE SWITCH OFF.
2. Land as soon as practical.

Procedure completed

■ COCKPIT/CABIN TEMPERATURE CONTROL INOPERATIVE

1. Affected PAC Temperature Select Switch - SELECT MANUAL.
2. Temperature - CONTROL MANUALLY.

Procedure Completed

● IF STILL UNABLE TO CONTROL

1. Affected PAC Switch - OFF (if required for comfort).
2. Altitude - FL410 Maximum (if one PAC off).
3. WEMAC Boost - ON.
4. PAC ISOL VALVE - OPEN.
5. Land as soon as practical.

Procedure completed

● IF BOTH PACs FAILED - COLD

1. Coldest PAC - OFF (if required for comfort).
2. Altitude - FL410 MAXIMUM (if one PAC off).
3. PAC ISOL VALVE - OPEN.
4. Land as soon as practical.

Procedure completed

● IF BOTH PACs FAILED - HOT

1. Hottest PAC (CKPT if equal) - OFF (if required for comfort).
2. Altitude - FL410 MAXIMUM (if one PAC off).
3. PAC ISOL VALVE - OPEN.
4. Operating PAC - HIGH.
5. WEMAC Boost - ON.
6. WEMACs - CLOSE UNNECESSARY CABIN WEMACS.
7. Land as soon as practical.

Procedure completed

■ PRESSURIZATION FAULT CONTROL LIGHT ILLUMINATED

Indicates the controller normal pressurization mode has faulted and automatically switched to manual mode, probably due to loss of MADC (Micro Air Data Computer) reference.

1. Pressurization - CONTROL MANUALLY (use Cabin Altitude UP/DN switch and Manual Rate Control as required).
2. Pressurization MANUAL/NORMAL Switch - MANUAL (to match controller mode).

Procedure completed

■ AILERON TRIM INOPERATIVE/RUNAWAY

1. AP/TRIM/NWS Disengage Button - PRESS (to turn autopilot off).
2. Either Control Wheel - APPLY OPPOSITE ROLL INPUT.
3. Rudder - TRIM as required for 1/2 ball sideslip to reduce roll control forces.
4. FUEL CROSSFEED - AS REQUIRED.

NOTE

If time permits, crossfeed to create a fuel imbalance, up to 400 lbs., to assist in reducing roll control forces.

5. Land as soon as practical. Refer to Normal Procedures, APPROACH AND LANDING.

Procedure completed

■ RUDDER TRIM INOPERATIVE/RUNAWAY

1. AP/TRIM/NWS Disengage Button - PRESS (to turn autopilot off).
2. Rudder - APPLY OPPOSING CONTROL INPUT as required.
3. Aileron - APPLY OPPOSING CONTROL INPUT and TRIM as required.
4. FUEL CROSSFEED - AS REQUIRED.

NOTE

If time permits, crossfeed to attain a fuel imbalance, up to 400 lbs, to assist in reducing roll forces.

5. Land as soon as practical. Refer to Normal Procedures, APPROACH AND LANDING.

Procedure completed

■ UPPER RUDDER JAM/HARDOVER

1. Directional Control - MAINTAIN.
2. EICAS - CTRL POS, CHECK UPPER POSITION.
3. Upper Yaw Damper - SELECT OPPOSITE CHANNEL A/B.

● **IF STILL NOT CENTERED**

   1. Upper Rudder A and B Circuit Breakers - PULL.
   2. Airspeed - 250 KIAS MAXIMUM.
   3. Altitude - 41,000 FEET MAXIMUM.
   4. Lower Rudder - TRIM as required.
   5. Land as soon as practical. Refer to Normal Procedures, APPROACH AND LANDING.

NOTE

The upper rudder functions as a yaw damper only with flaps retracted.

■ LOWER RUDDER JAM

1. AP/TRIM/NWS Disengage Button - PRESS (to turn autopilot off).
2. Rudder Flight Control Shutoff Switch - PRESS.
3. Altitude - 41,000 FEET MAXIMUM.
4. Airspeed - MINIMUM 0.75 MACH until reaching 31,000 feet.

NOTE

- Shutting off the rudder PCU pressure should reduce the amount of rudder travel unless the PCU itself is jammed.
- Do not exceed flaps 15° for approach and landing.
- Select a wide and dry runway if available.
- Maximum crosswind component is 10 knots.

BEFORE LANDING

1. Landing Data - CONFIRM. Refer to Section IV of the Flight Manual.
   a. Airspeed - V_{APP}(Flaps 15°)/V_{REF}(Flaps 15°).
   b. Use the Normal **FLAPS 15°** Landing Distance.

CAUTION

AVOID LANDING WITH TAILWIND OR DOWNHILL RUNWAY GRADIENT.

2. Crew Briefing - COMPLETED.
3. Avionics and Flight Instruments - CHECK/SET.
4. Minimums - SET (RA/BARO).
5. FUEL CROSSFEED - OFF.
6. ENG SYNC - OFF.
7. Flaps - 15°MAXIMUM.
8. Speedbrakes - RETRACTED.
9. Passengers - BRIEF.
10. Seats/Seat Belts/Shoulder Harness/Aft Divider Sliding Doors - CHECK/ SECURE/LATCHED OPEN (if belted toilet seat is occupied).
11. Passenger Advisory Lights - PASS SAFETY.
12. IGNITION - NORM.
13. Pressurization - ZERO DIFFERENTIAL at touchdown.
14. Landing Gear - CHECK DOWN and LOCKED (3 green lights).
15. EICAS - CHECK.
16. Airspeed - V_{REF}.

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■ LOWER RUDDER JAM (Continued)

LANDING

WARNING

DO NOT USE THRUST REVERSERS ON LANDING.

1. Throttles - IDLE (pilot not flying).
2. Speed Brakes - EXTEND at touchdown (pilot not flying).
3. Elevator control - FORWARD PRESSURE at touchdown.
4. Nose Wheel Tiller - HOLD to center position.
5. Use differential braking as required.

Procedure Completed

■ LOSS OF RUDDER FEEL AND CENTERING (NORMAL RUDDER RESPONSE WITH NO RUDDER PEDAL FEEL)

1. Pilot Not Flying - Place feet on rudder pedals to provide both force resistance and artificial rudder centering.

WARNING

DO NOT ATTEMPT TO PREVENT THE MOVEMENT OF THE RUDDER PEDALS WHEN THE FLYING PILOT IS APPLYING CORRECTIVE ACTION FOR FLIGHT PATH CONTROL. APPLY FORCE SUFFICIENT ONLY TO SIMULATE NORMAL RUDDER CONTROL LOADS AND PEDAL CENTERING. EFFECTIVE CREW COORDINATION IS CRITICAL.

NOTE

Lower rudder trim will be inoperative.

2. Land as soon as practical.

- **APPROACH AND LANDING**

  1. Refer to Normal Procedures, APPROACH AND LANDING if not single-engine.

  Procedure Completed

- **SINGLE-ENGINE APPROACH AND LANDING**

  1. Refer to Abnormal Procedures, SINGLE-ENGINE APPROACH AND LANDING.

WARNING

MAINTAIN A STABILIZED 3° APPROACH AND AVOID THE NEED FOR SUDDEN POWER TRANSIENTS WHICH COULD RESULT IN PILOT INDUCED DIRECTIONAL OSCILLATIONS.

Procedure Completed

■ AILERON CONTROL FEEL AND CENTERING FAILURE

WARNING

WITH LOSS OF CENTERING, THE CONTROL WHEEL MUST BE CONSCIOUSLY RECENTERED BY THE FLYING PILOT. MAKE SMALL DELIBERATE ROLL INPUTS TO AVOID ROLL OSCILLATION. AILERON TRIM WILL BE INOPERATIVE.

1. Land as soon as practical.
2. Refer to Normal Procedures, APPROACH AND LANDING.

Procedure completed

■ UNCOMMANDED SLAT EXTENSION

1. Airspeed - REDUCE TO 250 KIAS MAXIMUM.
2. Flaps/Slats Handle - CHECK UP.
3. LH/RH Stall Warn Circuit Breakers - CYCLE ONE AT A TIME (monitor slat position).
4. If Slats Retract, Affected Stall Warn Circuit Breaker - PULL (verify slats remain retracted).

● IF SLATS REMAIN EXTENDED

1. Land as soon as practical.
2. Refer to Normal Procedures, APPROACH AND LANDING.

Procedure completed

● IF SLATS RETRACT

1. Circuit Breaker reset prior to landing.
2. Refer to Normal Procedures, APPROACH AND LANDING.

Procedure completed

■ JAMMED STABILIZER TRIM SYSTEM

● JAMMED AT +1.6° TO -2°

1. Use Flaps 15° Landing.
2. Center Fuel Quantity - TRANSFER TO LESS THAN 100 LBS.
3. Maximum Landing Weight Not To Exceed 27,000 LBS.
4. Airspeed - 150 KIAS MINIMUM.
5. Copilot - APPLY ELEVATOR FORCE TO ASSIST PILOT as required.

NOTE

If time permits, shift passengers to the aft-most seats.

(Continued Next Page)

■ JAMMED STABILIZER TRIM SYSTEM (Continued)

BEFORE LANDING

1. Landing Data - CONFIRM.
   a. V_{REF} - 150 KIAS MINIMUM.
   b. Multiply Normal **FLAPS FULL** Landing Distance by 3.1 (use a factor of 2.3 if altitude is below 7,000 feet).

CAUTION

- AVOID LANDING WITH A TAILWIND OR DOWNHILL RUNWAY GRADIENT.
- LANDING DISTANCE FACTORS OF 3.0 OR GREATER MAY REQUIRE THE USE OF A RUNWAY WITH AN ARRESTING BARRIER.

2. Crew Briefing - COMPLETE.
3. Avionics and Flight Instruments - CHECK/SET.
4. Minimums - SET (RA/BARO).
5. FUEL CROSSFEED - AS REQUIRED, then OFF.
6. ENG SYNC - OFF.
7. Flaps - APPROACH SCHEDULE.
8. Passengers - BRIEF.
9. Seats/Seat Belts/Shoulder Harnesses/Aft Divider Sliding Doors - CHECK/SECURE/LATCHED OPEN (if belted toilet seat occupied).
10. Passenger Advisory Lights - PASS SAFETY.
11. IGNITION - NORM.
12. Pressurization - ZERO DIFFERENTIAL at touchdown.
13. Landing Gear - CHECK DOWN and LOCKED (3 green lights).
14. Flaps - 15°.
15. Speed Brakes - RETRACTED.
16. EICAS - CHECK.
17. Airspeed - 150 KIAS MINIMUM.

Procedure completed

● **JAMMED AT -2° TO -4°**

1. Use Flaps 15° Landing.
2. Airspeed - 145 KIAS MINIMUM.

BEFORE LANDING

1. Landing Data - CONFIRM.
   a. V_{REF} - 145 KIAS MINIMUM.
   b. Multiply Normal **FLAPS FULL** Landing Distance by 2.7 (use a factor of 2.0 if altitude is below 7,000 feet).

CAUTION

AVOID LANDING WITH A TAILWIND OR DOWNHILL RUNWAY GRADIENT.

2. Crew Briefing - COMPLETE.
3. Avionics and Flight Instruments - CHECK/SET.
4. Minimums - SET (RA/BARO).
5. FUEL CROSSFEED - AS REQUIRED, then OFF.
6. ENG SYNC - OFF.
7. Flaps - APPROACH SCHEDULE.
8. Passengers - BRIEF.
9. Seats/Seat Belts/Shoulder Harnesses/Aft Divider Sliding Doors - CHECK/SECURE/LATCHED OPEN (if belted toilet seat occupied).
10. Passenger Advisory Lights - PASS SAFETY.

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■ JAMMED STABILIZER TRIM SYSTEM (Continued)

11. IGNITION - NORM.
12. Pressurization - ZERO DIFFERENTIAL at touchdown.
13. Landing Gear - CHECK DOWN and LOCKED (3 green lights).
14. Flaps - 15°.
15. Speed Brakes - RETRACTED.
16. EICAS - CHECK.
17. Airspeed - 145 KIAS MINIMUM.

Procedure completed

● JAMMED AT -4° TO -7°

1. Landing Data - CONFIRM, Refer to Section IV, Performance, of the FAA Approved Flight Manual.
   a. Airspeed - V_{APP}(Flaps 15°)/V_{REF}(Flaps 15°).
   b. Use the Normal **FLAPS 15°** Landing Distance.

CAUTION

AVOID LANDING WITH A TAILWIND OR DOWNHILL RUNWAY GRADIENT.

2. Refer to Normal Procedures, APPROACH and LANDING.

Procedure completed

● JAMMED AT -7° TO -12°

1. If excessive push force is present - REDUCE AIRSPEED.
2. Land as soon as practical.
3. Refer to Normal Procedures, APPROACH and LANDING.

Procedure completed

■ SPEED BRAKES FAIL TO RETRACT

1. Speed Brakes Lever - FORWARD (or adjusted to achieve zero roll if asymmetrical condition exists).
2. Land as soon as practical. (Plan a Flaps 15° landing. If enroute, consider effect on range.)

BEFORE LANDING

1. Landing Data - CONFIRM, Refer to Section IV, Performance, of the FAA Approved Flight Manual.
   a. Airspeed - V_{APP}(Flaps 15°)/V_{REF}(Flaps 15°).
   b. Use the Normal **FLAPS 15°** Landing Distance.

CAUTION

AVOID LANDING WITH TAILWIND OR DOWNHILL RUNWAY GRADIENT.

2. Crew Briefing - COMPLETE.
3. Avionics and Flight Instruments - CHECK/SET.
4. Minimums - SET (RA/BARO).
5. FUEL CROSSFEED - AS REQUIRED, then OFF.
6. ENG SYNC - OFF.
7. Flaps - 15°.
8. Passengers - BRIEF.
9. Seats/Seat Belts/Shoulder Harnesses/Aft Divider Sliding Doors - CHECK/ SECURE/LATCHED OPEN (if belted toilet seat is occupied).
10. Passenger Advisory Lights - PASS SAFETY.
11. IGNITION - NORM.
12. Pressurization - ZERO DIFFERENTIAL at touchdown.
13. Landing Gear - DOWN AND LOCKED (3 green lights).

NOTE

SPEED BRAKES amber CAS message and the Master Caution will illuminate at 500 feet AGL with speed brakes not retracted.

14. EICAS - CHECK.
15. Airspeed - V_{REF}.
16. Thrust - AS REQUIRED to prevent high sink rate.

LANDING

1. Throttles - IDLE.
2. Elevator Control - FORWARD PRESSURE at touchdown.
3. Brakes - APPLY after nose wheel ground contact.
4. Thrust Reversers - DEPLOY after nose wheel ground contact.

■ SPEED BRAKES DEPLOY ASYMMETRICALLY

1. Speed Brakes Lever - ADJUST TO ACHIEVE ZERO ROLL.
2. Land as soon as practical.

● **IF SPEED BRAKES ARE NOT RETRACTED**

3. Refer to Abnormal Procedures, SPEED BRAKES FAIL TO RETRACT.

■ PFD DISPLAY TUBE FAILURE

1. Affected PFD DIM (Outer Concentric) Knob - OFF; PFD information is displayed on adjacent MFD.

NOTE

Refer to Limitations Section II regarding dispatch with Honeywell Primus 2000 System.

■ MFD DISPLAY TUBE FAILURE

1. Use opposite side MFD (no MFD backup mode is available).

■ EICAS DISPLAY TUBE FAILURE

1. EICAS DISPLAY Controller - SELECT L or R (EICAS will be displayed on selected MFD).

■ SINGLE MICRO AIR DATA COMPUTER FAILURE

Indicated by loss of affected side airspeed, altitude, and vertical speed.

1. Affected Side Display Controller - SELECT ADC REV.

■ COMPARISON MONITOR

Indicates one or more of the following parameters has exceeded its predetermined tolerance level:

COMPARED SIGNALS	PFD DISPLAYED EADI SYMBOL
Heading (±10°)	HDG
Localizer (±1/2 Dot)	LOC
Glideslope (±1/2 Dot)	GS
Pitch (±5°) and/or Roll (±6°) Attitude	ATT
Altitude (± 200 Feet)	ALT
Indicated Airspeed (± 20 Knots)	IAS

■ DISPLAY UNIT RED GUN FAILURE

NOTE

Affected display colors will be abnormal. Red color will be absent.

- **IF PFD**

1. Affected PFD Dim Knob (outer concentric) - OFF; PFD information is displayed on adjacent MFD.

- **IF MFD**

WARNING

AFFECTED MFD WILL NOT DISPLAY RED FUNCTIONS, i.e. WEATHER, TCAS, AND RED WARNINGS.

1. Opposite MFD - MONITOR.

- **IF EICAS**

1. EICAS DISPLAY Switch - SELECT LEFT. (Maintains normal redundant warning function of the RH MFD.)

■ SINGLE IRS FAILURE

1. Standby Flight Instruments - MONITOR.
2. Affected Side Display Controller - SELECT AHRS or IRS REV; Verify HDG 1 or 2 (AHRS), or MAG 1 or 2 or TRU 1 or 2 (IRS), and ATT 1 or 2 are displayed in both the pilot's and copilot's displays.

NOTE

- Autopilot must be disengaged and may not be reengaged.
- Heading and attitude comparator monitor functions will not be available.

■ RADIO ALTIMETER INOPERATIVE

● APPROACH

1. RA/BARO Switch - ENSURE BARO.
2. Landing Gear - CHECK DOWN AND LOCKED (3 green lights) at or prior to landing gear warning.

NOTE

With radio altimeter failure, the landing gear warning is set by the angle of attack to approximately 1.6 V_{S1}.

■ LANDING GEAR WILL NOT EXTEND (NORMAL "A" SYSTEM HYDRAULIC PRESSURE)

1. Landing Gear Handle - DOWN (airspeed below 210 KIAS).
2. LANDING GEAR BLOWDOWN Handle - PULL.

NOTE

- If the gear handle is locked up, the blowdown will bypass the hydraulic system.
- After the gear blowdown has actuated, the gear cannot be retracted.

3. Landing Gear - CHECK DOWN and LOCKED (3 green lights).
4. Landing Gear Blowdown Handle - PUSH in to stow.

- **IF GEAR FAILS TO EXTEND**

  1. Main Gear Uplock T-Handle - PULL if main gear is still up (located in aft cabin vanity).
  2. Nose Gear Uplock "D" Ring - PULL if nose gear is still up; then STOW (located under copilot's tilt panel next to LANDING GEAR BLOWDOWN knob).

  NOTE

  If either uplock handle is difficult to pull, force can be reduced by unloading the "A" hydraulic system, pulling the HYDR B/PTU CONT circuit breaker, and ensuring the auxiliary hydraulic pump is OFF.

  3. Landing Gear - CHECK DOWN and LOCKED (3 green lights). Yaw airplane left and right as required to engage main gear downlocks.

■ LANDING WITH FLAPS OR SLATS INOPERATIVE

WARNING

- **IF BOTH SLATS AND FLAPS ARE RETRACTED, DO NOT REDUCE AIRSPEED BELOW THE CORRESPONDING V_{REF} SPEED GIVEN IN THE TABLE BELOW, EXCEPT FOR LANDING FLARE. STALL CHARACTERISTICS ARE DEGRADED.**
- **DO NOT EXTEND FLAPS BEYOND 15° WITH SLATS RETRACTED.**

NOTE

- Autopilot coupled ILS approaches with flaps retracted are prohibited.
- If flaps are not extended, drag is significantly reduced. Plan a stabilized final within 10 to 20 KIAS of V_{REF}.
- Use speed brakes as required.

BEFORE LANDING

1. Landing Data - CONFIRM.
   a. Airspeed - V_{REF}.

V_{REF} (KIAS)

FLAPS/SLATS	WEIGHT - POUNDS								LANDING DISTANCE FACTORS
	23,000	25,000	27,000	28,000	29,000	30,000	31,000	31,800	
0°/Retracted	134	140	146	149	151	154	157	160	3.9 (3.0)*
0°/Extended	124	130	136	139	141	144	147	150	3.1 (2.7)**
5°/Retracted	130	136	142	144	147	150	153	155	3.5 (2.2)*
5°/Extended	120	126	132	134	137	140	143	145	2.8 (2.3)**
15°/Retracted	123	129	134	137	139	142	145	147	2.5

   b. Multiply Normal **FLAPS FULL** Landing Distance by the appropriate landing distance factor in the above table. The factors in parenthesis () can be used if the following conditions apply:

      ***** Altitude under 5,000 feet, weight less than 29,000 pounds.
      ****** Altitude under 5,000 feet.

CAUTION

- AVOID LANDING WITH TAILWIND OR DOWNHILL RUNWAY GRADIENT.
- LANDING DISTANCE FACTORS OF 3.0 OR GREATER MAY REQUIRE THE USE OF A RUNWAY WITH AN ARRESTING BARRIER.

2. Crew Briefing - COMPLETE.
3. Avionics and Flight Instruments - CHECK/SET.
4. Minimums - SET (RA/BARO).

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■ LANDING WITH FLAPS OR SLATS INOPERATIVE (Continued)

5. FUEL CROSSFEED - AS REQUIRED, then OFF.
6. Exterior Lights - AS REQUIRED.
7. Passengers - BRIEF.
8. Seats/Seat Belts/Shoulder Harnesses/Aft Divider Sliding Doors - CHECK/SECURE/LATCHED OPEN (if belted toilet seat is occupied).
9. Passenger Advisory Lights - PASS SAFETY.
10. IGNITION - NORM.
11. Pressurization - ZERO DIFFERENTIAL at touchdown.
12. Landing Gear - DOWN AND LOCKED (3 green lights).
13. Speed Brakes - RETRACTED.
14. ENG SYNC - OFF.
15. EICAS - CHECK.
16. GPWS - FLAP OVRD SELECT.

NOTE

Ground Proximity Warning (If installed) - MFD MAIN 2/2 MENU/EGPWS PUSH/FLAP OVRD SELECT.

17. Airspeed - V_{REF}.

LANDING

1. Throttles - IDLE.
2. Speed Brakes - EXTEND at touchdown.
3. Elevator Control - FORWARD PRESSURE at touchdown.
4. Brakes - APPLY after nose wheel ground contact.
5. Thrust Reversers - DEPLOY after nose wheel ground contact.

Procedure completed

■ LANDING WITH RESIDUAL ICE (DUE TO FAILURE OF SLAT AND/OR HORIZONTAL STABILIZER ANTI-ICE)

● SINGLE SIDE HORIZONTAL STABILIZER ANTI-ICE FAILURE

WARNING

- **AFTER HAVING AN ICING ENCOUNTER WITH ONE HORIZONTAL STABILIZER LEADING EDGE ANTI-ICE SYSTEM INOPERATIVE, THE FLAPS MUST NOT BE EXTENDED BEYOND THE 15° POSITION FOR LANDING.**
- **EXTENDING THE FLAPS TO THE FULL POSITION COULD RESULT IN THE AIRPLANE PITCHING NOSE DOWN.**
- **IF THERE IS A REDUCTION OF ELEVATOR CONTROL, (AS INDICATED BY THE AIRPLANE NOT RESPONDING TO THE ELEVATOR INPUT) AS THE FLAPS ARE EXTENDED FROM THE 15° POSITION TO THE FULL POSITION, IMMEDIATELY RESELECT FLAPS TO THE 15° POSITION AND TRIM APPROXIMATELY ONE DEGREE NOSE DOWN.**

1. Land as soon as practical, flaps 15° maximum.
2. Refer to BEFORE LANDING, this procedure.

(Continued Next Page)

■ LANDING WITH RESIDUAL ICE (DUE TO FAILURE OF SLAT AND/OR HORIZONTAL STABILIZER ANTI-ICE) (Continued)

● DUAL HORIZONTAL STABILIZER ANTI-ICE FAILURE

WARNING

- **AFTER HAVING AN ICING ENCOUNTER WITH BOTH HORIZONTAL STABILIZER LEADING EDGE ANTI-ICE SYSTEMS INOPERATIVE, THE FLAPS MUST NOT BE EXTENDED BEYOND THE 5° POSITION FOR LANDING.**

- **EXTENDING THE FLAPS BEYOND 5° TO THE FULL POSITION COULD RESULT IN THE AIRPLANE PITCHING NOSE DOWN.**

- **IF THERE IS A REDUCTION OF ELEVATOR CONTROL, (AS INDICATED BY THE AIRPLANE NOT RESPONDING TO THE ELEVATOR INPUT) AS THE FLAPS ARE EXTENDED FROM BEYOND THE 5° POSITION, IMMEDIATELY RESELECT FLAPS TO THE 5° POSITION.**

1. Land as soon as practical, flaps 5° maximum.
2. Refer to BEFORE LANDING, this procedure.

● SLAT ANTI-ICE SYSTEM FAILURE

WARNING

IF ONE SIDE SLAT ANTI-ICE IS INOPERATIVE, BOTH SIDES MUST BE TURNED OFF TO AVOID ASYMMETRY.

NOTE

- Buffet is noticeable during operation with ice on both wing slats.

- After an icing encounter with failed slat anti-ice, the crew should visually confirm the presence of ice on the slats. If no ice is present, the landing with 15° flap restriction is not applicable.

1. Land as soon as practical, Flaps 15° maximum.
2. Refer to BEFORE LANDING, this procedure.

(Continued Next Page)

■ LANDING WITH RESIDUAL ICE (DUE TO FAILURE OF SLAT AND/OR HORIZONTAL STABILIZER ANTI-ICE) (Continued)

BEFORE LANDING

1. Landing Data - CONFIRM.
   a. Airspeed - V_{REF}.

V_{REF} (KIAS)

FLAPS/SLATS	WEIGHT - POUNDS							
	23,000	25,000	27,000	28,000	29,000	30,000	31,000	31,800
5°/Extended	120	126	132	134	137	140	143	145

   b. For FLAPS 5°, multiply the Normal FLAPS FULL landing distance by 2.8 (use a factor of 2.3 if altitude is below 5,000 feet).
   c. For FLAPS 15°, refer to Normal Procedures, Approach and Landing.

2. Crew Briefing - COMPLETE.
3. Avionics and Flight Instruments - CHECK/SET.
4. Minimums - SET (RA/BARO).
5. FUEL CROSSFEED - AS REQUIRED, then OFF.
6. ENG SYNC - OFF.
7. Exterior Lights - AS REQUIRED.
8. Flaps - AS REQUIRED (5° maximum for both STAB ANTI-ICE INOP, 15° maximum for single STAB ANTI-ICE or SLAT ANTI-ICE INOP).
9. Passengers - BRIEF.
10. Seats/Seat Belts/Shoulder Harnesses/Aft Divider Sliding Doors - CHECK/SECURE/LATCHED OPEN (if belted toilet seat occupied).
11. Passenger Advisory Lights - PASS SAFETY.
12. IGNITION - NORM.
13. Pressurization - ZERO DIFFERENTIAL at touchdown.
14. Landing Gear - DOWN and LOCKED (3 green lights).
15. Speed Brakes - RETRACTED.
16. EICAS - CHECK.
17. Airspeed - V_{REF}.
18. Autopilot - OFF above minimum use height.

LANDING

1. Throttles - IDLE.
2. Speed Brakes - EXTEND at touchdown.
3. Elevator Control - FORWARD PRESSURE at touchdown.
4. Brakes - APPLY after nose wheel ground contact.
5. Thrust Reversers - DEPLOY after nose wheel ground contact.

Procedure completed

■ SINGLE-ENGINE APPROACH AND LANDING

● IF BOTH HYDRAULIC SYSTEMS ARE INOPERATIVE

1. Refer to Emergency Procedures, DUAL HYDRAULIC SYSTEM FAILURE.

● IF LEFT ENGINE INOPERATIVE - HYDRAULIC PTU OPERATING ("A" PRESSURE CONFIRMED)

1. "A" AUX Hydraulic Pump - ON.
2. Hydraulic Pressure - ≥ 2700 PSI.

BEFORE LANDING

1. Landing Data - CONFIRM.
   a. Airspeed - V_{APP}(Flaps 15°)/V_{REF}(Flaps 15°).
   b. Use the normal **FLAPS 15°** landing distance.

CAUTION

IF LANDING WITH FLAPS 15°, AVOID LANDING WITH TAILWIND OR DOWNHILL RUNWAY GRADIENT.

NOTE

For single engine circling approaches, fly V_{REF}(Flaps 15°) + 20 KIAS until landing is assured.

2. Airspeed - V_{REF}(Flaps 15°) +10 KIAS MINIMUM until landing assured.
3. Crew Briefing - COMPLETE.
4. Avionics and Flight Instruments - CHECK/SET.
5. Minimums - SET (RA/BARO).
6. FUEL CROSSFEED - AS REQUIRED, then OFF.
7. Exterior Lights - AS REQUIRED.
8. Flaps - 15° MAXIMUM (5°/250 KIAS, 15°/210 KIAS).
9. Passengers - BRIEF.
10. Seats/Seat Belts/Shoulder Harnesses/Aft Divider Sliding Doors - CHECK/SECURE/LATCHED OPEN (if belted toilet seat occupied).
11. Passenger Advisory Lights - PASS SAFETY.
12. IGNITION - NORM.
13. Pressurization - ZERO DIFFERENTIAL at touchdown.
14. Landing Gear - DOWN and LOCKED (3 green lights).
15. Speed Brakes - RETRACTED.
16. EICAS - CHECK.

(Continued Next Page)

■ SINGLE-ENGINE APPROACH AND LANDING (Continued)

17. Airspeed - V_{REF} (Flaps 15°).
18. Autopilot - OFF.

LANDING

1. Throttle - IDLE.
2. Speed Brakes - EXTEND at touchdown.
3. Elevator Control - FORWARD PRESSURE at touchdown.
4. Brakes - APPLY after nose wheel ground contact.
5. Thrust Reverser (RH only) - DEPLOY after nose wheel ground contact.

CAUTION

REVERSE THRUST MAY NEED TO BE REDUCED DURING CROSSWIND LANDINGS, OR ON WET OR ICY RUNWAYS, DUE TO ASYMMETRIC THRUST.

Procedure completed

● IF LEFT ENGINE INOPERATIVE - "A" HYDRAULIC SYSTEM INOPERATIVE

1. HYDRAULIC PUMP "A" Switch - UNLOAD.
2. HYDR B/PTU CONT Circuit Breaker - PULL.
3. "A" AUX HYDRAULIC PUMP - OFF.

WARNING

- **DO NOT EXTEND FLAPS BEYOND 15° WITH EITHER HYDRAULIC SYSTEM DEPRESSURIZED. IF A SPEED BRAKE OR ROLL SPOILER CHECK VALVE FAILS TO SEAT, UNCOMMANDED ROLL MAY RESULT. RETRACT FLAPS TO 15° IF EXTENDED.**

- **DO NOT USE SPEED BRAKES IN FLIGHT UNLESS "A" HYDRAULIC SYSTEM PRESSURE IS ZERO. OUTBOARD SPEED BRAKE PANELS MAY NOT RETRACT.**

NOTE

With "A" hydraulic system inoperative, the following subsystems will be inoperative: outboard roll spoilers, normal wheel brakes, anti-skid, LH thrust reverser, outboard speed brake panels, and normal landing gear extension. Nose wheel steering will have accumulator pressure only.

(Continued Next Page)

■ SINGLE-ENGINE APPROACH AND LANDING (Continued)

BEFORE LANDING (“A” HYDRAULIC SYSTEM INOPERATIVE)

1. Landing Data - CONFIRM.
   a. Airspeed - V_{REF}(Flaps 15°).

V_{REF} (KIAS)

FLAPS/SLATS	WEIGHT - POUNDS							
	23,000	25,000	27,000	28,000	29,000	30,000	31,000	31,800
15°/Extended	113	119	124	127	129	132	135	137

   b. Multiply Normal **FLAPS 15°** Landing Distance by 1.6.

CAUTION

AVOID LANDING WITH TAILWIND OR DOWNHILL RUNWAY GRADIENT.

NOTE

For single engine circling approaches, fly V_{REF}(Flaps 15°) +20 KIAS until landing is assured.

2. Airspeed - V_{REF}(Flaps 15°) +10 KIAS, MINIMUM until landing is assured.
3. Crew Briefing - COMPLETE.
4. Avionics and Flight Instruments - CHECK/SET.
5. Minimums - SET (RA/BARO).
6. FUEL CROSSFEED - AS REQUIRED, then OFF.
7. Exterior Lights - AS REQUIRED.
8. Flaps - 15° MAXIMUM (5°/250 KIAS, 15°/210 KIAS).
9. Passengers - BRIEF.
10. Seats/Seat Belts/Shoulder Harnesses/Aft Divider Sliding Doors - CHECK/SECURE/LATCHED OPEN (if belted toilet seat occupied).
11. Passenger Advisory Lights - PASS SAFETY.
12. IGNITION - NORM.
13. Pressurization - ZERO DIFFERENTIAL at touchdown.
14. Landing Gear - USE BLOWDOWN.
    a. Landing Gear Blowdown Handle - PULL (<210 KIAS).
    b. Landing Gear - CHECK DOWN and LOCKED (3 green lights).
    c. Landing Gear Handle - DOWN.

NOTE

Landing gear will not retract after blowdown.

15. Speed Brakes - RETRACTED.
16. EICAS - CHECK.
17. Airspeed - V_{REF} (Flaps 15°) when landing is assured.
18. Autopilot - OFF above minimum use height.

(Continued Next Page)

■ SINGLE-ENGINE APPROACH AND LANDING (Continued)

LANDING

1. Throttle - IDLE.
2. Speed Brakes - EXTEND at touchdown.
3. Elevator Control - FORWARD PRESSURE at touchdown.
4. EMERGENCY BRAKES - PULL after nose wheel ground contact.
5. Thrust Reverser (RH only) - DEPLOY WITH IDLE THRUST ONLY.

CAUTION

WHEN CLEAR OF RUNWAY, STOP AND SHUT DOWN. DO NOT ATTEMPT TO TAXI IN CLOSE PROXIMITY TO BUILDINGS OR OTHER AIRCRAFT USING EMERGENCY BRAKES AND NOSEWHEEL STEERING ACCUMULATOR PRESSURE.

Procedure completed

● **IF RIGHT ENGINE INOPERATIVE**

1. HYDRAULIC PUMP “B” Switch - UNLOAD.

WARNING

- **DO NOT EXTEND FLAPS BEYOND 15° WITH EITHER HYDRAULIC SYSTEM DEPRESSURIZED. IF A SPEED BRAKE OR ROLL SPOILER CHECK VALVE FAILS TO SEAT, UNCOMMANDED ROLL MAY RESULT. RETRACT FLAPS TO 15° IF EXTENDED.**
- **DO NOT USE SPEED BRAKES IN FLIGHT UNLESS “B” HYDRAULIC SYSTEM PRESSURE IS ZERO. INBOARD AND MIDDLE SPEED BRAKE PANELS MAY NOT RETRACT.**

NOTE

- With “B” hydraulic system inoperative, the following subsystems will be inoperative: PTU, inboard roll spoilers, inboard and middle speed brake panels and RH thrust reverser.

(Continued Next Page)

■ SINGLE-ENGINE APPROACH AND LANDING (Continued)

BEFORE LANDING

1. Landing Data - CONFIRM.
   a. Airspeed - V_{REF}(Flaps 15˚).

V_{REF} (KIAS)

FLAPS/SLATS	WEIGHT - POUNDS							
	23,000	25,000	27,000	28,000	29,000	30,000	31,000	31,800
15°/Extended	113	119	124	127	129	132	135	137

   b. Multiply normal **FLAPS 15°** landing distance by 1.3.

CAUTION

AVOID LANDING WITH TAILWIND OR DOWNHILL RUNWAY GRADIENT.

NOTE

For single engine circling approaches, fly V_{REF}(Flaps 15°) +20 KIAS until landing is assured.

2. Airspeed - V_{REF}(Flaps 15°) + 10 KIAS until landing is assured.
3. Crew Briefing - COMPLETE.
4. Avionics and Flight Instruments - CHECK/SET.
5. Minimums - SET (RA/BARO).
6. FUEL CROSSFEED - AS REQUIRED, then OFF.
7. Exterior Lights - AS REQUIRED.
8. Flaps - AS REQUIRED - 15° MAXIMUM (5°/250 KIAS, 15°/210 KIAS).
9. Passengers - BRIEF.
10. Seats/Seat Belts/Shoulder Harnesses/Aft Divider Sliding Doors - CHECK/SECURE/LATCHED OPEN (if belted toilet seat occupied).
11. Passenger Advisory Lights - PASS SAFETY.
12. IGNITION - NORM.
13. Pressurization - ZERO DIFFERENTIAL at touchdown.
14. Landing Gear - DOWN and LOCKED (3 green lights).
15. Speed Brakes - RETRACTED.
16. EICAS - CHECK.
17. Airspeed - V_{REF} (Flaps 15°) when landing is assured.
18. Autopilot - OFF above minimum use height.

(Continued Next Page)

■ SINGLE-ENGINE APPROACH AND LANDING (Continued)

LANDING

1. Throttle - IDLE.
2. Speed Brakes - EXTEND at touchdown.
3. Elevator Control - FORWARD PRESSURE at touchdown.
4. Brakes - APPLY after nose wheel ground contact.
5. Thrust Reverser (LH only) - DEPLOY after nose wheel ground contact.

CAUTION

DUE TO ASYMMETRIC THRUST, REVERSE THRUST SHOULD BE REDUCED TO IDLE BY 70 KIAS ON SLIPPERY RUNWAYS OR IF THE NOSE WHEEL STEERING IS INOPERATIVE.

Procedure completed

■ SINGLE-ENGINE GO-AROUND

1. Flight Director Go-Around Button (either throttle) - PRESS.

NOTE

The flight director go-around mode is recommended to establish the climb pitch attitude reference. Pressing the throttle mounted go-around button disengages the autopilot, if on, and engages the flight director to wings level, +10 degrees pitch up go-around mode.

2. Throttle (operating engine) - SET to TO detent.
3. Airplane Pitch Attitude - POSITIVE ROTATION to +10 degrees (flight director go-around pitch command).
4. Flaps - 15° (Flaps 5° if climb gradient is a factor).
5. Climb Speed - V_{APP} MINIMUM (Flaps 15° landing schedule).
6. Landing Gear - UP when positive climb is established.
7. Flaps - UP at V_{REF} +15 KIAS, when clear of obstacles above 1000 feet AGL.
8. Climb Speed - V_{ENR} (190 KIAS).

Procedure completed

■ SINGLE-ENGINE APPROACH AND LANDING (Continued)

BEFORE LANDING

1. Landing Data - CONFIRM.
   a. Airspeed - V_{REF}(Flaps 15˚).

V_{REF} (KIAS)

FLAPS/SLATS	WEIGHT - POUNDS							
	23,000	25,000	27,000	28,000	29,000	30,000	31,000	31,800
15°/Extended	113	119	124	127	129	132	135	137

   b. Multiply normal **FLAPS 15°** landing distance by 1.3.

CAUTION

AVOID LANDING WITH TAILWIND OR DOWNHILL RUNWAY GRADIENT.

NOTE

For single engine circling approaches, fly V_{REF}(Flaps 15°) +20 KIAS until landing is assured.

2. Airspeed - V_{REF}(Flaps 15°) +10 KIAS until landing is assured.
3. Crew Briefing - COMPLETE.
4. Avionics and Flight Instruments - CHECK/SET.
5. Minimums - SET (RA/BARO).
6. FUEL CROSSFEED - AS REQUIRED, then OFF.
7. Exterior Lights - AS REQUIRED.
8. Flaps - AS REQUIRED - 15° MAXIMUM (5°/250 KIAS, 15°/210 KIAS).
9. Passengers - BRIEF.
10. Seats/Seat Belts/Shoulder Harnesses/Aft Divider Sliding Doors - CHECK/SECURE/LATCHED OPEN (if belted toilet seat occupied).
11. Passenger Advisory Lights - PASS SAFETY.
12. IGNITION - NORM.
13. Pressurization - ZERO DIFFERENTIAL at touchdown.
14. Landing Gear - DOWN and LOCKED (3 green lights).
15. Speed Brakes - RETRACTED.
16. EICAS - CHECK.
17. Airspeed - V_{REF} (Flaps 15°) when landing is assured.
18. Autopilot - OFF above minimum use height.

(Continued Next Page)

■ SINGLE-ENGINE APPROACH AND LANDING (Continued)

LANDING

1. Throttle - IDLE.
2. Speed Brakes - EXTEND at touchdown.
3. Elevator Control - FORWARD PRESSURE at touchdown.
4. Brakes - APPLY after nose wheel ground contact.
5. Thrust Reverser (LH only) - DEPLOY after nose wheel ground contact.

CAUTION

DUE TO ASYMMETRIC THRUST, REVERSE THRUST SHOULD BE REDUCED TO IDLE BY 70 KIAS ON SLIPPERY RUNWAYS OR IF THE NOSE WHEEL STEERING IS INOPERATIVE.

Procedure completed

■ SINGLE-ENGINE GO-AROUND

1. Flight Director Go-Around Button (either throttle) - PRESS.

NOTE

The flight director go-around mode is recommended to establish the climb pitch attitude reference. Pressing the throttle mounted go-around button disengages the autopilot, if on, and engages the flight director to wings level, +13 degrees pitch up go-around mode.

2. Throttle (operating engine) - SET to TO detent.
3. Airplane Pitch Attitude - POSITIVE ROTATION to +10 degrees initially. When V_{APP} (minimum) is achieved increase pitch to +13 degrees or AS REQUIRED.
4. Flaps - 15° (Flaps 5° if climb gradient is a factor).
5. Climb Speed - V_{APP} MINIMUM (Flaps 15° landing schedule).
6. Landing Gear - UP when positive climb is established.
7. Flaps - UP at V_{REF} +15 KIAS, when clear of obstacles above 1000 feet AGL.
8. Climb Speed - V_{ENR} (190 KIAS).

Procedure completed

AMBER ABNORMAL PROCEDURES
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* Denotes Primus 2000 message

AMBER ABNORMAL PROCEDURES (Continued)

AMBER ABNORMAL PROCEDURES

This section lists procedures for specific individual Amber CAS and Primus messages. Procedure titles are listed alphabetically with the titles spelled out in parenthesis if needed.

NOTE

Except when dispatching in accordance with an approved Minimum Equipment List, conditions resulting in an amber CAS message on the ground, should be corrected prior to flight.

■ ADC1/ADC2 (AIR DATA COMPUTER 1/AIR DATA COMPUTER 2)*

Indicates both pilot and copilot displayed air data sources are the same or both pilot and copilot displayed air data sources are cross-side. (Displayed above attitude sphere in both PFDs.)

1. Cross reference standby instruments.

Procedure completed

■ AILERON LATCHED

Indicates the AILERON LATCH handle is not properly stowed. Used only for manual reversion flight.

● **IF NOT FLYING MANUAL REVERSION**

1. AILERON LATCH Handle - PUSH DOWN.

Procedure completed

■ ALT (ALTIMETER)*

Indicates FWC detects altitude miscompare. (Displayed in top half of altitude scale in both PFDs.)

1. Altimeter Settings - VERIFY (ensure both pilot and copilot have correct altimeter setting).

● **IF STILL MISCOMPARED**

1. Pilot and Copilot Altitude - COMPARE WITH STANDBY INSTRUMENTS.
2. Pilot or Copilot ADC REV - SELECT SOURCE WHICH AGREES WITH STANDBY ASI/ALT.
3. Confirm ADC 1 or ADC 2 displayed in both PFDs.

Procedure completed

* Denotes Primus 2000 message

■ ANTISKID FAIL

1. ANTISKID Switch - CHECK NORM.

● **IF STILL INOPERATIVE**

1. ANTISKID Switch - OFF.
2. Multiply Landing Distance by 1.4.

CAUTION

WITH ANTISKID OFF, IT IS POSSIBLE TO SKID THE MAIN GEAR TIRES RESULTING IN TIRE FAILURE. APPLY BRAKES ONLY AFTER NOSE WHEEL CONTACT. GRADUALLY INCREASE BRAKE PEDAL FORCE TO ACHIEVE THE DESIRED DECELERATION AND AVOID SKIDDING TIRES.

Procedure completed

■ AOA HEAT FAIL L-R (ANGLE-OF-ATTACK HEAT FAILURE L-R)

1. LH/RH PITOT/STATIC Switches - CHECK ON.
2. Leave icing environment as soon as possible.

NOTE

Affected side stall warning and low speed awareness may be unreliable in icing conditions.

Procedure completed

■ AOA PROBE FAIL L-R (ANGLE-OF-ATTACK PROBE FAILURE L-R)

● **IF ONE SIDE ONLY**

1. Opposite side AOA - MONITOR.

NOTE

Affected side stall warning and low speed awareness will be unreliable.

Procedure completed

● **IF BOTH SIDES FAILED**

1. Airspeed - 150 KIAS MINIMUM ABOVE 15,000 FEET MSL.
   - V_{APP}/V_{REF} MINIMUM (per flap schedule).

WARNING

THE FOLLOWING SYSTEMS WILL BE INOPERATIVE:

- **AUTOSLAT SYSTEM**
- **BOTH STICK SHAKERS**
- **MINIMUM SPEED WARNING SYSTEM**
- **LOW SPEED AWARENESS SYSTEM**

2. Land as soon as practical.

Procedure completed

* Denotes Primus 2000 message

■ AP STAB TRIM INOP (AUTOPILOT STABILIZER TRIM INOPERATIVE)

1. Control Column - GRIP.
2. AP/TRIM/NWS Disengage Button - PRESS (expect small force).
3. Stabilizer Trim - RETRIM.

NOTE

Primary stabilizer trim may be inoperative.

Procedure completed

■ APU GEN OFF (APU GENERATOR OFF)

In flight indicates the APU generator is running AND that BOTH the APU and right-hand generators are off-line.

1. Generator Switches - CHECK/AS REQUIRED.

Procedure Completed

■ ATT (ATTITUDE)*

Indicates FWC detects attitude miscompare. (Displayed in top half of attitude sphere in both PFDs.)

1. AP/TRIM/NWS Disengage Button - PRESS.
2. Pilot and Copilot Attitude Indicators - COMPARE WITH STANDBY ATTITUDE INDICATOR.
3. Pilot or Copilot AHRS REV - SELECT SOURCE THAT AGREES WITH STANDBY ATTITUDE.
4. Confirm ATT1 or ATT2 displayed on both PFDs.

Procedure Completed

■ ATT1/ATT2 (ATTITUDE 1/ATTITUDE 2)*

Indicates both pilot and copilot displayed attitude sources are the same or both pilot and copilot displayed attitude sources are cross-side. (Displayed in both PFD attitude spheres.)

■ BAGGAGE ALTITUDE

1. Pressurization ISO VLV Switch - CLOSE (lift cover).
2. Altitude - FL410 MAXIMUM.
3. Cabin Pressure - MONITOR.

NOTE

- Indicates either the baggage compartment altitude is above approximately 14,000 feet or delta pressure between the cabin and the baggage compartment exceeds 1.0 PSID.
- Baggage isolation valve should close automatically with actual loss of baggage compartment pressure.
- Baggage compartment will not repressurize until delta pressure between the cabin and the baggage compartment is less than 1.0 PSID and baggage compartment pressure is below 14,000 feet.
- After landing, refer to AFM limitations for logging flights (cycles) with baggage compartment not pressurized.
- Determine the cause of the baggage compartment pressure loss before further dispatch.

Procedure completed

■ BAGGAGE DOOR OPEN

NOTE

Baggage door not latched.

1. Pressurization ISO VLV Switch - CLOSE (lift cover).
2. Altitude - FL410 MAXIMUM.
3. Cabin Pressure - MONITOR.

NOTE

After landing, refer to AFM limitations for logging flights (cycles) with baggage compartment not pressurized.

Procedure completed

■ AP STAB TRIM INOP (AUTOPILOT STABILIZER TRIM INOPERATIVE)

1. Control Column - GRIP.
2. AP/TRIM/NWS Disengage Button - PRESS (expect small force).
3. Stabilizer Trim - RETRIM.

NOTE

Primary stabilizer trim may be inoperative.

Procedure completed

■ APU GEN OFF (APU GENERATOR OFF)

Indicates APU generator is OFF (or failed), and APU is running, and either main generator is OFF. (In flight only)

1. Generator Switches - CHECK/AS REQUIRED.

Procedure completed

■ ATT (ATTITUDE)*

Indicates FWC detects attitude miscompare. (Displayed in top half of attitude sphere in both PFDs.)

1. AP/TRIM/NWS Disengage Button - PRESS.
2. Pilot and Copilot Attitude Indicators - COMPARE WITH STANDBY ATTITUDE INDICATOR.
3. Pilot or Copilot AHRS REV - SELECT SOURCE THAT AGREES WITH STANDBY ATTITUDE.
4. Confirm ATT1 or ATT2 displayed on both PFDs.

Procedure completed

■ ATT1/ATT2 (ATTITUDE 1/ATTITUDE 2)*

Indicates both pilot and copilot displayed attitude sources are the same or both pilot and copilot displayed attitude sources are cross-side. (Displayed in both PFD attitude spheres.)

■ BAGGAGE ALTITUDE

1. Pressurization ISO VLV Switch - CLOSE (lift cover).
2. Altitude - FL410 MAXIMUM.
3. Cabin Pressure - MONITOR.

NOTE

- Indicates either the baggage compartment altitude is above approximately 14,000 feet or delta pressure between the cabin and the baggage compartment exceeds 1.0 PSID.
- Baggage isolation valve should close automatically with actual loss of baggage compartment pressure.
- Baggage compartment will not repressurize until delta pressure between the cabin and the baggage compartment is less than 1.0 PSID and baggage compartment pressure is below 14,000 feet.
- After landing, refer to AFM limitations for logging flights (cycles) with baggage compartment not pressurized.
- Determine the cause of the baggage compartment pressure loss before further dispatch.

Procedure completed

■ BAGGAGE DOOR OPEN

NOTE

Baggage door not latched.

1. Pressurization ISO VLV Switch - CLOSE (lift cover).
2. Altitude - FL410 MAXIMUM.
3. Cabin Pressure - MONITOR.

NOTE

After landing, refer to AFM limitations for logging flights (cycles) with baggage compartment not pressurized.

Procedure completed

■ BAGGAGE DOOR SEAL

NOTE

Baggage door seal not properly inflated.

1. Cabin Pressure - MONITOR.

● **IF CABIN ALTITUDE IS NOT MAINTAINED**

   1. Pressurization ISO VLV Switch - CLOSE (lift cover).

NOTE

- The pressurization ISO VLV will automatically close if baggage compartment altitude is above approximately 14,000 feet, or delta pressure between the cabin and the baggage compartment exceeds approximately 1.0 PSID. A slow leak may not result in >1.0 PSID.
- Refer to Abnormal Procedures, BAGGAGE ALTITUDE, and after landing, refer to AFM limitations for logging flights (cycles) with baggage compartment not pressurized

   2. Altitude - FL410 MAXIMUM.

Procedure completed

■ BUS CTRL 1-2 FAIL (BUS CONTROLLER 1-2 FAILURE)

1. Land as soon as practical.

NOTE

- Digital data bus controller has failed and opposite controller is automatically selected.
- Loss of the second controller will result in loss of all PFD, MFD and EICAS displays, FADECs ADC reversionary mode, and loss of FGCs, lower rudder yaw dampers, primary trim, and Mach trim.

Procedure completed

● **IF SECOND FAILURE OCCURS**

   1. Refer to Standby Instruments; ASI/ALT, Attitude, HSI and engine.
   2. Altitude - FL410 MAXIMUM.
   3. Airspeed - PER STANDBY ASI/ALT PLACARD.
   4. Land as soon as possible.

Procedure completed

■ CABIN ALTITUDE (CABIN ALTITUDE ABOVE 8500 FEET) (10,000 FEET RED CABIN ALTITUDE MESSAGE NOT ON)

1. Pressurization Controls - CHECK PROPER SETTINGS.
2. PAC TEMP SEL Switches - SELECT FULL HOT (auto or manual, if above FL470).

Procedure completed

- **IF CABIN ALTITUDE NOT ARRESTED**

  1. Pressurization ISO VLV Switch - CLOSE (lift cover).

  Procedure completed

- **IF CABIN ALTITUDE STILL NOT ARRESTED**

  1. Pressurization NORM/ALT SEL Switch - SELECT ALT SEL.
  2. Cabin Altitude Selector - SET CABIN ALTITUDE 8000 FEET/MAX RATE.
  3. PAC BLEED SELECT Switch - HP.

  Procedure completed

- **IF CABIN ALTITUDE STILL NOT ARRESTED IN ALT SEL MODE**

  1. Pressurization NORM/MANUAL Switch - MANUAL.
  2. Manual UP/DN Switch - DN, RATE - MAX.
  3. PAC Select Switches - HIGH (if required).

  Procedure completed

- **IF NOT ARRESTED BY 10,000 FEET CABIN ALTITUDE (IN ALT SEL OR MANUAL MODE)**

NOTE

Cabin altitude red CAS message will illuminate indicating cabin altitude above 10,000 feet.

1. Refer to Emergency Procedures, LOSS OF CABIN PRESSURE.

Procedure completed

■ CABIN DOOR OPEN

WARNING

CABIN DOOR LATCH AND/OR ONE OR MORE DOOR PIN SWITCHES ARE NOT SEATED, OR THE DOOR MECHANISM OR SWITCH SEQUENCING WAS NOT CORRECT. STAY CLEAR OF CABIN DOOR.

1. Master Caution Reset - PRESS.

(Continued Next Page)

■ CABIN DOOR OPEN (Continued)

● IF MESSAGE CLEARS

1. Cabin Door Pins - INSPECT.

NOTE

Pressing the MASTER CAUTION RESET will inhibit the message for any one switch, or sequencing problem. Dispatch is permitted if the message clears and visual inspection confirms all door pins to be seated.

Procedure completed

● IF MESSAGE REMAINS

1. Pressurization NORM/ALT SEL Switch - SELECT ALT SEL.
2. Cabin Altitude Selector - SET 10,000 FEET.
3. Descend as soon as practical - ≤41,000 FEET.

Procedure completed

■ CABIN DOOR SEAL

Indicates cabin door primary seal pressure is low.

1. Descend as soon as practical - ≤41,000 feet.

Procedure completed

■ CABIN PAC O'TEMP (CABIN PAC OVERTEMPERATURE)

NOTE

The PAC will automatically shut down. The following procedure is to reset the PAC.

1. CAB PAC Switch - OFF.
2. Cabin Temperature - SELECT WARMER TEMPERATURE.
3. CAB PAC Switch - ON (after O'TEMP message is out).

● IF PAC DOES NOT RESET (NO AIRFLOW EVIDENT)

1. Descend as soon as practical - ≤41,000 FEET.

Procedure completed

■ CBN VENT DOOR OPEN (CABIN VENT DOOR OPEN)

● **IN FLIGHT - IF CABIN PRESSURE NOT LOST**

1. Pressurization NORM/ALT SEL Switch - SELECT ALT SEL.
2. Cabin Altitude Selector - SET 10,000 FEET.
3. Descend as soon as practical - ≤41,000 FEET.
4. Cabin Altitude - MONITOR.

NOTE

- May indicate a cabin door sequencing problem. Check for CABIN DOOR OPEN message.
- If the vent door opens, cabin pressurization will be lost.

Procedure completed

● **ON GROUND**

1. Cabin Door - OPEN.
2. Cabin Door - CLOSE.
3. Cabin Door EICAS Messages - VERIFY EXTINGUISHED.

□ **IF MESSAGE STILL ILLUMINATED**

1. Cabin Vent Door - CLOSE MANUALLY.
2. Cabin Door EICAS Messages - VERIFY EXTINGUISHED.

NOTE

The cabin vent door can be manually closed using a lever located inside the door assembly. The lever is accessible through a plug in the aft side of the stair assembly.

Procedure completed

■ CHECK AP ENGAGE (CHECK AUTOPILOT ENGAGE)

Indicates FWC and AFCS monitors disagree on autopilot clutch status.

1. Autopilot - DISENGAGE, REENGAGE.

● **IF AUTOPILOT WILL NOT DISENGAGE**

1. AP - A and AP - B Circuit Breakers - PULL (RH circuit breaker panel).

Procedure completed

■ CHECK DU 1-2-3-4-5 (CHECK DISPLAY UNIT 1-2-3-4-5)

Indicates display unit wrap around monitor has failed. If the affected display unit is used as a PFD, it may be presenting misleading Mach, altitude, airspeed, attitude or baro-set information. DU's are numbered left to right.

1. Display Unit - VERIFY PROPER INFORMATION DISPLAYED.
2. Display Controllers - SELECT REVERSIONARY IF REQUIRED.

Procedure completed

■ CHIP DETECT L-R (CHIP DETECTOR L OR R ENGINE OIL)

1. Land as soon as practical (within 4 hours).
2. Chip Detectors - VISUALLY INSPECT AFTER LANDING.

Procedure completed

■ COCKPIT PAC O'TEMP (COCKPIT PAC OVERTEMPERATURE)

NOTE

The PAC will automatically shut down. The following procedure is to reset the PAC.

1. CKPT PAC Switch - OFF.
2. Cockpit Temperature - SELECT WARMER TEMPERATURE.
3. CKPT PAC Switch - ON (after O'TEMP message is out).

● **IF PAC RESETS**

Procedure completed

● **IF PAC DOES NOT RESET (NO AIRFLOW EVIDENT)**

1. Descend as soon as practical - ≤41,000 FEET.

Procedure completed

■ CONFIG MISMTCH 1-2 (CONFIGURATION MISMATCH 1-2)

NOTE

Indicates Primus 2000 system is detecting mismatched software in the IACs. This message is inhibited in flight.

1. Correct prior to flight.

Procedure completed

■ CTR XFER OFF L-R (CENTER TRANSFER OFF L-R)

Indicates affected center tank to wing tank fuel transfer is off.

1. CTR WING XFER Switch - AS REQUIRED.

NOTE

Center tank to wing transfer must be initiated prior to reaching 3100 lbs per side wing fuel.

Procedure completed

■ CTR XFER XSIT L-R (CENTER TRANSFER IN TRANSIT L-R)

Indicates that the affected center tank transfer valve is neither open nor closed. If fuel is in the center tank, fuel transfer to the affected wing may be reduced.

1. Affected CTR WING XFER Switch - ON.
2. Wing Fuel Quantity - MONITOR.
3. CROSSFEED - AS REQUIRED.

Procedure completed

■ DAU 1-2 MISCMP (DATA ACQUISITION UNITS 1-2 MISCOMPARE)

Indicates A and B channels of the affected DAU do not agree (except engine parameters).

1. EICAS - CHECK DISPLAY.
2. DAU REV Switch (affected side) - SELECT DAU REV, CHECK DISPLAY FOR DIFFERENCES.
3. DAU REV Switch - SELECT CHANNEL WHICH IS CORRECT.
4. Red CAS Messages - TREAT AS REAL if not positively verified to be invalid.

NOTE

Red CAS messages, valid or invalid, will always be displayed.

Procedure completed

■ DAU 1-2 MISCMP-ENG (DATA ACQUISITION UNITS 1-2 MISCOMPARE - ENGINE)

Indicates A and B channels of the affected DAU do not agree with respect to engine data (N_1, N_2, ITT, oil temperature, oil pressure, oil quantity and fuel flow).

1. EICAS - CHECK AFFECTED SIDE ENGINE DATA (compare to standby).

● **IF ENGINE DATA IS NOT ACCURATE**

1. DAU REV Switch (affected side) - SELECT DAU REV.

Procedure completed

■ DAU 1A - 1B - 2A - 2B FAIL (DATA ACQUISITION UNIT 1A - 1B - 2A - 2B FAILURE)

● **IF 1A OR 2A**

1. Affected DAU - SELECT DAU REV.

NOTE

If either DAU “A” Channel is failed, the following information, which receives “A” channel excitation, will not be available from the affected DAU, even if DAU reversionary is selected:

Engine Oil Pressure	Battery 1 Temperature
Engine Oil Level	Fuel Tank Temperature
Hydraulic Pressure	Engine Fuel Temperature
Hydraulic Temperature	Rudder (RSS) Hydraulic Pressure
Hydraulic Volume	Start Duct Pressure

Procedure completed

● **IF 1B OR 2B**

1. Do not select DAU REV.

NOTE

DAU 1 and 2 normally power up on “A” channel. Selecting REVERSIONARY will select the “B” channel.

Procedure completed

● **IF BOTH A AND B ON SAME DAU**

NOTE

Affected side EICAS engine data and numerous CAS messages will be inoperative.

1. Engine Data - USE STANDBY instruments.
2. Land as soon as practical.

Procedure completed

■ DAU ALL FAIL (DATA ACQUISITION UNITS ALL FAIL)

NOTE

EICAS engine data and most CAS messages will be inoperative.

1. Engine Data - USE STANDBY instruments.
2. Land as soon as practical.

Procedure completed

■ DC OVERCURRENT L-R

NOTE

Indicates left or right generator load above limits. May momentarily flash on during APU starts using the generator(s) as a power source.

1. Electrical Load - ADJUST AS REQUIRED.

■ DG1/DG2 (DIRECTIONAL GYRO 1/DIRECTIONAL GYRO 2)*

Indicates the respective AHRS switch is in DG. (Displayed above the HSI compass rose on the PFDs and MFDs.)

Procedure completed

■ DGR (FMS DEGRADED MODE)*

Indicates FMS operating in degraded mode. (Displayed to the left of the HSI compass rose in the PFDs.)

1. Check FMS sensors reception.
2. Terminal area FMS navigation is prohibited.

Procedure completed

■ DR (DEAD RECKONING)*

Indicates FMS operating in Dead Reckoning mode. (Displayed to the left of the HSI compass rose in the PFDs.)

1. Navigation - USE OTHER SOURCES.
2. Check FMS sensors reception.

Procedure completed

* Denotes Primus 2000 message

■ DU 1-2-3-4-5 HOT (DISPLAY UNIT 1-2-3-4-5 HOT)

● **IF 1 OR 5 (PFDS)**

1. Affected Display Dim Knob - OFF (transfer PFD function to adjacent MFD).

Procedure completed

☐ **IF MESSAGE DOES NOT CLEAR**

1. Affected PFD Circuit Breaker - PULL.

NOTE

Selecting the PFD DIM knob to OFF only removes partial power from the DU.

Procedure completed

● **IF 2 OR 4 (MFDS)**

1. Affected MFD Circuit Breaker - PULL.

Procedure completed

● **IF 3 (EICAS)**

1. EICAS DISPLAY Switch - LEFT (retains RH MFD for FWC2 red messages).
2. If message does not clear, EICAS Circuit Breaker - PULL.

Procedure completed

■ DUCT O'TEMP CABIN/CKPT (DUCT OVERTEMPERATURE CABIN OR COCKPIT)

1. Affected PAC TEMP SEL Switch - SELECT COOLER TEMPERATURE.

Procedure completed

● **IF CONDITION DOES NOT CLEAR**

1. Affected PAC TEMP SEL Switch - MANUAL FULL COLD.

Procedure completed

☐ **IF CONDITION DOES NOT CLEAR**

1. Refer to Abnormal Procedures, COCKPIT/CABIN TEMPERATURE CONTROL INOPERATIVE.

Procedure completed

■ EICAS (ENGINE INDICATING CREW ALERTING SYSTEM)*

Indicates FWC wrap-around monitor detects difference in engine parameters: N_1, N_2 or ITT. (Displayed above and left of the HSI compass rose in PFD.)

1. EICAS Engine Data - COMPARE WITH STANDBY INSTRUMENTS.
2. If EICAS instruments are in error - USE STANDBY ENGINE INSTRUMENTS.

Procedure completed

* Denotes Primus 2000 message

■ ENG A/I COLD L-R (ENGINE ANTI-ICE COLD L-R)

1. Engine Anti-Ice Switches - CHECK.
2. Throttle (affected engine) - INCREASE POWER.

Procedure completed

● IF MESSAGE REMAINS AND PAC HP VLV OPEN CAS MESSAGE IS DISPLAYED

1. PAC BLEED SELECT Switch - LP.

Procedure completed

□ IF MESSAGE REMAINS

1. Affected ENG/WING Anti-Ice Circuit Breaker - PULL.
2. Visually verify inlet is anti-icing.

Procedure completed

● IF IT CANNOT BE VISUALLY VERIFIED THAT INLET IS ANTI-ICING

1. Leave icing environment as soon as possible.

NOTE

- This message will be cyan if the PYLON BLD LEAK L-R message is on. Refer to Emergency Procedures, PYLON BLEED LEAK.
- This message will also be illuminated if the respective engine anti-ice switch is off and the opposite engine anti-ice or either stabilizer anti-ice switch is on.

Procedure completed

■ ENG A/I HOT L-R (ENGINE ANTI-ICE HOT L-R)

● IF MESSAGE CYCLES

1 Engine Anti-Ice - CONTINUE TO MONITOR.

NOTE

Cycling ENG A/I HOT message indicates the automatic overheat protection is functioning. Continue to monitor EICAS and periodically have a crew member visually verify that the inlet is anti-icing.

Procedure completed

● IF MESSAGE IS STEADY

1. Affected Engine - REDUCE POWER.
2. Leave icing environment as soon as practical.

NOTE

The ENG A/I HOT monitor is enabled whether or not anti-ice is on. If engine anti-ice can be verified to be off (switches, N_2, ITT), this message may be a monitor failure.

Procedure completed

■ ENG MTR VLV FAIL L-R (ENGINE METERING VALVE FAILURE L-R)

Indicates the metering valve has failed at the last controlled position. Thrust control is not possible, except for cutoff.

● **IF THRUST REDUCTION IS REQUIRED**

1. Throttle (affected engine) - CONFIRM, then CUTOFF.
2. Refer to Abnormal Procedures, ENGINE FAILURE/PRECAUTIONARY SHUTDOWN and SINGLE ENGINE APPROACH AND LANDING.

Procedure completed

■ ENG O'SPD SHUTDN L-R (ENGINE OVERSPEED SHUTDOWN L-R)

CAUTION

DO NOT ATTEMPT TO RESTART.

1. Refer to Abnormal Procedures, ENGINE FAILURE/PRECAUTIONARY SHUTDOWN and SINGLE ENGINE APPROACH AND LANDING.

Procedure completed

■ ENG TLA FAILED L-R (ENGINE THROTTLE LEVER ANGLE FAILED L-R)

Indicates engine thrust will not respond to throttle movement. Thrust control is not possible from the failed position except CUTOFF.

● **IF THRUST REDUCTION IS REQUIRED**

1. Throttle (affected engine) - CONFIRM, then CUTOFF.
2. Refer to Abnormal Procedures, ENGINE FAILURE/PRECAUTIONARY SHUTDOWN and SINGLE ENGINE APPROACH AND LANDING.

Procedure completed

■ ENGINE TR SW FAULT L-R (ENGINE THRUST REVERSER SWITCH FAULT L-R)

1. FADEC Select Switch - SELECT OPPOSITE FADEC.
2. Land as soon as practical.

NOTE

If message does not clear on opposite FADEC, inadvertent thrust reverser deployment may not automatically retard the engine thrust. Auto stow may not be operational. Emergency stow will be operational.

Procedure completed

■ ENG VIBRATION L-R (ENGINE VIBRATION L-R)

CAUTION

ENGINE VIBRATION RED CAS MESSAGE INDICATES A HIGHER LEVEL OF VIBRATION. REFER TO EMERGENCY PROCEDURES, ENGINE VIBRATION L-R.

1. Vibration - CONFIRM (Audible and tactile indications).

● **IF NO VIBRATION EXISTS**

1. Engine - MONITOR FOR OTHER EVIDENCE OF MALFUNCTION.

Procedure completed

● **IF VIBRATION EXISTS**

1. Engine - MONITOR FOR OTHER EVIDENCE OF MALFUNCTION. Consider reducing RPM
2. Land as soon as practical.

Procedure completed

□ **IF VIBRATION INCREASES OR OTHER EVIDENCE OF ENGINE MALFUNCTION**

1. Consider the possibility of shutting down the engine. Refer to Abnormal Procedures, ENGINE FAILURE/PRECAUTIONARY SHUTDOWN and SINGLE ENGINE APPROACH AND LANDING.
2. Land as soon as possible.

CAUTION

IF SIGNIFICANT VIBRATION CONTINUES WITH THE ENGINE RUNNING, ENGINE FAILURE MAY RESULT.

Procedure completed

■ ESCAPE HATCH OPEN

Indicates escape hatch door proximity switch is open.

● **IN FLIGHT**

1. Escape Hatch - VERIFY SECURE.
2. Descend as soon as practical - $\leq$41,000 FEET.

Procedure completed

● **IF HATCH IS NOT SECURE**

1. Land as soon as possible.

Procedure completed

■ FADEC BUS FAIL L-A, L-B, R-A, R-B

● **IF ONLY A OR B**

1. FADEC Select Switch - SELECT OPPOSITE FADEC.

Procedure completed

(Continued Next Page)

■ FADEC BUS FAIL L A-B, R A-B (continued)

● IF BOTH A AND B ON SAME FADEC

NOTE

Indicates electrical connection between FADECs is compromised which could affect engine stability. Both FADECs may be in control.

1. Avoid rapid throttle movements.
2. Land as soon as practical.

Procedure completed

■ FADEC FAIL L A-B, R A-B

● ALTITUDE FL ≥ 450 AND MACH ≤ 0.6

Indicates affected FADEC CVG monitor has declared the FADEC incapable or the FADEC has failed, and the engine has automatically switched to the opposite FADEC. The opposite FADEC will continue to operate normally and the affected FADEC may reset when Mach is increased above 0.6 or altitude is below FL450.

1. Accelerate to Mach greater than 0.6.
2. Reset affected FADEC(s).

Procedure completed

□ IF THE MESSAGE DOES NOT EXTINGUISH

1. Land as soon as practical.

Procedure completed

● N_1 TARGET INDICATOR IS AMBER

1. Takeoff/Go-Around N_1 Thrust Setting - CONFIRM.
2. Land as soon as practical.

Procedure completed

● ALL OTHER FLIGHT CONDITIONS

Indicates affected FADEC has failed, and the engine has automatically switched to the opposite FADEC. Failure of the second FADEC could result in engine flameout.

1. Land as soon as practical.

Procedure completed

■ FADEC FAULT L A-B, R A-B

1. Affected FADEC Switch - RESET

Procedure completed

● IF ONLY A OR B AND WILL NOT RESET

1. Affected FADEC Switch - SELECT OPPOSITE FADEC.

Procedure completed

(Continued Next Page)

■ FADEC FAULT L A-B, R A-B (Continued)

● **IF BOTH A AND B AND WILL NOT RESET**

1. Affected Engine - MONITOR.

NOTE

The FADEC in control is unable to monitor itself, or the FADEC in control and FADEC not in control are detecting differences; or faulty data is being received from the air data computers, compressor inlet temperature, or pressure sensors. The engine should continue to operate normally. This message will occur during the OVER SPD warning test on the ground if the throttle(s) was (were) above idle when power was applied to the FADEC. It will also occur if the SG REV switch is selected to SG1 or SG2. If the message does not automatically clear after the SG switch is placed to NORM it can be RESET.

Procedure completed

■ FADEC REV ADC L-R OR FADEC REV N_1 L-R (FADEC REVERSIONARY AIR DATA COMPUTER OR N_1, L-R)

Indicates engine is operating in reversionary mode due to loss of or faulty MADC data, (ADC REV), and/or FADEC N_1 data, (N_1 REV).

1. Affected engine FADEC - RESET.

Procedure completed

● **IF STILL REVERSIONARY**

1. Avoid rapid throttle movements (N_1 Reversionary).

NOTE

- If the FADEC is in ADC reversionary mode (due to loss of both MADCs or faulty MADC data), significant thrust loss may be experienced at high altitude. At lower altitudes, within the takeoff envelope, full takeoff thrust is available. Engine response to throttle movement is normal.
- In ADC or N_1 reversionary mode, idle N_1 will not automatically increase when engine anti-ice is on. Idle N_1 will have to be manually increased in icing to keep ANTI-ICE COLD CAS messages extinguished.
- If the FADEC is in N_1 reversionary due to loss of N_1 signal, N_1 speed schedule is derived from N_2 speed. Rapid throttle movements should be avoided. Some thrust loss may be experienced at high altitude or high ambient temperatures. N_1 will not be displayed. FADEC will continue to provide engine limit protection.

Procedure completed

■ ENG MTR VLV FAIL L-R (ENGINE METERING VALVE FAILURE L-R)

Indicates the metering valve has failed at the last controlled position. Thrust control is not possible.

- **IF THRUST REDUCTION IS REQUIRED**

  1. Throttle (affected engine) - CONFIRM, then CUTOFF.
  2. Refer to Abnormal Procedures, ENGINE FAILURE/PRECAUTIONARY SHUTDOWN and SINGLE ENGINE APPROACH AND LANDING.

  Procedure completed

■ ENG O'SPD SHUTDN L-R (ENGINE OVERSPEED SHUTDOWN L-R)

CAUTION

DO NOT ATTEMPT TO RESTART.

1. Refer to Abnormal Procedures, ENGINE FAILURE/PRECAUTIONARY SHUTDOWN and SINGLE ENGINE APPROACH AND LANDING.

Procedure completed

■ ENG TLA FAILED L-R (ENGINE THROTTLE LEVER ANGLE FAILED L-R)

Indicates engine thrust will not respond to throttle movement. Thrust control is not possible from the failed position except CUTOFF.

- **IF THRUST REDUCTION IS REQUIRED**

  1. Throttle (affected engine) - CONFIRM, then CUTOFF.
  2. Refer to Abnormal Procedures, ENGINE FAILURE/PRECAUTIONARY SHUTDOWN and SINGLE ENGINE APPROACH AND LANDING.

  Procedure completed

■ ENGINE TR SW FAULT L-R (ENGINE THRUST REVERSER SWITCH FAULT L-R)

1. FADEC Select Switch - SELECT OPPOSITE FADEC.
2. Land as soon as practical.

NOTE

If message does not clear on opposite FADEC, inadvertent thrust reverser deployment may not automatically retard the engine thrust. Auto stow may not be operational. Emergency stow will be operational.

Procedure completed

■ FIRE DETECT FAIL L-R-A (FIRE DETECTION SYSTEM FAILURE L-R ENGINE OR APU)

NOTE

Affected fire detection system is inoperative (L or R engine, or APU).

- **IN FLIGHT**
  - ☐ **IF L-R ENGINE**
    1. Land as soon as practical.

    Procedure completed
  - ☐ **IF APU**
    1. Do not use APU.

    Procedure completed
- **ON GROUND**
  - ☐ **IF L-R ENGINE**
    1. Correct condition prior to dispatch.

    Procedure completed
  - ☐ **IF APU**
    1. Do not use APU.

    Procedure completed

■ FLAPS FAIL

1. Flap Handle - ENSURE HANDLE IS IN A DETENT. (UP, SLAT, 5, 15, FULL).
2. FLAP RESET Switch - PRESS.

Procedure completed

- **IF FLAPS REMAIN INOPERATIVE**
  1. Refer to Abnormal Procedures, LANDING WITH FLAPS OR SLATS INOPERATIVE.

■ FLT CONTROL FAULT (FLIGHT CONTROL FAULT)

WARNING

DO NOT UNLOAD HYDRAULIC SYSTEMS; ONE PCU MAY BE HARDOVER.

NOTE

This message and associated illuminated FLT CONTROL SHUTOFF switch(es) could mean that one (or more) FLT CONTROL SHUTOFF switch(es) has/have been inadvertently pressed. In this case both the top and bottom (OFF) halves of the FLT CONTROL SHUTOFF switch would be illuminated. Press the illuminated FLT CONTROL SHUTOFF switch(es) to restore normal operation. The CAS message and switch(es) will extinguish.

1. Autopilot - OFF.
2. Flight Controls - CHECK FOR NORMAL RESPONSE AND FEEL.

(Continued Next Page)

■ FLT CONTROL FAULT (FLIGHT CONTROL FAULT) (Continued)

● **IF FLIGHT CONTROLS ARE NORMAL AND HYDRAULIC SYSTEMS ARE NORMAL (PROBABLE FLIGHT CONTROL MONITOR FAILURE)**

1. Do not press FLT CONTROL SHUTOFF Switch.

WARNING

DO NOT UNLOAD ANY HYDRAULIC SYSTEM. A HARDOVER MAY NOT ALWAYS BE DETECTABLE BY PILOT FEEL. IF A HYDRAULIC FAILURE SUBSEQUENTLY OCCURS ON THE SIDE OPPOSITE THE HARDOVER, THE AFFECTED FLIGHT CONTROL WILL RESPOND TO THE HARDOVER. BE PREPARED TO RESIST THE CONTROL MOTION AND IMMEDIATELY PRESS THE ILLUMINATED FLT CONTROL SHUTOFF SWITCH.

2. Land as soon as practical.

Procedure completed

● **IF FLIGHT CONTROLS DO NOT RESPOND OR NOT NORMAL**

1. Affected (Illuminated) FLT CONTROL SHUTOFF Switch - LIFT COVER AND PRESS.
2. Land as soon as practical.

NOTE

Plan for the longest available runway which minimizes crosswind.

□ **IF AILERON PCU**

1. AILERON LATCH Handle - PULL.

NOTE

Ailerons will be in manual reversion and all roll spoilers will be operational, however, control response will be slow due to high forces. Crosswind limit, 10 knots.

2. Use NORMAL LANDING procedure.

Procedure completed

□ **IF ELEVATOR PCU**

1. Opposite Side PCUs - VERIFY OPERATIONAL.

CAUTION

ENSURE THAT THE NOSE WHEEL IS FIRMLY ON THE GROUND BEFORE DEPLOYING THRUST REVERSERS.

NOTE

Elevator forces will not be significantly increased, however, control response will be slower due to only one set of PCUs powering the elevator.

2. Use NORMAL LANDING procedure.

Procedure completed

(Continued Next Page)

■ FLT CONTROL FAULT (FLIGHT CONTROL FAULT) (Continued)

☐ IF RUDDER PCU

1. Altitude/Airspeed - 41,000 FEET/250 KIAS/0.82M MAXIMUM, DESCEND/SLOW AS REQUIRED.

NOTE

- Maximum crosswind is 10 Knots.
- Rudder forces will be high and response slow. Rudder trim will be ineffective. Maintain equal thrust. Single-engine go-around may not be possible from slow airspeed.
- Lateral control input is effective in aiding directional control, particularly if one engine is shut down.
- Copilot can reduce work load by assisting the pilot in reducing rudder force if required.
- Lower rudder yaw damper will be ineffective.

2. Use Normal Procedures for DESCENT, APPROACH, BEFORE LANDING, and LANDING.

■ FUEL BOOST ON L-R

1. FUEL BOOST Switch (affected side) - ON.
2. Land as soon as practical.

NOTE

- Do not turn the fuel boost switch off. Engine flameout may result. Amber CAS message indicates fuel boost pump has tripped on due to low fuel pressure.
- Except in an emergency, do not crossfeed when either fuel boost pump has been turned on by low pressure, i.e., amber CAS message.
- FUEL BOOST ON white CAS message indicates normal operation.
- Gravity crossflow is preferred to balance fuel. Sideslipping the airplane will increase rate.

Procedure completed

● IF WING FUEL BALANCE REQUIRED

1. GRVTY XFLOW Switch - ON.
2. Sideslip Aircraft - BALL TO LOW TANK QUANTITY.
3. Check Balance - STRAIGHT FLIGHT, repeat step 2 if required.
4. GRVTY XFLOW Switch - OFF.

Procedure completed

(Continued Next Page)

■ FUEL BOOST ON L-R (Continued)

● IF CROSSFEED IS REQUIRED FROM AFFECTED SIDE

1. FUEL BOOST Switch (opposite side) - NORM.
2. FUEL CROSSFEED Switch - SELECT AFFECTED TANK.
3. FUEL CROSSFEED Switch - OFF when crossfeed is completed.

Procedure completed

☐ IF OPPOSITE FUEL BOOST PUMP COMES ON

1. Throttles - REDUCE to safe thrust.
2. FUEL BOOST Switch (opposite side) - OFF, then NORM.

NOTE

A single boost pump may not supply required pressure to both engines at high fuel flow.

3. FUEL CROSSFEED Switch - OFF when crossfeed is completed.

Procedure completed

● IF CROSSFEED IS REQUIRED FROM OPPOSITE SIDE

1. FUEL CROSSFEED Switch - SELECT OPPOSITE TANK; VERIFY BOTH FUEL BOOST PUMPS ARE ON.
2. FUEL BOOST Switch (affected side) - OFF, then NORM.

NOTE

The amber FUEL BOOST ON L-R CAS message will extinguish.

● WHEN CROSSFEED IS COMPLETED

1. FUEL BOOST Switch (affected side) - ON before selecting crossfeed off.
2. FUEL CROSSFEED Switch - OFF.

Procedure completed

■ FUEL DOOR OPEN

Indicates that either the single point pressure refueling door or the center tank overwing transfer valve access door is open.

1. Land as soon as practical.

Procedure completed

■ FUEL FLTR BYPASS L-R (FUEL FILTER BYPASS L-R)

Indicates impending bypass of the fuel filter due to fuel contamination.

1. Land as soon as practical.

WARNING

IT IS POSSIBLE THAT CONTAMINATED FUEL COULD HAVE BEEN INTRODUCED INTO ALL FUEL TANKS. MONITOR OPPOSITE ENGINE, RESTRICT CROSSFEED AND CONSIDER POSSIBLE PARTIAL OR TOTAL LOSS OF THRUST FROM BOTH ENGINES. INSPECT FILTERS AFTER LANDING.

Procedure completed

■ FUEL FW VLV XSIT L-R (FUEL FIREWALL VALVE IN TRANSIT L-R)

Indicates that the respective fuel firewall shutoff valve is neither fully open nor fully closed.

WARNING

IF THE FIREWALL VALVE WAS ACTUATED DUE TO AN ENGINE FIRE, FUEL MAY STILL BE SUPPLIED TO THE ENGINE IF THE BOOST PUMP IS ON OR THE ENGINE IS WINDMILLING. DO NOT CROSSFEED IF FIRE IS STILL PROBABLE.

Procedure completed

■ FUEL IMBALANCE

Indicates lateral fuel imbalance is 400 lbs. or more.

NOTE

- Safe return and landing has been demonstrated with up to 800 lbs. imbalance. Emergency imbalance is 800 lbs. Roll response away from heavy wing is reduced.
- Check FMS fuel quantity verses indicated. A large difference could indicate a fuel leak. Indicated fuel quantity may vary in climb or descent.

1. Aileron Trim - AS REQUIRED.

Procedure completed

- **IF FUEL REMAINS IN CENTER TANK AND ONE WING TANK IS MORE THAN 3300 LBS AND THE OTHER IS MORE THAN OR EQUAL TO 3000 LBS.**

NOTE

Indicates probable failure of center-to-wing transfer shutoff float valve in wing with the most fuel.

1. CTR WING XFER (tank with most fuel) - OFF.
2. FUEL CROSSFEED Switch - AS REQUIRED, select tank with most fuel.

□ **WHEN FUEL QUANTITY IS BALANCED**

1. FUEL CROSSFEED Switch - OFF.
2. CTR WING XFER (affected side) - CYCLE MANUALLY TO MAINTAIN FUEL BALANCE until center tank transfer is complete.

Procedure completed

(Continued Next Page)

FUEL IMBALANCE (Continued)

- **IF FUEL REMAINS IN CENTER TANK AND ONE WING TANK FUEL QUANTITY IS LESS THAN APPROXIMATELY 2900 LBS. WITH BOTH CTR WING XFER SWITCHES NORM OR ON**

NOTE

Indicates probable failure of center-to-wing transfer system to transfer fuel into the low quantity wing.

1. GRVTY XFLOW Switch - L WING-R WING.

NOTE

Gravity crossflow will open the wing tanks to each other and to the engine feed tanks. Use sideslip as required to aid in crossflow rate.

2. FUEL CROSSFEED Switch - AS REQUIRED, select tank with most fuel.

☐ **WHEN CENTER TANK TRANSFER IS COMPLETE AND WING FUEL QUANTITIES ARE BALANCED**

1. GRVTY XFLOW Switch - OFF.
2. FUEL CROSSFEED Switch - OFF.

Procedure completed

- **IF FUEL REMAINS IN CENTER TANK AND BOTH WING TANK FUEL QUANTITIES ARE LESS THAN APPROXIMATELY 2900 LBS. EACH**

NOTE

This procedure assumes that, in addition to a wing fuel imbalance, the pilot placed the CTR WING XFER switches to OFF and inadvertantly left them in that position. With normal fuel system operation, neither wing tank fuel quantity should be less than 2900 lbs. with fuel remaining in the center tank.

1. CTR WING XFER Switch (tank with least fuel) - NORM or ON; opposite wing XFER switch - OFF. Ensure center tank fuel is being transferred.

☐ **WHEN FUEL QUANTITY IS BALANCED**

1. CTR WING XFER Switch (opposite tank) - NORM or ON.

WARNING

SIMULTANEOUS USE OF CROSSFEED AND CENTER-TO-WING TRANSFER IS PROHIBITED WHEN BOTH WING FUEL QUANTITIES ARE LESS THAN 2900 LBS. GREATER FUEL IMBALANCE WILL OCCUR.

Procedure completed

- **NO FUEL IN CENTER TANK**

1. FUEL CROSSFEED Switch - AS REQUIRED select tank with most fuel.

Procedure completed

■ FUEL LEVEL LOW L-R

Indicates affected tank fuel quantity is less than 450 ±50 pounds. EICAS fuel quantity will turn amber at 500 pounds remaining.

● FUEL IN CENTER TANK (DUE TO CENTER WING XFER SWITCHES BEING OFF)

1. Both Center Wing XFER Switches - ON.

NOTE

A center-to-wing transfer valve may not open in NORM if the associated wing tank fuel quantity is less than 500 lbs.

2. Both Center Wing XFER Switches - NORM.

Procedure completed

● IF NO FUEL IN CENTER TANK

1. Fuel Crossfeed and/or Gravity XFLOW Transfer - AS REQUIRED.

Procedure completed

● IF OPPOSITE TANK AND/OR CENTER TANK FUEL NOT AVAILABLE

1. FUEL BOOST Switches - BOTH ON.
2. Land as soon as possible.

Procedure completed

■ FUEL MOTV FAIL L-R (FUEL MOTIVE FLOW SHUTOFF VALVE FAIL L-R)

Indicates the respective fuel motive flow shutoff valve has failed to close when crossfeed has been selected. Crossfeed from the opposite tank may not occur. Fuel will continue to feed from the affected tank.

1. FUEL CROSSFEED Switch - OFF (amber CAS message should clear).

● IF FUEL BALANCE IS NEEDED

1. GRVTY XFLOW Switch - L WING-R WING until fuel is balanced.

NOTE

Gravity crossflow will open the wing tanks to each other and to the engine feed tanks. Fuel balance is highly affected by sideslipping the airplane.

Procedure completed

■ FUEL PRESS LOW L-R (FUEL PRESSURE LOW L-R)

Indicates fuel supply pressure is low.

NOTE

If the respective FUEL BOOST switch is selected to NORM, a below normal fuel pressure condition should automatically turn on the respective fuel boost pump. The corresponding amber FUEL BOOST ON message should appear. When fuel pressure is restored by the fuel boost pump, the amber FUEL PRESS LOW L-R message should extinguish.

1. FUEL BOOST Switch (affected side) - ON.

● **IF FUEL PRESS LOW L-R MESSAGE CLEARS**

2. Refer to Amber Abnormal Procedures, FUEL BOOST ON L-R.

Procedure completed

● **IF FUEL BOOST PUMP IS INOPERATIVE (FUEL BOOST ON CAS MESSAGE DOES NOT APPEAR)**

2. Altitude - MAINTAIN, or DESCEND if practical. DO NOT CLIMB.

NOTE

- If fuel pressure is low, and the boost pump is failed, the engine may flame out at higher altitude.
- Do not attempt to crossfeed from the tank on the side with low pressure and a failed boost pump.

3. Land as soon as practical

Procedure completed

● **IF ENGINE FLAMES OUT**

1. Throttle (affected engine) - CUTOFF.
2. FUEL CROSSFEED Switch - SELECT OPPOSITE TANK.
3. Affected Engine - RESTART (at or below FL250), Refer to Abnormal Procedure INFLIGHT RESTART (NORMAL OR REVERSIONARY MODE).
   a. PAC ISOL VALVE - OPEN.
   b. Engine START BUTTON (affected engine) - PRESS.
   c. Throttle (affected engine) - IDLE at 10% N_2.
   d. Engine Instruments - MONITOR.
4. GRVTY XFLOW Switch - L WING-R WING.

NOTE

Maintain fuel balance using center-to-wing transfer and gravity crossflow. Gravity crossflow is highly sensitive to sideslipping the airplane.

5. Land as soon as practical.

Procedure completed

■ FUEL TEMP L-R (FUEL TEMPERATURE L-R)

Indicates fuel temperature (engine and/or tank) is above the maximum temperature limit or below the minimum temperature limit.

1. EICAS - CHECK FUEL (engine and tank) TEMPERATURES and engine oil temperature.

● **IF ENGINE FUEL TEMPERATURE IS BELOW MINIMUM**

1. Engine Instruments - CONTINUE TO MONITOR fuel and oil temperatures.

NOTE

This condition may occur during initial takeoff thrust application if engine oil temperature is low and fuel tank temperature is below -30°C. Refer to Normal Procedures, EXTREME COLD WEATHER OPERATION.

2. Land as soon as practical.

Procedure completed

● **IF ENGINE FUEL TEMPERATURE IS ABOVE MAXIMUM**

1. Throttle (affected engine) - REDUCE.

NOTE

- If fuel temperature is high, consider possible engine flameout due to vaporization.
- This condition may indicate faulty air cooled, or fuel cooled, engine oil cooler.

2. Land as soon as practical.

Procedure completed

● **IF TANK FUEL TEMPERATURE IS ABOVE OR BELOW LIMITS**

1. Modify flight profile to maintain temperature within limits.

NOTE

Refer to Section I, Figure 1-7 Fuel Limitations for type of fuel being used. CAS is set for the following fuel temperature limits: Tank fuel, +52°C maximum, -37°C minimum; engine fuel, +99°C maximum, +4°C minimum. These limits are applicable to Jet A, Jet A-1, JP-5 and JP-8 fuels.

Procedure completed

■ FUEL XFEED OPEN (FUEL CROSSFEED OPEN)

1. Fuel Quantity - CHECK.
2. Fuel Crossfeed - AS REQUIRED.

NOTE

Indicates that the fuel crossfeed valve is open and the non-feed fuel quantity is more than 50 lbs. greater than the feed tank quantity.

Procedure completed

■ FUEL XFEED XSIT (FUEL CROSSFEED IN TRANSIT)

Indicates that the fuel crossfeed valve is neither fully open nor fully closed. Crossfeed may not occur, depending on actual valve position.

● **IF NO CROSSFEED DESIRED OR UNABLE TO CROSSFEED**

1. FUEL BOOST Switches - BOTH ON.
2. FUEL CROSSFEED Switch - OFF.
3. GRVTY XFLOW Switch - L WING-R WING.

NOTE

- Gravity crossflow is slow with low wing fuel quantity difference and can be significantly influenced by sideslipping the airplane.
- With crossfeed off and the valve partially open, some crossfeed may occur due to differences in primary ejector pump pressure.

Procedure completed

■ FWC (FAULT WARNING COMPUTER)*

Indicates miscompare between FWCs. (Displayed above and to the left of compass rose in both PFDs.)

1. Fault Warning Computers - RESET.
   a. SG REV Switch - SG1; PAUSE for tubes to reset. (Resets FWC 2).
   b. SG REV Switch - NORM; PAUSE for tubes to reset.
   c. FADEC switches - RESET.
   d. SG REV Switch - SG2; PAUSE for tubes to reset. (Resets FWC 1).
   e. SG REV Switch - NORM; PAUSE for tubes to reset.
   f. FADEC switches - RESET.

NOTE

When SG1 and SG2 are selected, FADEC FAULT LB, RB, or LA, RA amber CAS messages will illuminate. Both engine FADECs will revert to FADEC ADC REV mode when all four FADECs are faulted. The FADECs can be reset in the SG NORM position by selecting the FADEC switches to RESET.

Procedure completed

(Continued Next Page)

* Denotes Primus 2000 Message

■ FWC (FAULT WARNING COMPUTER)* (Continued)

● FWC MESSAGE DOES NOT CLEAR

1. CAS Field - NOTE MESSAGES (this is FWC 1).
2. SG REV Switch - SG2.
3. CAS Field - NOTE MESSAGES (this is FWC 2).
4. CAS Field - DETERMINE VALIDITY of differing messages.
5. SG REV Switch - NORM or SG2 as required to display valid messages.
6. FADEC Switches - RESET (if SG REV is in NORM).

NOTE

If the SG REV switch is left in SG2, the FADEC FAULT LB, RB messages will remain illuminated. FADECs will operate normally on the “A” channel.

7. CAS Messages - TAKE APPROPRIATE ACTION.

Procedure completed

■ FWC 1-2 FAIL (FAULT WARNING COMPUTER 1-2 FAILURE)

● IF FWC 1 FAILED (INDICATED BY RED X IN CAS DISPLAY)

1. SG REV Switch - SG2. Confirm FWC 1 FAIL message and FADEC FAULT messages appear.

● IF FWC 2 FAILED (INDICATED BY FWC 2 FAIL CAS MESSAGE)

1. SG REV Switch - DO NOT SELECT SG2 REVERSION.

NOTE

Selecting SG2 will result in loss of all EICAS messages.

Procedure completed

■ GEN OFF L-R (GENERATOR OFF L-R)

1. GEN Switch (affected generator) - CHECK GEN; RESET AS REQUIRED.

● IF UNABLE TO RESET

1. Electrical Load - MONITOR; REDUCE as required.
2. APU Generator - AS REQUIRED (within APU limitations).

NOTE

Refer to Normal Proceudres, APU GROUND OR IN-FLIGHT START.

Procedure completed

* Denotes Primus 2000 Message

■ GS (GLIDESLOPE MISCOMPARE)*

Indicates FWC detects glideslope miscompare. Active only when both NAV receivers are tuned to the same ILS frequency. (Displayed on the right center of the attitude sphere on both PFDs.)

1. Glideslope Data - CROSSCHECK; DISREGARD GLIDESLOPE DATA if unable to confirm valid source.

Procedure completed

■ GROUND IDLE L-R

1. FADEC Switch (affected engine) - RESET.

Procedure completed

● **IF MESSAGE DOES NOT CLEAR**

1. FADEC Switch (affected engine) - SELECT OPPOSITE FADEC.

Procedure completed

● **IF MESSAGE STILL DOES NOT CLEAR**

1. GND IDLE Switch - HIGH.

Procedure completed

■ HDG (HEADING)*

Indicates heading miscompare. (Displayed above and to the right of the HSI on both PFDs.)

● **IF AHRS INSTALLED**

1. LH and RH AHRS Switches - CHECK IN SLV.

Procedure completed

● **IF IRS INSTALLED**

1. LH or RH IRS (if in attitude mode) - VERIFY HEADING.

Procedure completed

● **IF STILL MISCOMPARED**

1. PFD Heading Displays - DETERMINE WHICH AHRS OR IRS IS CORRECT.
2. AHRS or IRS REV Switch (faulty side) - SELECT AHRS OR IRS REV.

NOTE

On the ground, proximity to buildings or high energy buried cables may cause AHRS compass slaving unit errors. The slaving units are in each wing tip.

3. PFD Heading Displays - CONFIRM HDG 1 or 2 or DG 1 or 2 (AHRS), or MAG 1 or 2 or TRU 1 or 2 (IRS) are displayed in both PFDs and both MFDs.

Procedure completed

■ HDG1/HDG2 (HEADING 1/HEADING 2)*

Indicates both pilot and copilot displayed heading sources are from the same AHRS/IRS or both pilot and copilot displayed heading sources are cross-side AHRS/IRS. (Displayed above the HSI compass rose on both PFDs and both MFDs).

* Denotes Primus 2000 Message

■ HP DUCT O'PRESS L-R (HIGH PRESSURE DUCT OVERPRESSURE L-R)

1. Throttle (affected engine) - REDUCE if practical.

NOTE

The CAS message will cycle on and off and the HP firewall shutoff valve will automatically cycle closed and open until the throttle is reduced.

Procedure completed

■ HP PCOOLR O'HT L-R (HIGH PRESSURE PRECOOLER OVERHEAT L-R)

1. Throttle (affected engine) - REDUCE if practical.

Procedure completed

■ HYD O'TEMP A-B (HYDRAULIC OVERTEMPERATURE A-B)

Indicates an overtemperature condition (>93°C) exists in the affected hydraulic system.

1. Hydraulic Temperature and Pressure (affected system) - MONITOR.

NOTE

If temperature continues to increase, the HYD O'TEMP A-B red CAS message will illuminate.

● **IF AFFECTED SYSTEM HYDRAULIC PRESSURE IS NORMAL (3000 PSI)**

Procedure completed

● **IF AFFECTED SYSTEM HYDRAULIC PRESSURE IS ABOVE 3200 PSI**

1. HYDRAULIC PUMP "A" or HYDRAULIC PUMP "B" Switch (as applicable) - UNLOAD.
2. Refer to Amber Abnormal Procedures, HYD PUMP FAIL A or HYD PUMP FAIL B, as applicable.

Procedure completed

■ HYD PTU FAIL (HYDRAULIC POWER TRANSFER UNIT FAILURE)

Indicates the hydraulic PTU output ("A" system) pressure is low while "B" system pressure is normal. If both systems' pressures are normal, this warning is false and no action is required.

● **IF "A" HYDRAULIC SYSTEM PRESSURE IS LOW**

1. Refer to Amber Abnormal Procedures, HYD PUMP FAIL A.

NOTE

The PTU is not active if both "A" and "B" hydraulic systems are at normal system pressure.

Procedure completed

■ HYD PUMP FAIL A (HYDRAULIC PUMP FAILURE OR FLUID LOSS, A SYSTEM)

1. Hydraulic Pressure and Fluid Quantity - CHECK.

● **IF HYDRAULIC PRESSURE AND QUANTITY ARE NORMAL (PUMP NOT FAILED)**

1. Land as soon as practical. Use NORMAL Procedures.

Procedure completed

● **IF PRESSURE CYCLING (“A” PUMP FAILED AND PTU OPERATING)**

1. Land as soon as practical. Use NORMAL Procedures.
2. "A" aux hydraulic pump ON for landing.

Procedure completed

● **IF QUANTITY NORMAL AND HYD PTU FAIL CAS MESSAGE IS ILLUMINATED**

1. “A” AUX HYDRAULIC PUMP - ON.

NOTE

- Do not unload the “A” system pump if the PTU or the “A” aux hydraulic pump is operating. “A” system hydraulic fluid overtemperature may result.
- The HYD PTU FAIL CAS message, if illuminated, will extinguish when the "A" aux hydraulic pump is operating.

2. Land as soon as practical.
3. Flaps - 15° MAXIMUM.

Procedure completed

● **IF PRESSURE (DUE TO FAILED AUX PUMP) AND/OR QUANTITY ARE LOW (FLUID LOSS)**

NOTE

This condition will be accompanied by a HYD PTU FAIL CAS message.

1. HYDRAULIC PUMP “A” Switch - UNLOAD.

NOTE

Unloading the hydraulic pump will inhibit the HYD PUMP FAIL message.

2. HYDR B/PTU CONT Circuit Breaker - PULL.
3. Land as soon as practical. Flaps 15° MAXIMUM.

WARNING

- **DO NOT EXTEND FLAPS BEYOND 15° WITH EITHER HYDRAULIC SYSTEM DEPRESSURIZED. IF A SPEED BRAKE OR SPOILER CHECK VALVE FAILS TO SEAT, UNCOMMANDED ROLL MAY RESULT. RETRACT FLAPS TO 15° IF EXTENDED.**
- **DO NOT USE SPEED BRAKES IN FLIGHT UNLESS “A” HYDRAULIC SYSTEM PRESSURE IS ZERO. OUTBOARD SPEED BRAKE PANELS MAY NOT RETRACT.**

(Continued Next Page)

■ HYD PUMP FAIL A (HYDRAULIC PUMP FAILURE OR FLUID LOSS, A SYSTEM) (Continued)

NOTE

- In the case of either hydraulic system not being pressurized, the affected system flight control PCUs are not powered. PCU monitor protection is not available.
- If “A” hydraulic system is inoperative, the following subsystems will be inoperative: outboard roll spoilers, normal wheel brakes, antiskid, LH thrust reverser, outboard speed brake panels and normal gear extension/retraction. Nose wheel steering will have accumulator pressure only.

BEFORE LANDING

1. Landing Data - CONFIRM.
   a. Airspeed - V_{REF}.

V_{REF} (KIAS)

FLAPS/SLATS	WEIGHT - POUNDS							
	23,000	25,000	27,000	28,000	29,000	30,000	31,000	31,800
15°/Extended	113	119	124	127	129	132	135	137

   b. Multiply Normal **FLAPS 15°** Landing Distance by 1.6.

CAUTION

AVOID LANDING WITH TAILWIND OR DOWNHILL RUNWAY GRADIENT.

2. Crew Briefing - COMPLETE.
3. Avionics and Flight Instruments - CHECK/SET.
4. Minimums - SET (RA/BARO).
5. FUEL CROSSFEED - AS REQUIRED, then OFF.
6. ENG SYNC - OFF.
7. Exterior Lights - AS REQUIRED.
8. Flaps - 15° MAXIMUM.

WARNING

DO NOT EXTEND FLAPS BEYOND 15° WITH EITHER HYDRAULIC SYSTEM DEPRESSURIZED. IF A SPEED BRAKE OR SPOILER CHECK VALVE FAILS TO SEAT, UNCOMMANDED ROLL MAY RESULT. RETRACT FLAPS TO 15° IF EXTENDED.

(Continued Next Page)

■ HYD PUMP FAIL A (HYDRAULIC PUMP FAILURE OR FLUID LOSS, A SYSTEM) (Continued)

9. Passengers - BRIEF.
10. Seats/Seat Belts/Shoulder Harnesses/Aft Divider Sliding Doors - CHECK/SECURE/LATCHED OPEN (if belted toilet seat occupied).
11. Passenger Advisory Lights - PASS SAFETY.
12. IGNITION - NORM.
13. Pressurization - ZERO DIFFERENTIAL at touchdown.
14. Landing Gear - BLOW DOWN.
    a. Landing Gear Blowdown Handle - PULL (< 210 KIAS).
    b. Landing Gear - CHECK DOWN and LOCKED (3 green lights).
    c. Gear Handle - DOWN.

NOTE

Landing gear will not retract after blowdown.

15. Speed Brakes - RETRACTED.
16. EICAS - CHECK.
17. AIRSPEED - V_{REF}.

LANDING

1. Throttles - IDLE.
2. Speed Brakes - EXTEND at touchdown.
3. Elevator Control - FORWARD PRESSURE at touchdown.
4. Emergency Brake Handle - PULL and HOLD UNTIL STOPPED after nose wheel ground contact.

CAUTION

- REPEATED APPLICATION AND RELEASE MAY CAUSE PREMATURE LOSS OF PNEUMATIC PRESSURE.
- WHEN CLEAR OF THE RUNWAY, STOP AND SHUT DOWN. DO NOT ATTEMPT TO TAXI IN CLOSE PROXIMITY TO BUILDINGS OR OTHER AIRCRAFT USING EMERGENCY BRAKES.

NOTE

- The antiskid brake system does not function during emergency braking.
- Emergency brake pressure is regulated for optimum braking on most dry surfaces.

5. Right Thrust Reverser - DEPLOY WITH IDLE THRUST after nose wheel ground contact.

Procedure completed

■ HYD PUMP FAIL B (HYDRAULIC PUMP FAILURE OR FLUID LOSS, B SYSTEM)

1. "B" Hydraulic Pressure and Fluid Quantity - CHECK.

● **IF HYDRAULIC PRESSURE AND QUANTITY ARE NORMAL (PUMP NOT FAILED)**

1. Land as soon as practical.

Procedure completed

● **IF HYDRAULIC PRESSURE AND/OR QUANTITY ARE LOW (PUMP FAILED OR UNLOADED AND/OR FLUID LOSS)**

1. HYDRAULIC PUMP “B” Switch - UNLOAD.

NOTE

Unloading the hydraulic pump will inhibit the HYD PUMP FAIL message.

2. Rudder Standby System Pressure - CHECK.

□ **IF RUDDER STANDBY SYSTEM PRESSURE IS LOW**

1. RUDDER STBY Circuit Breaker - PULL (avoid running dry pump).
2. Land as soon as practical. Flaps 15° MAXIMUM.

Procedure completed

□ **IF RUDDER STANDBY SYSTEM PRESSURE IS NORMAL (MORE THAN 2200 PSI)**

1. Land as soon as practical. Flaps 15° maximum.

Procedure completed

WARNING

- **DO NOT EXTEND FLAPS BEYOND 15° WITH EITHER HYDRAULIC SYSTEM DEPRESSURIZED. IF A SPEED BRAKE OR SPOILER CHECK VALVE FAILS TO SEAT, UNCOMMANDED ROLL MAY RESULT. RETRACT FLAPS TO 15° IF EXTENDED**.

- **DO NOT USE SPEED BRAKES IN FLIGHT UNLESS “B” HYDRAULIC SYSTEM PRESSURE IS ZERO. INBOARD AND MIDDLE SPEED BRAKE PANELS MAY NOT RETRACT.**

NOTE

- In the case of either hydraulic system not being pressurized and the rudder standby system inoperative, the affected system flight control PCUs are not powered. PCU monitor protection is not available. Rudder PCU monitor protection is available if the RSS is operative.
- If “B” hydraulic system is inoperative, the following subsystems will be inoperative: PTU, inboard roll spoilers, inboard and middle speed brake panels, and RH thrust reverser.

(Continued Next Page)

■ HYD PUMP FAIL B (HYDRAULIC PUMP FAILURE OR FLUID LOSS, B SYSTEM) (Continued)

BEFORE LANDING

1. Landing Data - CONFIRM.
   a. Airspeed - V_{REF}.

V_{REF} (KIAS)

FLAPS/SLATS	WEIGHT - POUNDS							
	23,000	25,000	27,000	28,000	29,000	30,000	31,000	31,800
15°/Extended	113	119	124	127	129	132	135	137

   b. Multiply Normal **FLAPS 15°** Landing Distance by 1.3.

CAUTION

AVOID LANDING WITH TAILWIND OR DOWNHILL RUNWAY GRADIENT.

2. Crew Briefing - COMPLETE.
3. Avionics and Flight Instruments - CHECK/SET.
4. Minimums - SET (RA/BARO).
5. FUEL CROSSFEED - AS REQUIRED, then OFF.
6. ENG SYNC - OFF.
7. Exterior Lights - AS REQUIRED.
8. Flaps - 15° MAXIMUM.

WARNING

DO NOT EXTEND FLAPS BEYOND 15° WITH EITHER HYDRAULIC SYSTEM DEPRESSURIZED. IF A SPEED BRAKE OR SPOILER CHECK VALVE FAILS TO SEAT, UNCOMMANDED ROLL MAY RESULT. RETRACT FLAPS TO 15° IF EXTENDED.

9. Passengers - BRIEF.
10. Seats/Seat Belts/Shoulder Harnesses/Aft Divider Sliding Doors - CHECK/ SECURE/LATCHED OPEN (if belted toilet seat occupied).
11. Passenger Advisory Lights - PASS SAFETY.
12. IGNITION - NORM.
13. Pressurization - ZERO DIFFERENTIAL at touchdown.
14. Landing Gear - DOWN and LOCKED (3 green lights).
15. Speed Brakes - RETRACTED.
16. EICAS - CHECK.
17. Airspeed - V_{REF}.

LANDING

1. Throttles - IDLE.
2. Speed Brakes - EXTEND at touchdown.
3. Elevator Control - FORWARD PRESSURE at touchdown.
4. Brakes - APPLY after nose wheel ground contact.
5. Left Thrust Reverser - DEPLOY with IDLE THRUST after nose wheel ground contact.

Procedure completed

■ HYD PUMP UNLOAD A-B (HYDRAULIC PUMP UNLOAD A-B)

Indicates the respective hydraulic pump has been unloaded either by selecting the corresponding hydraulic “A” or “B” switch to UNLOAD or automatically, due to high hydraulic fluid temperature of faulty valve.

1. Respective hydraulic pump switch - CHECK.

● **IF SWITCH IS IN NORM AND RESPECTIVE SYSTEM HYDRAULIC PRESSURE IS LOW AND NO HYD O'TEMP MESSAGE**

1. Respective (HYDR A CONT or HYDR B/PTU CONT) Circuit Breaker - PULL.

□ **IF PRESSURE RECOVERS**

1. Land as soon as practical.

Procedure completed

□ **IF PRESSURE REMAINS LOW**

1. Refer to Amber Abnormal Procedures, HYD PUMP FAIL A or HYD PUMP FAIL B (except unload switch is inoperative).

Procedure completed

● **IF SWITCH IS IN UNLOAD DUE TO HYDRAULIC OVERTEMPERATURE**

1. Refer to Amber Abnormal Procedures, HYD PUMP FAIL A OR HYD PUMP FAIL B.

Procedure completed

■ HYD VOLUME LOW A-B (HYDRAULIC VOLUME LOW A-B)

1. Hydraulic Pressure and Fluid Quantity - CHECK.

● **IF HYDRAULIC FLUID QUANTITY IS LOW (<16%) AND PRESSURE IS NORMAL OR LOW (PROBABLE LEAK)**

1. HYDRAULIC PUMP “A” or “B” Switch (as applicable) - UNLOAD.
2. Refer to Amber Abnormal Procedures, HYD PUMP FAIL A or HYD PUMP FAIL B.

Procedure completed

■ IAC 1-2 O’TEMP (INTEGRATED AVIONICS COMPUTER 1-2 OVERTEMPERATURE)

1. SG REV Switch - OPPOSITE SG.

NOTE

- FADEC FAULT L and R, A or B, and BUS CTRL 1 or 2 (relative to the failed IAC) amber CAS messages will also illuminate. No further action is required for these messages.
- Pulling the IAC circuit breaker will remove power from the respective FMS. If using FMS NAV, select opposite FMS on the affected side.

2. Affected IAC Circuit Breaker - PULL.
3. Land as soon as practical.

Procedure completed

■ IAC TEST INOP 1-2 (INTEGRATED AVIONICS COMPUTER BUILT-IN TEST INOPERATIVE 1-2)

This message is inhibited in flight and must be corrected prior to takeoff.

Indicates that the respective IAC built in test did not accomplish all power-up tests due to invalid weight-on-wheels signal. This message does not necessarily imply invalid weight-on-wheels logic to other airplane systems.

■ IAS (INDICATED AIRSPEED MISCOMPARE)*

Indicates FWC detects airspeed miscompare. (Displayed within the airspeed scale on both PFDs.)

1. Pilot/Copilot Airspeed - COMPARE with standby instruments.
2. ADC REV Switch (faulty side) - SELECT ADC REV.
3. Confirm ADC1 or ADC2 is displayed in both PFDs.

Procedure completed

■ J-BOX LIMITER OPEN L-R

Indicates both J-Box limiters are open preventing recharging of the batteries. The interior, emergency, and EICAS buses are powered only from the batteries.

1. Interior Master Switch - OFF.

● **IF APU CAN BE STARTED (AT OR BELOW FL310)**

1. APU - START
2. APU Generator - ON (will supply power to above systems).
3. Land as soon as practical. Refer to Normal Procedures, BEFORE LANDING.

Procedure completed

● **IF APU CANNOT BE STARTED OR ALTITUDE GREATER THAN FL310 MUST BE MAINTAINED**

1. BATT 1 and BATT 2 Switches - AS REQUIRED.

NOTE

The batteries will supply power for approximately 30 minutes depending on load. Consideration should be given to selecting battery switches OFF to conserve battery power until needed. Once the batteries become depleted, the EICAS, emergency, and interior bus items will be lost and the APU cannot be started.

2. Land as soon as practical. Use the appropriate Normal or Abnormal Landing Procedure.

Procedure completed

* Denotes Primums 2000 Messages

■ LATERAL MODE OFF

Indicates the flight guidance computer has dropped the lateral mode. Clears after five seconds. Normally due to pilot action.

1. Flight Guidance Computer - VERIFY SELECTED MODES.

Procedure completed

■ LOAD SHED

1. LOAD SHED Switch - O'RIDE.

- **IF MESSAGE CLEARS**

  Procedure completed

- **IF MESSAGE DOES NOT CLEAR**

  1. Batteries - CHECK VOLTAGE (EICAS SELECT).

  □ **IF BATTERY VOLTAGE LESS THAN SYSTEM VOLTAGE (NOT CHARGING)**

  1. Land as soon as practical (within 30 minutes).

  NOTE

  Items powered from the emergency bus are now powered only from the batteries and will cease to function when the batteries are depleted.

  2. Refer to BEFORE DESCENT FOR LANDING, this procedure.

  Procedure completed

  ○ **IF UNABLE TO LAND WITHIN 30 MINUTES**

  1. Establish cruise altitude and airspeed.
  2. BATT 1 and BATT 2 Switches - OFF.

(Continued Next Page)

■ LOAD SHED (Continued)

NOTE

With the LOAD SHED relay open and the battery switches off, the following emergency bus items will be inoperative:

Both Rudder Limiters	"A" AUX Hydraulic Pump
Pilot and Copilot Audio Panels	Upper Rudder Actuator
Audio Warnings	Pitch Feel
VHF Comm 1	Rudder Trim
VHF Nav 1	Aileron Trim
RMU 1	Secondary Stabilizer Trim
Standby Nav/Comm	APU
Standby HSI	Engine Start Logic
Standby Attitude*	Both Engine A and B FADECs (ADC rev Mode)
Standby Pitot/Static Heat	Engine Fire Detect and Extinguishers
Auxiliary Panel Lights	Firewall Shutoff - Fuel and Hydraulic
AHRS 1 or IRS 1	Standby Engine Instruments*
Emergency Lighting**	Landing Gear Control and Indication Lights (Except Retract)
MADC 1	HF Radio 1 (750-0023 and on, if installed)
LH Windshield Heat	

* Powered until Standby Battery depletes
** Powered until emergency light battery pack depletes

○ **IF ALTITUDE, AIRSPEED OR TRIM CHANGES REQUIRED**

1. BATT 1 or BATT 2 Switch - BATT (ON) (alternate).
2. Altitude, Airspeed, Trim - AS REQUIRED.
3. BATT Switches - OFF (in stable cruise).

Procedure completed

● **BEFORE DESCENT FOR LANDING**

1. BATT 1 and BATT 2 Switches - BATT (ON).
2. Land as soon as practical (within 30 minutes). Refer to the FAA Approved Flight Manual, Section IV, Performance, APPROACH AND LANDING.

■ LOC (LOCALIZER MISCOMPARE)*

Indicates FWC detected localizer miscompare. Active only if both NAVs are tuned to the same ILS frequency. (Displayed below and right of attitude sphere on both PFDs.)

1. NAV Sources - ATTEMPT TO DETERMINE which NAV source is correct and select that source on both sides.

IF UNABLE TO DETERMINE

1. Execute missed approach (unless runway is in sight).

Procedure completed

* Denotes Primus 2000 Messages

■ MACH TRIM OFF

1. Flight Guidance Computer - SELECT OPPOSITE FGC.

IF MESSAGE REMAINS

1. Mach Speed - 0.82 MAXIMUM.

NOTE

- Mach trim will be inactive if primary trim fails or as a result of FGC failures.
- Overspeed warning will sound until Mach is at or below 0.82.

Procedure completed

■ MAG 1/MAG 2 (MAGNETIC 1 / MAGNETIC 2)*

Indicates both pilot and copilot displayed heading sources are from the same IRS or both pilot and copilot displayed heading sources are cross-side IRS. (Displayed above the HSI compass rose on both PFDs and MFDs. Applicable with IRSs in the MAGNETIC mode.)

■ MAX SPD (MAXIMUM SPEED)*

Indicates FGC overspeed protection active. (Displayed to the right of the airspeed scale in both PFDs.)

1. Reduce Speed.

Procedure completed

■ MIN (MINIMUM)*

Indicates radio altitude or barometric altitude less than or equal to decision height or minimum descent altitude. (Displayed within the ADI sphere on both PFDs.)

NOTE

AURAL ALERT “Minimums” - “Minimums” will be activated.

■ MSG (MESSAGE)*

Indicates message available in FMS. (Displayed to the left of the HSI in both PFDs.)

■ NOSE DOOR OPEN L-R

Indicates Nose Avionics Compartment Door not fully closed.

1. Reduce speed as required.
2. Land as soon as practical.

Procedure completed

* Denotes Primus 2000 Messages

■ NOSE WHL STR INOP (NOSE WHEEL STEERING INOPERATIVE)

1. Directional Control - MAINTAIN (rudder and differential brakes).

NOTE

This message is operative on ground only.

Procedure completed

■ OIL LEVEL LOW L-R

1. Oil Quantity - CHECK (EICAS, ENG).
2. Oil Pressure/Temperature - MONITOR.
3. Plan for possibility of shutting engine down. Refer to Abnormal Procedures, ENGINE FAILURE/PRECAUTIONARY SHUTDOWN.

Procedure completed

■ P/S-RAT HEAT OFF (PITOT-STATIC/RAM AIR TEMPERATURE HEAT OFF)

Indicates PITOT-STATIC heat switches are off in flight.

1. PITOT/STATIC Switches - LH/RH (ON).

Procedure completed

■ PARK BRK/LOW PRESS (PARKING BRAKE/LOW PRESSURE)

1. Parking Brake - CHECK, SET if required (“A” AUX PUMP ON).

NOTE

In flight this message should be accompanied by the PARK BRAKE ON amber CAS message.

Procedure completed

■ PARK BRAKE ON

Indicates parking brake handle is pulled up in flight.

1. Parking Brake Handle - DOWN.

Procedure completed

PITCH FEEL FAIL

1. Autopilot - OFF.
2. Airspeed - 250 KIAS/0.80 MACH MAXIMUM.
3. Altitude - 41,000 FEET MAXIMUM.

NOTE

Avoid making abrupt elevator inputs when airspeed is greater than 150 KIAS. Proper elevator feel scheduling cannot be assured. Pitch control forces may be lighter or heavier than normal.

4. Land as soon as possible. Plan stabilized approach. Refer to Normal Procedures, APPROACH AND LANDING.

Procedure completed

■ PITCH/ROLL DISC (PITCH/ROLL DISCONNECTED)

NOTE

- Indicates that the pitch-roll disconnect handle has been pulled up or stowed incorrectly. If a single axis has been reconnected, the message will remain displayed.
- Autopilot will disengage and will not reengage.

IF NOT INTENTIONAL

1. Pitch/Roll Disconnect Handle - PITCH/ROLL RECONNECT, THEN PUSH DOWN AND ROTATE TO NORM.

CAUTION

DO NOT ATTEMPT TO PUSH THE HANDLE DOWN IN ANY POSITION OTHER THAN PITCH/ROLL RECONNECT. IT WILL NOT STOW PROPERLY.

2. Aileron/Elevator Controls - CHECK BOTH SIDES CONNECTED.

Procedure completed

■ PITOT HTR FAIL L-R, SB (PITOT HEATER FAILURE L-R, STANDBY)

1. Airspeed/Altitude (affected system) - COMPARE WITH UNAFFECTED SYSTEMS.

IF DEGRADED

1. ADC REV Switch (faulty side) - SELECT ADC REV.
2. Leave icing conditions as soon as practical.

Procedure completed

■ PRI STAB TRIM FAIL (PRIMARY STABILIZER TRIM FAILURE)

1. SECONDARY TRIM Switch - ON (lift guard).
2. Horizontal Stabilizer - TRIM.
3. Airspeed - 0.82 MACH MAXIMUM (new airspeed redline displayed).
4. Altitude - 41,000 FEET MAXIMUM.

NOTE

Mach trim and autopilot will be inoperative.

Procedure completed

IF UNABLE TO TRIM

1. Refer to Abnormal Procedures, JAMMED STABILIZER TRIM SYSTEM.

Procedure completed

■ RA (RADIO ALTIMETER MISCOMPARE)*

Indicates FWC detects radio altimeter miscompare if dual radio altimeters installed. (Displayed in the ADI sphere in both PFDs.)

1. DH/MDA - USE BARO MINIMUMS (if applicable).

Procedure completed

■ RAT HEAT FAIL L-R (RAM AIR TEMPERATURE HEAT FAILURE L-R)

NOTE

- If in icing conditions, improper RAT information may be supplied to the FADECs. FADECs will compensate automatically; however, a FADEC FAULT message may result. Refer to Amber Abnormal Procedures, FADEC FAULT L A-B, R A-B
- SAT displayed on the affected side may be inaccurate.

1. Leave icing conditions as soon as practical.

Procedure completed

■ RAT PROBE FAIL L-R (RAM AIR TEMPERATURE PROBE FAILURE L AND R)

NOTE

- Both engines will be in ADC Reversionary Mode.
- RAT PROBE FAIL amber CAS message indicates failure of both RAT probes. Single probe failure will be indicated by a cyan message.
- SAT and RAT will not be displayed in the cockpit.

1. Refer to Amber Abnormal Procedures, FADEC REV ADC- L-R.

Procedure completed

* Denotes Primus 2000 Messages

■ RETRIM L-R WING DOWN

Indicates that the autopilot is detecting a lateral/directional mistrim.

1. Rudder Trim - CHECK/SET.

NOTE

Rudder trim has a large influence on lateral trim. Check directional trim before retrimming aileron.

2. Aileron Trim - TRIM WING DOWN in direction indicated, if still required.
3. Fuel Quantity - CHECK/BALANCED.

Procedure completed

■ RETRIM NOSE UP-DOWN

Indicates that the autopilot is detecting a longitudinal mistrim.

1. AP/TRIM/NWS Disengage Button - PRESS (expect out-of-trim pitch forces).
2. Stabilizer Trim - RETRIM.

Procedure completed

■ RUD STBY SYS FAIL (RUDDER STANDBY SYSTEM FAILURE)

● **IF RUDDER STANDBY PRESSURE <2200 OR >3200 PSI (FLIGHT CONTROLS NOT REVERSIONARY)**

1. RUDDER STBY Circuit Breaker - PULL.
2. Land as soon as practical.

Procedure completed

● **IF PRESSURE IS NORMAL**

1. EICAS Message - RESET.
   a. SG REV Switch - SG1 (allow tubes to reset; resets FWC 2).
   b. SG REV Switch - NORM (allow tubes to reset).
   c. FADEC Switches - RESET.
   d. SG REV Switch - SG2 (allow tubes to reset; resets FWC 1).
   e. SG REV Switch - NORM.
   f. FADEC Switches - RESET.

NOTE

The RUD STBY SYS FAIL message will appear and latch on when triggered by excessive pump run time or by applying power to the EICAS with the RUDDER STBY circuit breaker pulled.

Procedure completed

● **IF MESSAGE REPEATS**

1. RUDDER STBY Circuit Breaker - PULL.
2. Land as soon as practical.

Procedure completed

■ RUD LIMIT FAIL A-B (RUDDER LIMIT FAIL A-B)

1. Rudder Limit - CHECK (EICAS, CTRL POS).
2. Land as soon as practical. Consider crosswind.

NOTE

- Single engine controllability may be limited at low airspeed.
- Indicates failure of a single rudder limiter. This failure may restrict rudder travel to less than normal as airspeed is reduced and may reduce nose wheel steering through the rudder pedals after landing.
- Normal lower rudder travel limit varies from $\pm$30° (100%) at 140 KIAS to $\pm$4° (14%) at 330 KIAS and above.
- The green area on the rudder position display (as indicated on the CAS CTRL POS page) indicates available travel, the area will vary with airspeed.
- If available rudder travel limit (as indicated on the CAS CTRL POS page) is less than 70%, limit crosswind to 10 knots.
- At 140 KIAS and slower, RUDDER LIMIT FAIL EICAS message will extinguish. DO NOT ASSUME FAILURE HAS CLEARED. Available rudder travel limits must be verified on the CAS CTRL POS page.

Procedure completed

■ SEC STAB TRIM FAIL (SECONDARY STABILIZER TRIM FAILURE)

1. Refer to Abnormal Procedures, JAMMED STABILIZER TRIM SYSTEM.

■ SG 1/SG 2 (SYMBOL GENERATOR 1/SYMBOL GENERATOR 2)*

Indicates symbol generator reversionary mode selected. (Displayed in ADI sphere on both PFDs and top of both MFDs.)

■ SG 1-2 FAIL (SYMBOL GENERATOR 1-2 FAILURE)

1. SG REV Switch - SELECT OPPOSITE SG.

NOTE

Loss of either SG is indicated by loss of mutiple displayed units (DU 1-3 if SG1, DU 4 and 5 if SG2).

Procedure completed

* Denotes Primus 2000 messages

■ SLAT A/I COLD L-R (SLAT ANTI-ICE COLD L-R)

1. Throttle (affected side) - INCREASE.

● **IF MESSAGE REMAINS AND WING A/I COLD MESSAGE NOT ILLUMINATED**

1. SLAT ANTI-ICE Switch - OFF (to prevent asymmetric icing unless it can be visually verified that the slat is anti-icing).
2. Leave icing environment as soon as practical.

NOTE

This message will be CYAN if the WING BLD LEAK CAS message is on. Refer to Amber Abnormal Procedures, WING BLD LEAK.

Procedure completed

☐ **IF ICE IS NOT A FACTOR FOR LANDING**

Procedure completed

☐ **IF LANDING WITH RESIDUAL ICE ON THE SLAT**

1. Refer to Abnormal Procedures, LANDING WITH RESIDUAL ICE.

Procedure completed

● **IF MESSAGE REMAINS AND WING A/I COLD MESSAGE IS ALSO ILLUMINATED**

1. Refer to Amber Abnormal Procedures, WING A/I COLD L-R.

Procedure completed

■ SLAT A/I HOT L-R (SLAT ANTI-ICE HOT L-R)

NOTE

- Slat anti-ice will automatically shut off with HOT message and turn on when message clears. Heat damage is not likely.
- Anti-ice HOT monitors are enabled when the anti-ice system is on or off. If the HOT message is on when the anti-ice system is selected off, the problem can be assumed to be a faulty temperature sensor, provided it can be verified that the anti-ice system is off (ITT, N_1, etc.).

● **IF MESSAGE CYCLES**

1. Anti-ice System - MONITOR.
2. Slats - VISUALLY MONITOR for anti-icing.

Procedure completed

● **IF MESSAGE IS STEADY**

1. SLAT ANTI-ICE Switch - OFF, THEN ON when message clears.
2. Slats - VISUALLY MONITOR for anti-icing.
3. Leave icing conditions as soon as practical.

Procedure completed

■ RUDDER LIMIT FAIL

1. Rudder Limit - CHECK (EICAS, CTRL POS).
2. Land as soon as practical. Consider crosswind.

NOTE

- Single engine controllability may be limited at low airspeed.
- Indicates failure of a single rudder limiter. This failure may restrict rudder travel to less than normal as airspeed is reduced and may reduce nose wheel steering through the rudder pedals after landing.
- Normal lower rudder travel limit varies from ±30° (100%) at 140 KIAS to ±4° (14%) at 330 KIAS and above.
- The green area on the rudder position display (as indicated on the CAS CTRL POS page) indicates available travel, the area will vary with airspeed.
- If available rudder travel limit (as indicated on the CAS CTRL POS page) is less than 70%, limit crosswind to 10 knots.
- At 140 KIAS and slower, RUDDER LIMIT FAIL EICAS message will extinguish. DO NOT ASSUME FAILURE HAS CLEARED. Available rudder travel limits must be verified on the CAS CTRL POS page.

Procedure completed

■ SEC STAB TRIM FAIL (SECONDARY STABILIZER TRIM FAILURE)

1. Refer to Abnormal Procedures, JAMMED STABILIZER TRIM SYSTEM.

■ SG 1/SG 2 (SYMBOL GENERATOR 1/SYMBOL GENERATOR 2)*

Indicates symbol generator reversionary mode selected. (Displayed in ADI sphere on both PFDs and top of both MFDs.)

■ SG 1-2 FAIL (SYMBOL GENERATOR 1-2 FAILURE)

1. SG REV Switch - SELECT OPPOSITE SG.

NOTE

Loss of either SG is indicated by loss of mutiple displayed units (DU 1-3 if SG1, DU 4 and 5 if SG2).

Procedure completed

* Denotes Primus 2000 messages

■ SLAT A/I COLD L-R (SLAT ANTI-ICE COLD L-R)

1. Throttle (affected side) - INCREASE.

● **IF MESSAGE REMAINS AND WING A/I COLD MESSAGE NOT ILLUMINATED**

1. SLAT ANTI-ICE Switch - OFF (to prevent asymmetric icing unless it can be visually verified that the slat is anti-icing).
2. Leave icing environment as soon as practical.

NOTE

This message will be CYAN if the WING BLD LEAK CAS message is on. Refer to Amber Abnormal Procedures, WING BLD LEAK.

Procedure completed

☐ **IF ICE IS NOT A FACTOR FOR LANDING**

Procedure completed

☐ **IF LANDING WITH RESIDUAL ICE ON THE SLAT**

1. Refer to Abnormal Procedures, LANDING WITH RESIDUAL ICE.

Procedure completed

● **IF MESSAGE REMAINS AND WING A/I COLD MESSAGE IS ALSO ILLUMINATED**

1. Refer to Amber Abnormal Procedures, WING A/I COLD L-R.

Procedure completed

■ SLAT A/I HOT L-R (SLAT ANTI-ICE HOT L-R)

NOTE

- Slat anti-ice will automatically shut off with HOT message and turn on when message clears. Heat damage is not likely.
- Anti-ice HOT monitors are enabled when the anti-ice system is on or off. If the HOT message is on when the anti-ice system is selected off, the problem can be assumed to be a faulty temperature sensor, provided it can be verified that the anti-ice system is off (ITT, N_1, etc.).

● **IF MESSAGE CYCLES**

1. Anti-ice System - MONITOR.
2. Slats - VISUALLY MONITOR for anti-icing.

Procedure completed

● **IF MESSAGE IS STEADY**

1. SLAT ANTI-ICE Switch - OFF, THEN ON when message clears.
2. Slats - VISUALLY MONITOR for anti-icing.
3. Leave icing conditions as soon as practical.

Procedure completed

■ SLATS ASYMMETRY

NOTE

- Slat asymmetry will result if both slats are neither fully retracted nor fully extended. Full asymmetry will not create a hazardous roll condition, provided the airplane is not slowed below stick shaker speed.

- If it cannot be verified that both slats extend, assume slats retracted for landing.

1. Flap/Slat Selector - UP (unless needed for approach).

IF STILL ASYMMETRIC

2. AP/TRIM/NWS Disengage Button - PRESS (if autopilot is engaged).
3. Control Wheel - APPLY OPPOSITE INPUT as required.
4. Airspeed - 250 KIAS MAXIMUM.
5. Rudder and Aileron Trim - AS REQUIRED.
6. Land as soon as practical. Refer to Abnormal Procedures, LANDING WITH FLAPS OR SLATS INOPERATIVE.

Procedure completed

■ SLATS FAIL

● SLATS DO NOT EXTEND

1. Refer to Abnormal Procedures, LANDING WITH FLAPS OR SLATS INOPERATIVE.

Procedure completed

● SLATS REMAIN EXTENDED

1. A-B Control - CHECK.
2. Slat CBs (Pilot CB Panel) - CHECK.

Procedure completed

☐ IF SLATS STILL EXTENDED

1. Airspeed - 250 KIAS (maximum).
2. Land as soon as practical - NORMAL Landing Procedures.

Procedure completed

■ SPEED BRAKES

1. Speed Brake Lever - STOW.

NOTE

- Speed brakes extended on final approach can result in high sink rate upon throttle reduction.
- Indicates speed brakes are extended below 500 feet AGL and flaps are extended to any position.

Procedure completed

■ STAB A/I COLD L-R (STABILIZER ANTI-ICE COLD L-R)

1. Anti-ice Switches - CHECK.
2. Throttles - INCREASE.

NOTE

This message will also illuminate if the affected STABILIZER anti-ice switch is OFF and either engine anti-ice switch or the opposite anti-ice switch is ON.

● IF MESSAGE REMAINS

1. Leave icing environment as soon as possible.

Procedure completed

● IF IT IS LIKELY THAT ICE IN ANY AMOUNT HAS FORMED ON THE STABILIZER

1. Refer to Abnormal Procedures, LANDING WITH RESIDUAL ICE.

Procedure completed

■ STAB A/I HOT L-R (STABILIZER ANTI-ICE HOT L-R)

NOTE

The STAB A/I HOT monitor is enabled whether or not the anti-ice is on. If stabilizer anti-ice can be verified to be OFF (Switches, N_2, ITT), this message may be a monitor failure.

● **IF MESSAGE CYCLES**

1. Anti-ice System - MONITOR.

NOTE

Stabilizer anti-ice will automatically shut off with hot message and turn on after message clears. Heat damage is not likely.

Procedure completed

● **IF MESSAGE IS STEADY**

1. STABILIZER ANTI-ICE Switch (affected side) - CYCLE OFF 1 MINUTE THEN ON IF NEEDED.
2. Leave icing conditions as soon as practical.

Procedure completed

● **ON GROUND**

1. Throttle (affected side) - REDUCE.

Procedure completed

■ STAB TRIM MISCMP (STABILIZER TRIM MISCOMPARE)

Indicates disagreement between stabilizer trim position displayed on EICAS and that sensed by the autopilot. This message is disabled in flight.

1. Correct prior to flight.

Procedure completed

■ STALL WARN L-R

1. Opposite Side Low Speed Awareness Data - MONITOR AT LOW AIRSPEED.

● **IF BOTH**

1. Airspeed - MAINTAIN ≥ 50 KIAS ABOVE STALL SPEED (except for landing).
2. Bank Angle - 30° MAXIMUM.

WARNING

- **STALL WARNING STICK SHAKER WILL BE INOPERATIVE.**
- **AUTOMATIC SLAT EXTENSION FUNCTION WILL BE INOPERATIVE.**
- **MINIMUM SPEED AND RESPECTIVE LOW SPEED AWARENESS SYSTEM WILL BE INOPERATIVE.**

Procedure completed

■ START VLV OPEN L-R (START VALVE OPEN L-R)

Indicates the start valve is open after the start sequence is completed.

● IN FLIGHT

1. Engine START DISENGAGE Button - PRESS.
2. START Circuit Breaker (affected side) - PULL.

Procedure completed

◻ IF MESSAGE REMAINS

1. Land as soon as possible.

AFTER LANDING, IF STILL OPEN PRIOR TO SHUTDOWN

CAUTION

DO NOT SHUT THE ENGINE DOWN WITH THE START VALVE OPEN AND BLEED AIR ON. AIR TURBINE STARTER DRIVE SHAFT DAMAGE MAY RESULT.

1. Both ENG BLD AIR and APU BLEED AIR Switches - OFF (prior to shutdown).

Procedure completed

● ON GROUND AFTER START

1. Engine START DISENGAGE Button - PRESS.

◻ IF MESSAGE REMAINS

1. Both ENG BLD AIR and APU BLEED AIR Switches - OFF (prior to shutdown)

Procedure completed

■ STATIC HT FAIL L-R (STATIC HEATER FAILURE L-R)

1. Airspeed/Altitude (affected system) - COMPARE WITH UNAFFECTED SYSTEMS.
2. Leave icing environment as soon as practical.
3. Maintain zero sideslip - OBSERVE SLIP and LATERAL ACCELERATION INDICATORS.

Procedure completed

■ TAILCONE BLD LEAK (TAILCONE BLEED LEAK)

NOTE

- Indicates possible bleed air leak in the tailcone near the PACs.
- May occur during long ground operations in hot ambient conditions with engine or APU bleed on.

1. L and R ENG BLD AIR and APU BLEED AIR Switches - OFF one at a time, CHECK for message to clear.

Procedure completed

■ TAILCONE DOOR OPEN

Indicates tailcone door is not closed.

1. Land as soon as practical.

Procedure completed

■ TCAS FAIL*

Indicates TCAS failure has occurred. This message will appear in both PFDs and in both MFDs if traffic is selected on the MFD.

■ TOILET DOOR OPEN

1. Land as soon as practical.

Procedure completed

■ TRIM SW FAIL L-R

Indicates monitor has detected failure of one half of the respective primary pitch trim switch. This message will also illuminate if one half of the switch is depressed for more than 25 seconds. The respective trim switch will remain inactive.

1. Pitch Trim - USE OPPOSITE SWITCH.

Procedure completed

* Denotes Primus 2000 Messages

■ TR AUTOSTOW L-R (THRUST REVERSER AUTOSTOW L-R) TR NOT DEPLOYED

WARNING

THROTTLE MUST BE MOVED TO IDLE STOP TO RESET FADEC LOGIC AND REGAIN CONTROL OF THRUST. FADECS WILL REDUCE ENGINE TO IDLE IN EVENT OF INADVERTENT THRUST REVERSER DEPLOYMENT BUT WILL NOT MOVE THE THROTTLE TO THE IDLE POSITION.

NOTE

Thrust reverser partial or full deployment and autostow has occurred and the respective throttle is not fully against the idle stop. The autostow message will not illuminate if the throttle is at idle when the autostow occurs.

1. Throttle (affected engine) - IDLE, THEN NORMAL OPERATION.
2. Stow Switch (affected engine) - EMER.
3. Land as soon as practical.

Procedure completed

■ TRU 1/TRU 2 (TRUE 1/TRUE 2)*

Indicates the respective IRS if installed, has been selected to the True Heading mode. (Displayed above the HSI compass rose on the respective PFD and MFD.) Also, if pilot and copilot displayed heading sources are from the same IRS or both pilot and copilot displayed heading sources are cross-side IRS. (Displayed above the HSI compass rose on both PFDs and MFDs.)

■ VERTICAL MODE OFF

Indicates the flight guidance computer has disengaged the vertical modes, most likely due to pilot action.

1. Flight Guidance Computer - VERIFY SELECTED MODES.

Procedure completed

■ VSPD (V SPEED)*

Indicates takeoff speeds are not set on ground. (Displayed below airspeed scale in both PFDs.)

1. Enter appropriate takeoff speeds.

Procedure completed

* Denotes Primus 2000 Messages

■ WING A/I COLD L-R (WING ANTI-ICE COLD L-R)

1. Anti-ice Switches - CHECK.
2. Throttle (affected engine) - INCREASE.

Procedure completed

● IF PAC HP VLV OPN MESSAGE IS DISPLAYED

1. PAC BLEED SELECT Switch - LP.

Procedure completed

● IF MESSAGE REMAINS

1. ANTI-ICE WING XOVER Switch - WING XOVER (will require increased engine thrust on the opposite engine).
2. Leave icing conditions as soon as practical.

□ IF ICE ON WING OR SLAT IS NOT A FACTOR FOR LANDING

1. Refer to NORMAL Landing Procedures.

Procedure completed

□ IF LANDING WITH RESIDUAL ICE ON THE WING OR SLAT

1. Refer to Abnormal Procedures, LANDING WITH RESIDUAL ICE.

NOTE

- This message will be CYAN if the WING BLD LEAK message is on. Refer to Amber Abnormal Procedures, WING BLD LEAK.
- This message will illuminate if the respective engine ant-ice switch is OFF and the WING XOVER is OFF and the opposite engine anti-ice or either stabilizer anti-ice switch is on.

Procedure completed

■ WING A/I HOT L-R (WING ANTI-ICE HOT L-R)

● IF MESSAGE CYCLES

1. Anti-ice System - MONITOR.

NOTE

Wing anti-ice (and slat, if it was turned on) will automatically be shut off with WING A/I HOT message displayed and then turn on when the message clears. Heat damage is not likely.

2. Wing and Slats - VISUALLY MONITOR for anti-icing.
3. Leave icing conditions as soon as practical.

Procedure completed

(Continued Next Page)

■ WING A/I HOT L-R (WING ANTI-ICE HOT L-R) (Continued)

● IF MESSAGE IS STEADY

1. Throttle (affected engine) - REDUCE.
2. Leave icing conditions as soon as practical.

NOTE

- If the message remains with the throttle at IDLE, it may then be considered to be a nuisance message.
- The WING A/I HOT monitor is enabled whether or not the anti-ice is on. If wing and slat anti-ice can be verified to be off (switches, N_2, ITT), this message may be a monitor failure.

Procedure completed

● ON GROUND

1. Throttle (affected engine) - REDUCE.

Procedure completed

■ WING BLD LEAK L-R (WING BLEED LEAK L-R)

1. Throttle (affected engine) - REDUCE.

NOTE

Indicates a bleed leak in the over-wing fairing.

2. ANTI-ICE WING XOVER Switch - WING XOVER (will require increased opposite engine thrust).
3. Leave icing conditions as soon as practical.

NOTE

- The WING BLD LEAK monitor is enabled whether or not the anti-ice is on. If wing and slat anti-ice can be verified to be off (switches, N_2, ITT), this message may be a monitor failure.
- The associated wing anti-ice valve closes automatically when the wing BLD LEAK L-R message is displayed. The valve will stay closed after the sensor cools and the message has cleared.
- WING or SLAT COLD message is cyan if the WING BLD LEAK monitor is active.

Procedure completed

■ WING CUFF COLD L-R

1. Leave icing conditions as soon as practical.

Procedure completed

■ WING CUFF HOT L-R

● IF MESSAGE CYCLES

1. Anti-ice System - MONITOR.

NOTE

The wing cuff will cycle off and on if the cuff overheats.

Procedure completed

● IF MESSAGE STAYS ON STEADY

1. Affected Side ENG/WING Anti-ice Circuit Breaker - PULL.
2. Affected Side ENGINE Anti-ice Switch - OFF.

NOTE

Power will be removed from the wing cuff. The affected engine anti-ice valve and the wing anti-ice valves will remain open. Automatic wing overtemp protection will not be available when the circuit breaker is out.

3. Leave icing conditions as soon as practical.

Procedure completed

■ WING TANK O'FULL L-R (WING TANK OVERFULL L-R)

1. CTR WING XFER Switch (affected side) - OFF, THEN ON as required to maintain fuel balance.

NOTE

Indicates possible failure of the single point automatic shutoff (on ground) or center tank to wing transfer shutoff.

Procedure completed

■ WSHLD HEAT INOP L-R (WINDSHIELD HEAT INOPERATIVE L-R)

1. Leave icing conditions as soon as practical.

NOTE

- Defog capability will be reduced on affected windshield sections.
- Message may cycle if windshield temperature controller has failed.

Procedure completed

■ WSHLD O'TEMP L-R (WINDSHIELD OVERTEMPERATURE L-R)

- **IF MESSAGE CYCLES**

1. Windshield - MONITOR.

NOTE

The temperature controller has failed. The windshield is cycling on the overheat limit. This will also result in WSHLD HEAT INOP while the windshield is cycled off. Refer to Amber Abnormal Procedures, WSHLD HEAT INOP L-R.

Procedure completed

- **IF MESSAGE STEADY**

1. Windshield Heat Switch (affected side) - OFF for one minute, then ON (if required).

Procedure completed

■ YD FAIL LOWER A-B (YAW DAMPER FAILURE LOWER A AND B)

1. Upper Rudder Yaw Damper - CHECK ON.
2. Altitude - 41,000 FEET MAXIMUM, DESCEND AS REQUIRED.
3. Airspeed - 0.75 MACH MINIMUM until below 31,000 FEET.
4. Land as soon as practical (flaps 15° maximum).

NOTE

Do not exceed flaps 15° for approach and landing.

Procedure completed

■ YD FAIL UPPER A-B (YAW DAMPER FAILURE UPPER A-B)

● ON GROUND

Indicates the selected upper yaw damper channel has failed or both channels have failed.

● IN FLIGHT

Indicates the affected upper yaw damper channel has failed.

☐ If Selected Channel

1. UPPER YAW DAMP Switch - PRESS (select opposite channel).

Procedure completed

☐ If Both A and B Fail

1. Altitude - 45,000 Feet (maximum descent if required).
2. Land as soon as practical. Use NORMAL Landing Procedures.

Procedure completed

■ YD NOT CENTERED (YAW DAMPER NOT CENTERED)

1. Flight Guidance Computer - SELECT OPPOSITE FGC.

NOTE

- This can occur if the yaw damper is powered up with the rudder pedals not centered.
- Indicates the yaw damper actuator did not center on powerup. This is a ground only message and will initiate NO TAKEOFF warning.

Procedure completed

■ YD OFF LOWER (YAW DAMPER OFF LOWER)

1. YD Button - PRESS (ON).

Procedure completed

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CYAN CAS MESSAGE DEFINITIONS AND PROCEDURES

This section presents cyan CAS messages in alphabetical order with the titles spelled out in parenthesis. In most cases, these messages provide information pertaining to future action which may be required and no specific procedure is applicable.

AC BEARING L-R (ALTERNATOR BEARING FAILURE L-R)

Indicates impending alternator bearing failure within approximately 20 hours of operation. Maintenance is required.

AHRS 1-2 AUX POWER (ATTITUDE, HEADING 1-2 AUXILIARY POWER)

Indicates that primary attitude/heading electrical power has failed and the AHRS is powered from the emergency bus.

APU GEN OFF (APU GENERATOR OFF)

ON GROUND: Indicates APU generator is OFF (or failed) and APU is running.

IN FLIGHT: Indicates APU generator is OFF (or failed) and APU is running and both main generators are on.

1. Generator Switches - CHECK/AS REQUIRED.

Procedure completed

BATT 1-2 OFF

Indicates the respective battery has been selected OFF.

CVR FAIL (COCKPIT VOICE RECORDER FAILURE)

Indicates loss of DC power to the Cockpit Voice Recorder or an internal fault, or downloading data.

DC BEARING L-R APU (GENERATOR BEARING FAILURE L-R OR APU)

Indicates impending generator bearing failure within approximately 4 hours of operations. Maintenance is required.

NOTE

This message may appear as a momentary message then extinguish. The 4 hour time limit still starts from the first time that the message was posted.

ENG A/I COLD L-R (ENGINE ANTI-ICE COLD L-R)

Indicates that the engine anti-ice is on and inlet lip temperature is cold due to a pylon bleed leak. Refer to Emergency Procedures, PYLON BLD LEAK.

ENG SHUTDOWN L-R (ENGINE SHUTDOWN L-R)

Indicates that the affected engine has been shut down by the engine throttle. Clears after engine start.

FDR FAIL (FLIGHT DATA RECORDER FAILURE)

Indicates loss of DC power to the Flight Data Recorder or internal fault.

FGC A-B FAIL (FLIGHT GUIDANCE COMPUTER FAIL A OR B)

NOTE

- Indicates failure of the respective flight guidance computer. Depending on the cause, the computer may reset in about 30 seconds.
- If the FGC has failed twice in two minutes, it will not reset.

IF FGC DOES NOT RESET

1. Land as soon as practical.

Procedure completed

FGC-ADC MISCMP (FLIGHT GUIDANCE COMPUTER AIR-DATA COMPUTER MISCOMPARE)

Indicates that Air Data Computer 1 and 2 data to the Flight Guidance Computers does not agree. One or more Flight Director/Autopilot modes may disconnect or not engage.

1. Primary Flight Displays - CHECK AIR DATA DISPLAYS.
2. ADC REV Switch (faulty side) - SELECT ADC REV.

Procedure completed

FGC-ATT MISCMP (FLIGHT GUIDANCE COMPUTER ATTITUDE MISCOMPARE)

Indicates that the Flight Guidance Computer has prohibited autopilot engagement due to AHRS or IRS attitude miscompare. This CAS message will clear after 5 seconds.

FIRE BOTTL LOW APU L-R (FIRE BOTTLE PRESSURE LOW APU OR L-R ENGINE)

Indicates that the APU or left or right engine fire extinguisher bottle pressure is low, or the bottle has been discharged. Dispatch is prohibited with either engine fire bottle low. APU operation is prohibited if the APU fire bottle is low.

CYAN CAS MESSAGE DEFINITIONS AND PROCEDURES

This section presents cyan CAS messages in alphabetical order with the titles spelled out in parenthesis. In most cases, these messages provide information pertaining to future action which may be required and no specific procedure is applicable.

AC BEARING L-R (ALTERNATOR BEARING FAILURE L-R)

Indicates impending alternator bearing failure within approximately 20 hours of operation. Maintenance is required.

AHRS 1-2 AUX POWER (ATTITUDE, HEADING 1-2 AUXILIARY POWER)

Indicates that primary attitude/heading electrical power has failed and the AHRS is powered from the emergency bus.

AIRCRAFT MAINTENANCE

This is a ground only message that indicates Aircraft Maintenance Test (AMT) data is available from the TEMPERATURE MONITORS (RTDs). Maintenance is required.

1. Maintenance is required within 10 hours of indication of the message.

Procedure completed

APU GEN OFF (APU GENERATOR OFF)

In flight indicates that APU is running AND that the APU GEN is selected ON and both left and right hand generators are ON or the left hand generator is OFF and the right hand generator is ON.

1. Generator Switches - CHECK/AS REQUIRED.

Procedure completed

BATT 1-2 OFF

Indicates the respective battery has been selected OFF.

CVR FAIL (COCKPIT VOICE RECORDER FAILURE)

Indicates loss of DC power to the Cockpit Voice Recorder or an internal fault, or downloading data.

DC BEARING L-R APU (GENERATOR BEARING FAILURE L-R OR APU)

Indicates impending generator bearing failure within approximately 4 hours of operations. Maintenance is required.

NOTE

This message may appear as a momentary message then extinguish. The 4 hour time limit still starts from the first time that the message was posted.

ENG A/I COLD L-R (ENGINE ANTI-ICE COLD L-R)

Indicates that the engine anti-ice is on and inlet lip temperature is cold due to a pylon bleed leak. Refer to Emergency Procedures, PYLON BLD LEAK.

ENG SHUTDOWN L-R (ENGINE SHUTDOWN L-R)

Indicates that the affected engine has been shut down by the engine throttle. Clears after engine start.

FDR FAIL (FLIGHT DATA RECORDER FAILURE)

Indicates loss of DC power to the Flight Data Recorder or internal fault.

FGC A-B FAIL (FLIGHT GUIDANCE COMPUTER FAIL A OR B)

NOTE

- Indicates failure of the respective flight guidance computer. Depending on the cause, the computer may reset in about 30 seconds.
- If the FGC has failed twice in two minutes, it will not reset.

IF FGC DOES NOT RESET

1. Land as soon as practical.

Procedure completed

FGC-ADC MISCMP (FLIGHT GUIDANCE COMPUTER AIR-DATA COMPUTER MISCOMPARE)

Indicates that Air Data Computer 1 and 2 data to the Flight Guidance Computers does not agree. One or more Flight Director/Autopilot modes may disconnect or not engage.

1. Primary Flight Displays - CHECK AIR DATA DISPLAYS.
2. ADC REV Switch (faulty side) - SELECT ADC REV.

Procedure completed

FGC-ATT MISCMP (FLIGHT GUIDANCE COMPUTER ATTITUDE MISCOMPARE)

Indicates that the Flight Guidance Computer has prohibited autopilot engagement due to AHRS or IRS attitude miscompare. This CAS message will clear after 5 seconds.

FIRE BOTTL LOW APU L-R (FIRE BOTTLE PRESSURE LOW APU OR L-R ENGINE)

Indicates that the APU or left or right engine fire extinguisher bottle pressure is low, or the bottle has been discharged. Dispatch is prohibited with either engine fire bottle low. APU operation is prohibited if the APU fire bottle is low.

FLIGHT IDLE L-R

Indicates that the ground idle switch is in the HIGH position on the ground.

FUEL GRV XFLW XSIT (FUEL GRAVITY CROSSFLOW IN TRANSIT)

Indicates a failure of the gravity crossflow valve to fully open or to fully close.

GUST LOCK ON (Airplanes serial 750-0002 through 750-0063)

Indicates that the flight control gust lock is engaged (if installed). This will trigger the NO TAKEOFF warning system. Refer to Cyan CAS Abnormal Procedures, NO TAKEOFF or Emergency Procedures, NO TAKEOFF.

MEMORY FULL

Indicates that the Engine Exceedance Parameters memory is full and must be downloaded to clear the message.

J-BOX LIMITER OPEN L-R (JUNCTION BOX LIMITER OPEN L-R)

Indicates that the left or right 275 amp crossfeed current limiter has opened. Shutting off or failure of the same side generator will result in loss of electrical power to the respective side feed and avionics busses.

LOAD SHED OVERRIDE

Indicates that the Load Shed switch has been selected to the OVERRIDE position.

NOTE

In the event of loss of all generated power, electrical power is supplied only from the batteries. Total electrical failure will occur in less than 30 minutes, depending on load demanded and battery charge state.

NO TAKEOFF

Indicates that the airplane is not in safe takeoff configuration on the ground. This message will change to RED with MASTER WARNING and aural warning if the throttles are advanced for takeoff. Refer to Emergency Procedures, NO TAKEOFF.

NOTE

No Takeoff Cyan CAS message indicates engines running and one or more of the following:

- Flaps < 5°.
- Flaps > 15°.
- Either slat not extended.
- Slat asymmetry.
- Parking brake on.
- Either start valve open.
- Speed brakes extended.
- Stabilizer, aileron, rudder trim not within takeoff limits.
- Yaw damper not centered.
- Gust lock on (if installed).
- Fuel quantity low.
- Engine synchronizer on.
- Aileron latch handle not stowed.
- Pitch/Roll disconnect handle not stowed correctly.

Message will be displayed in Cyan below 60° TLA and will change to red with MASTER WARNING and Aural Warning if either TLA is above 60°. MASTER WARNING and Aural Warning will clear at 80 KIAS if takeoff is continued.

OIL FILTER BYPASS L-R

Indicates impending or actual engine oil filter bypass.

NOTE

20 hours of operation are allowed provided the Amber CHIP DETECT L-R CAS message is not displayed.

IN FLIGHT

1. Engine Oil Pressure/Temperature - MONITOR.

Procedure completed

P/S-RAT HEAT OFF (PITOT/STATIC RAM AIR TEMPERATURE HEAT OFF)

Indicates that either PITOT/STATIC heat switch is selected to OFF on the ground. This message will change to amber with MASTER CAUTION if the throttles are advanced for takeoff or when airborne. Refer to Amber Abnormal Procedures, P/S RAT HEAT OFF.

PARK BRAKE ON

Indicates that the parking brake handle has been pulled up and sufficient pressure is being maintained. This message is amber if the handle is pulled up in flight.

CAUTION

HYDRAULIC PRESSURE MUST BE APPLIED TO SET THE BRAKES.

RAT PROBE FAIL L-R (RAM AIR TEMPERATURE PROBE FAILURE L OR R)

Indicates either, but not both RAT probes inoperative. Autopilot vertical modes on the affected side will drop and FADEC FAULT L-R amber CAS message will illuminate.

REMOTE CB TRIPPED (REMOTE CIRCUIT BREAKER TRIPPED)

Indicates tripped status of one or more of the following aft J-Box circuit breakers:

- AHRS AUX PWR
- APU Feed
- AVN Emergency Feed (1/2)
- Battery 1
- Battery 2
- Cabin ECU
- Cockpit ECU
- EICAS Feed
- Elec Emergency Feed (1/2)
- LH Start Logic (starter assisted)
- LH Landing Light
- LH Wing Root Heater
- Seat Belt/Chime
- RH Landing Light
- RH Start Logic (starter assisted)
- RH Wing Root Heater
- Secondary Trim 1
- Secondary Trim 2
- Standby Battery Pack
- Optional ELT

NOTE

The AHRS AUX PWR AFT J-BOX circuit breaker provides power to AHRS 1, or IRS 1 if the optional IRSs are installed.

Procedure completed

SLAT A/I COLD L-R (SLAT ANTI-ICE COLD L-R)

Indicates that the respective slat anti-ice is cold due to wing supply bleed leak. Refer to Amber Abnormal Procedures, WING BLD LEAK L-R.

TONE GEN 1-2 FAIL (TONE GENERATOR 1-2 FAILURE)

Indicates that the respective IAC warning tone generator has failed. The opposite tone generator will continue to supply all warning tones. If both tone generators fail, no tones will be available (caution/warning tones, altitude alert, AP disconnect and minimums tone).

WING A/I COLD L-R (WING ANTI-ICE COLD L-R)

Indicates that the respective inboard wing anti-ice is cold due to wing supply bleed leak. Refer to Amber Abnormal Procedures, WING BLD LEAK L-R.

YD FAIL LOWER A-B (YAW DAMPER FAILURE LOWER A-B)

Indicates failure of the respective lower yaw damper.

1. Ensure FGC has switched to operative channel.

Procedure completed

YD FAIL UPPER A-B (YAW DAMPER FAILURE UPPER A-B)

On the ground, indicates that the off-side (not selected) yaw damper channel has failed. Amber CAS message would be displayed in flight.

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WHITE CAS MESSAGE DEFINITIONS AND PROCEDURES

This section presents white CAS messages in alphabetical order with the titles spelled out in parenthesis. In most cases these messages provide information pertaining to system status or future action which may be required and no specific procedure is applicable.

ACFT MAINTENANCE (AIRCRAFT MAINTENANCE)

This is a ground only ADVISORY message that indicates Aircraft Maintenance Test (AMT) data is available. The systems that activate this message are: FADEC, APU, PCU-MONITOR, ACTIVE MOUNT (if installed), GLARESHIELD FAN, NOSE COMPARTMENT FAN, TAILCONE FAN and CABIN DOOR FAULT.

AHRS 1-2 BASIC (ATTITUDE HEADING REFERENCE SYSTEM)

Indicates true airspeed input has been lost from air data computer, therefore, affected AHRS attitude and heading may precess slightly.

A/I ON ENG-STAB-SLAT-ALL

This message indicates the respective engine, stabilizer, slat, or anti-ice system has been selected on. If all systems are on the message will be ALL.

APU ON (AUXILIARY POWER UNIT ON)

This is a status message indicating that the APU is on.

AVN MAINTENANCE (AVIONICS MAINTENANCE)

Ground only message that indicates Integrated Avionics Maintenance Test (IMT) data is available for the Primus 2000 system.

CHECKLIST MISMATCH

The configuration monitor in the IAC detects that the two IAC's have different checklist procedures. Use hard copy checklist.

FGC A-B MASTER (FLIGHT GUIDANCE COMPUTER A-B MASTER)

This message indicates whether A or B Flight Guidance Computer is in control, and is displayed for 5 seconds after an automatic or pilot initiated transfer.

FUEL BOOST ON L-R

The affected fuel boost pump has been activated manually or automatically (APU on, fuel crossfeed, engine start), in normal operation.

FUEL FW VLV CLSD L-R (FUEL FIRE WALL VALVE CLOSED L-R)

Indicates that the affected fuel firewall shutoff valve is in the closed position, thus preventing fuel from reaching the engine.

FUEL GRV XFLW OPEN (FUEL GRAVITY CROSSFLOW OPEN)

Indicates that the fuel gravity crossflow valve is in the open position.

FUEL XFEED OPEN (FUEL CROSSFEED OPEN)

Indicates that the fuel crossfeed valve is in the open position.

NOTE

This message may also be displayed in Amber. Refer to Amber Abnormal Procedures.

HYD AUX PUMP ON (HYDRAULIC AUXILIARY PUMP ON)

The electric auxiliary hydraulic pump is on as sensed by voltage supplied to the pump.

HYD FW SHUTOFF A-B (HYDRAULIC FIREWALL SHUTOFF A-B)

Indicates that the hydraulic system firewall shutoff valve(s) is closed.

IMT - AFCS ON (INTEGRATED MAINTENANCE TEST - AUTOMATIC FLIGHT CONTROL SYSTEM ON)

This ground only message indicates inability to enter IMT because the automatic flight control system is engaged.

IMT - IAS HIGH (INTEGRATED MAINTENANCE TEST - INDICATED AIRSPEED HIGH)

This ground only message indicates inability to enter IMT because airspeed is > 50 KIAS. Thus, IMT may construe the aircraft as being in the air.

WHITE CAS MESSAGE DEFINITIONS AND PROCEDURES

This section presents white CAS messages in alphabetical order with the titles spelled out in parenthesis. In most cases these messages provide information pertaining to system status or future action which may be required and no specific procedure is applicable.

ACFT MAINTENANCE (AIRCRAFT MAINTENANCE)

This is a ground only ADVISORY message that indicates Aircraft Maintenance Test (AMT) data is available. The systems that activate this message are: FADEC, PCU-MONITOR, BLEED AIR RESISTANCE TEMPERATURE DEVICES (RTDs), ACTIVE MOUNT (if installed), GLARESHIELD FAN, NOSE COMPARTMENT FAN, TAILCONE FAN and CABIN DOOR FAULT.

1. Maintenance is required within 10 hours of indication of the message.

Procedure completed

AHRS 1-2 BASIC (ATTITUDE HEADING REFERENCE SYSTEM)

Indicates true airspeed input has been lost from air data computer, therefore, affected AHRS attitude and heading may precess slightly.

APU ON (AUXILIARY POWER UNIT ON)

This is a status message indicating that the APU is on.

AVN MAINTENANCE (AVIONICS MAINTENANCE)

Ground only message that indicates Integrated Avionics Maintenance Test (IMT) data is available for the Primus 2000 system.

CHECKLIST MISMATCH

The configuration monitor in the IAC detects that the two IAC's have different checklist procedures. Use hard copy checklist.

FGC A-B MASTER (FLIGHT GUIDANCE COMPUTER A-B MASTER)

This message indicates whether A or B Flight Guidance Computer is in control, and is displayed for 5 seconds after an automatic or pilot initiated transfer.

FUEL BOOST ON L-R

The affected fuel boost pump has been activated manually or automatically (APU on, fuel crossfeed, engine start), in normal operation.

FUEL FW VLV CLSD L-R (FUEL FIRE WALL VALVE CLOSED L-R)

Indicates that the affected fuel firewall shutoff valve is in the closed position, thus preventing fuel from reaching the engine.

FUEL GRV XFLW OPEN (FUEL GRAVITY CROSSFLOW OPEN)

Indicates that the fuel gravity crossflow valve is in the open position.

FUEL XFEED OPEN (FUEL CROSSFEED OPEN)

Indicates that the fuel crossfeed valve is in the open position.

NOTE

This message may also be displayed in Amber. Refer to Amber Abnormal Procedures.

HYD AUX PUMP ON (HYDRAULIC AUXILIARY PUMP ON)

The electric auxiliary hydraulic pump is on as sensed by voltage supplied to the pump.

HYD FW SHUTOFF A-B (HYDRAULIC FIREWALL SHUTOFF A-B)

Indicates that the hydraulic system firewall shutoff valve(s) is closed.

IMT - AFCS ON (INTEGRATED MAINTENANCE TEST - AUTOMATIC FLIGHT CONTROL SYSTEM ON)

This ground only message indicates inability to enter IMT because the automatic flight control system is engaged.

IMT - IAS HIGH (INTEGRATED MAINTENANCE TEST - INDICATED AIRSPEED HIGH)

This ground only message indicates inability to enter IMT because airspeed is > 50 KIAS. Thus, IMT may construe the aircraft as being in the air.

IMT - NO EFIS (INTEGRATED MAINTENANCE TEST - NO ELECTRONIC FLIGHT INSTRUMENT SYSTEMS)

This ground only message indicates inability to enter IMT because the electronic flight instruments are not operational, therefore one would be unable to access IMT through either MFD.

IMT - NO WOW (INTEGRATED MAINTENANCE TEST - NO WEIGHT ON WHEELS)

Inability to enter IMT because the aircraft must be on the ground.

KEY NOT ACTIVE

When not labeled with ENG/MSGS, depressing the left most bezel button on the EICAS produces this message to indicate its inactive status.

PAC HI CKPT-CBN (PRESSURIZED AIR CONDITIONING HIGH COCKPIT - CABIN)

Indicates respective PAC is in high flow mode. Refer to applicable limitations.

PAC HP VLV OPN L-R (PRESSURIZED AIR CONDITIONING HIGH PRESSURE VALVE OPEN L-R)

Indicates PACs are using high pressure bleed air. Refer to applicable limitations.

SATCOM CALL 1-2

Indicates SELCAL alert on the optional satellite communication system.

SELCAL VHF 1-2 / HF 1-2

Indicates SELCAL alert on the optional VHF or HF SELCAL system.

SPEED BRAKES

Two of the six speed brakes are position monitored. This message indicates at least one of the monitored panels is not stowed, and may be illuminated in conjunction with an amber speed brake EICAS symbology indicating an asymmetric condition exists.

SECTION V

ABNORMAL PROCEDURES

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ABNORMAL PROCEDURES (Not Specific To CAS Messages) (Continued)

FLIGHT GUIDANCE (Continued)

HYDRAULICS/BRAKES

ABNORMAL LANDING

ABNORMAL PROCEDURES

For clarity, the following Abnormal Procedures are listed by system rather than with respect to a particular CAS or Primus message. They will normally be accompanied by one or more CAS or Primus messages and aural warnings. Procedures for specific CAS and Primus messages are listed separately and grouped by color.

■ ENGINE FAILURE/PRECAUTIONARY SHUTDOWN

NOTE

- This procedure may also be used for intentional training shutdown.
- Intentional training shutdown should be left engine inoperative to retain both hydraulic systems operating. The engine should be allowed to stabilize at least one minute at idle prior to shutdown.

1. AP/TRIM/NWS Disengage Button - PRESS.
2. Throttle (operating engine) - CLIMB DETENT (or as required).
3. Rudder and Aileron Trim - AS REQUIRED.
4. Airspeed - MAINTAIN (as required).
5. Throttle (affected engine) - CONFIRM, then CUTOFF.
6. Electrical Load - REDUCE as required.
7. TCAS - TA only.
8. PAC ISOL VALVE - OPEN (for improved ventilation).
9. Autopilot - AS DESIRED.
10. FUEL CROSSFEED - AS REQUIRED.
11. DC Power XTIE Switch - CLSD.
12. Land as soon as practical. Refer to Abnormal Procedures, INFLIGHT RESTART or SINGLE-ENGINE APPROACH AND LANDING.

- **IF IN ICING CONDITIONS**

  1. WING X-OVER ANTI-ICE Switch - WING X-OVER.
  2. Leave icing conditions as soon as possible.

Procedure completed

■ INFLIGHT RESTART (NORMAL OR REVERSIONARY MODE) - ONE ENGINE (Refer to Figure 5-1 for Airstart Envelope)

- **WITH STARTER ASSIST**

1. Throttle (affected engine) - CUTOFF.

NOTE

Throttle must be placed to cutoff to reset FADECs.

2. ENGINE FIRE Switch - CHECK OPEN (HYD F/W SHUTOFF and FUEL F/W SHUTOFF messages extinguished).
3. IGNITION - NORM.
4. FUEL BOOST - NORM.
5. PAC ISOL VALVE - OPEN or APU - ON/BLEED AIR - ON.
6. ENGINE, SLAT and STABILIZER Anti-ice - OFF, for start.

CAUTION

DO NOT ATTEMPT TO RESTART AN ENGINE IF IT IS POSSIBLE THAT ICE HAS FORMED IN THE ENGINE OR ENGINE INLET. SIGNIFICANT DAMAGE TO THE ENGINE CAN OCCUR.

(Continued Next Page)

■ IN-FLIGHT RESTART - ONE ENGINE (Refer to Figure 5-1 for Airstart Envelope) (Continued)

7. Opposite Engine - ADJUST, ITT 800°C or lower for start.

CAUTION

EXCEPT IN AN EMERGENCY, DO NOT ATTEMPT A STARTER ASSISTED AIRSTART WITH THE OPPOSITE ENGINE ABOVE THE CLIMB DETENT. OPERATING ENGINE ITT MAY EXCEED LIMITS.

NOTE

- With anti-ice off, the opposite engine will normally provide enough bleed air start pressure at idle for a satisfactory start. If at low airspeed, high altitude, and the engine being started appears to not accelerate, increase the opposite engine approximately 10% N_2 above idle. Start time will be shorter if the operating engine N_2 is above 80% RPM.
- APU bleed pressure is satisfactory for engine start, ($\geq$ 25 PSI).
- During engine start, cabin pressure will momentarily decrease.
- Residual ITTs below 150°C increase the probability of successful starter assisted airstarts.

8. ENGINE START Button (affected engine) - PRESS momentarily if N_2 is $\leq$25% RPM.

CAUTION

STARTER ENGAGEMENT ABOVE 25% N_2 RPM MAY SHEAR THE AIR TURBINE STARTER DRIVE SHAFT.

9. Throttle (affected engine) - IDLE at approximately 10% N_2 RPM.

NOTE

Move the throttle to idle at 10% N_2 RPM. Do not allow N_2 to peak or stabilize prior to moving the throttle to idle. A lower (windmilling start) fuel schedule would be selected by the FADECs and the engine may not start.

10. Engine Instruments - MONITOR.
11. PAC ISOL VALVE - CLOSE (after start if opened).
12. Anti-Ice - AS REQUIRED.

NOTE

The engine start procedure is the same with the engine FADECs in reversionary mode.

(Continued Next Page)

■ IN-FLIGHT RESTART - ONE ENGINE (Refer to Figure 5-1 for Engine Airstart Envelope) (Continued)

● ENGINE WINDMILLING (10% N_2 RPM MINIMUM)

1. Throttle (affected engine) - CUTOFF.

NOTE

- Throttle must be placed to cutoff to reset FADECs.
- If N_2 is less than 10%, selecting the respective hydraulic pump switch to UNLOAD and increasing airspeed to 250 KIAS should result in a 10% N_2 windmill speed. Below 8000 feet MSL, start may be initiated as low as 240 KIAS if N_2 has not decreased below 10% RPM.
- Engine acceleration during windmilling airstarts will be considerably slower than during starter assisted starts, particularly at the low airspeed end of the start envelope. If N_2 is accelerating and ITT is within limits, allow the start to continue. ITT fluctuations from 500°C to 700°C during the start are normal.
- Starter assist airstarts must be used if N_2 RPM is stabilized below 10%.
- The engine start procedure is the same with the engine FADECs in reversionary mode.
- Do not attempt to engage the starter after initiating a windmilling start. This could prevent a successful start. If starter assist is needed, return the throttle to CUTOFF, then press the start button (below 25% N_2) and then advance the throttle to idle.

2. HYDRAULIC PUMP Switch (affected engine) - UNLOAD (if turbine speed is less than 10% N_2).
3. ENG FIRE Switch - CHECK OPEN (HYD F/W SHUTOFF and FUEL F/W SHUTOFF message extinguished).
4. IGNITION (affected engine) - NORM.
5. FUEL BOOST (affected engine) - NORM.
6. Throttle (affected engine) - IDLE at a minimum 10% N_2 RPM.
7. Engine Instruments - MONITOR (888°C ITT limit for windmilling start).
8. FUEL BOOST (affected engine) - OFF, then NORM after engine stabilizes at idle.

Procedure Completed

☐ IF ENGINE DOES NOT START

1. Throttle (affected engine) - CUTOFF.
2. FADEC Select Switch - SELECT OPPOSITE FADEC.
3. Throttle (affected engine) - IDLE at a minimum 10% N_2 RPM.
4. Engine Instruments - MONITOR (888°C ITT limit for windmilling start).
5. FUEL BOOST (affected engine) - OFF, then NORM after engine stabilizes at idle.

Procedure Completed

ENGINE AIRSTART ENVELOPE

NOTE

- Engine windmilling airstart requires a minimum turbine speed of 10% turbine RPM (N_2), otherwise starter assist is required.
- APU and/or opposite engine bleed air can be used for engine starts at or below FL250.
- Residual ITTs below 150°C increase the probability of successful starter assisted airstart.

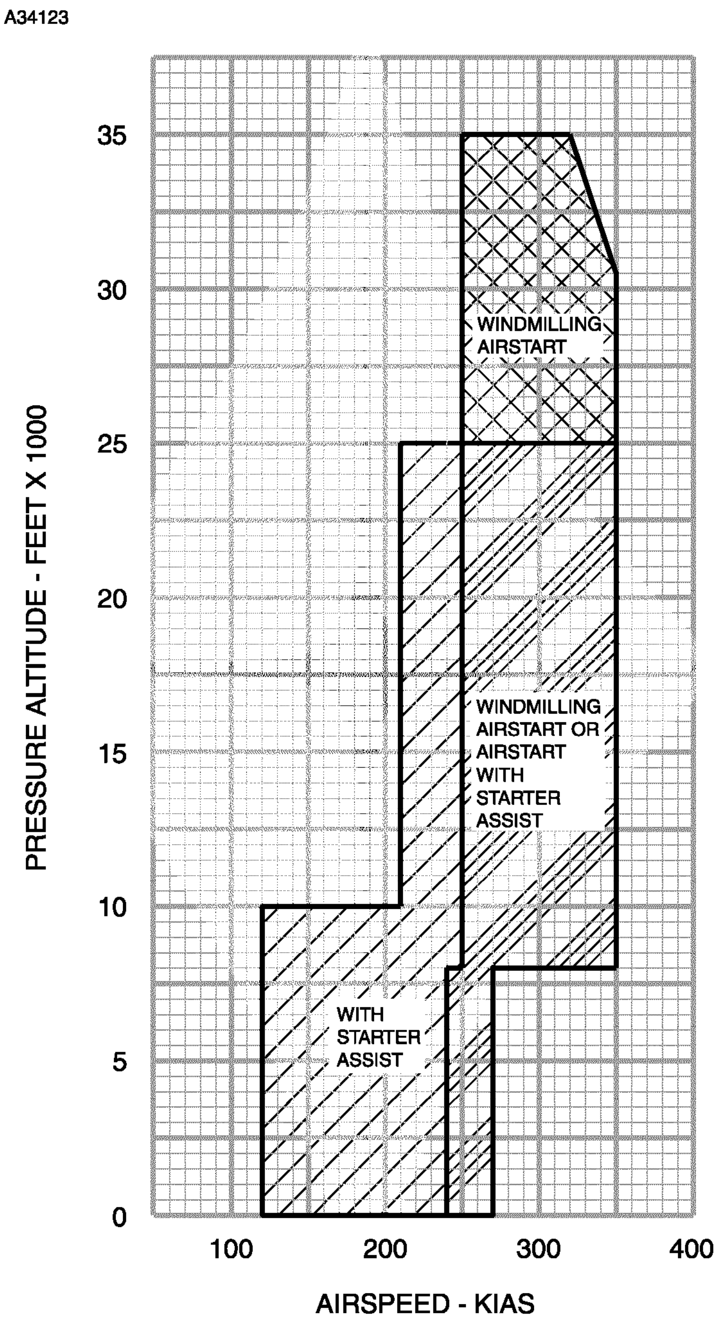

Figure 5-1

■ ENGINE START MALFUNCTION

1. Throttle (affected engine) - CUTOFF.
2. ENGINE START DISENGAGE Button - PRESS 15 seconds after throttle cutoff.

CAUTION

DO NOT ATTEMPT TO REENGAGE THE AIR TURBINE STARTER ABOVE 25% N_2. DOING SO MAY SHEAR THE STARTER DRIVE SHAFT.

Procedure completed

■ HIGH ENGINE ITT

● DURING START OR GROUND SHUTDOWN

1. Throttle (affected engine) - CUTOFF.
2. ENGINE START Button (if start valve is not open) - PRESS momentarily if BELOW 25% N_2 RPM. (Requires bleed air from APU, ground cart, or opposite engine, PAC ISOL VALVE open if using opposite engine).

CAUTION

DO NOT ATTEMPT TO REENGAGE THE AIR TURBINE STARTER ABOVE 25% N_2. DOING SO MAY SHEAR THE STARTER DRIVE SHAFT.

3. ENGINE START DISENGAGE Button - PRESS after ITT returns to normal.

● ENGINE RUNNING

1. Throttle (affected engine) - RETARD.

□ IF ITT CANNOT BE REDUCED

1. Throttle (affected engine) - CUTOFF.
2. Refer to Abnormal Procedures, ENGINE FAILURE/PRECAUTIONARY SHUTDOWN.

Procedure completed

■ N_1 OR N_2 OVERSPEED

1. Throttle (affected engine) - REDUCE.

● IF N_1 OR N_2 CANNOT BE CONTROLLED

1. Throttle (affected engine) - CUTOFF.
2. Refer to Abnormal Procedures, ENGINE FAILURE/PRECAUTIONARY SHUTDOWN.

NOTE

The FADEC will automatically shut the engine down at 105% N_1 or 105.6% N_2.

Procedure completed

■ THRUST REVERSER UNLOCK LIGHT ON IN FLIGHT (NO OTHER INDICATION OF DEPLOYMENT)

1. Stow Switch (affected thrust reverser) - EMER.
2. Thrust Reverser Levers - CHECK STOWED (down) position.
3. Land as soon as practical. Refer to Normal Procedures, BEFORE LANDING.

Procedure completed

■ THRUST REVERSER ARM LIGHT ON IN FLIGHT

1. Thrust Reverser Levers - CHECK STOWED (down position).
2. STOW Switch (affected thrust reverser) - VERIFY NORM.

● **IF LIGHT REMAINS ILLUMINATED**

1. STOW Switch (affected thrust reverser) - EMER.

● **IF T/R AUTOSTOW L-R AMBER CAS MESSAGE IS ON**

1. Throttle (affected engine) - IDLE, then NORMAL OPERATION.

NOTE

Affected throttle must be reduced to idle to reset the FADEC to regain normal throttle operation.

2. Land as soon as practical. Refer to Normal Procedures, BEFORE LANDING.

Procedure complete

■ OIL PRESSURE LOW LEFT OR RIGHT (NO CAS MESSAGE)

● **BELOW 34 PSI (NO OTHER EVIDENCE OF A PROBLEM EXISTS, OIL QUANTITY OR OIL TEMPERATURE)**

1. Land as soon as practical.

Procedure completed

● **BETWEEN 34 AND 49 PSI (SUSTAINED)**

1. Throttle (affected engine) - REDUCE, $N_2 \leq 88\%$ RPM.
2. Land as soon as practical.

Procedure completed

NOTE

Oil pressure in the transient (amber) range from 34 to 49 PSI is normal during ground idle, and in flight for a short period following reduction from high thrust to idle.

■ OIL PRESSURE HIGH (>95 PSI)

NOTE

Oil pressure above 95 PSI is normal following engine start in cold conditions, until the engine has warmed up. Refer to Normal Procedures, EXTREME COLD WEATHER OPERATIONS.

1. Throttle (affected engine) - RETARD to maintain oil pressure at or below 95 PSI.

● **IF THE INDICATION RESPONDS BUT PRESSURE IS ABOVE 95 PSI AT IDLE**

1. Monitor Oil Temperature and Quantity (EICAS ENG page for quantity).

□ **IF OIL TEMPERATURE IS NORMAL AND QUANTITY DOES NOT DECREASE**

1. Throttle (affected engine) - AS REQUIRED, normal operations.
2. Land as soon as practical.

Procedure completed

■ OIL PRESSURE HIGH (>95 PSI) (Continued)

☐ IF OIL TEMPERATURE INCREASES OR QUANTITY DECREASES

1. Consider shutting the engine down to conserve oil for a later restart. Refer to Abnormal Procedures, ENGINE FAILURE/PRECAUTIONARY SHUTDOWN.
2. Land as soon as practical.

Procedure completed

■ OIL TEMPERATURE HIGH (>127°C)

1. Thrust - REDUCE.
2. Engine Parameters - MONITOR (fuel temperature, oil pressure and quantity).

Procedure completed

■ APU FAILS TO START

1. APU Master Switch - OFF.
2. APU Circuit Breakers (3) - RESET.
3. APU - ATTEMPT START AGAIN (refer to Normal Procedures).

NOTE

Observe APU start/cycle limitations.

Procedure completed

■ APU RELAY STUCK (APU RELAY ENGAGED LIGHT STAYS ON)

NOTE

The APU RELAY ENGAGED light will be on during APU start and will extinguish when the start is complete; then the READY TO LOAD light will illuminate. The APU RELAY ENGAGED light will illuminate again when the APU generator is on.

1. APU START Switch - STOP.
2. APU MASTER Switch - OFF.

Procedure completed

■ APU FAIL (APU FAIL ANNUNCIATOR ILLUMINATED)

Indicates failure of APU self-test or automatic shutdown. APU will not start.

● ON GROUND

1. APU Compartment - INSPECT prior to next start attempt.
2. APU MASTER Switch - OFF.
3. APU Circuit Breakers (3) - RESET.
4. APU MASTER Switch - ON.

☐ IF APU FAIL ANNUNCIATOR STILL ILLUMINATED

1. APU Master Switch - OFF.

Procedure completed

(Continued Next Page)

■ APU FAIL (APU FAIL ANNUNCIATOR ILLUMINATED) (continued)

☐ **IF APU FAIL ANNUNCIATOR IS NOT ILLUMINATED**

1. APU - START. Refer to Normal Procedures.

Procedure completed

● **IN FLIGHT**

1. APU MASTER Switch - OFF.
2. Do not attempt APU start.

Procedure completed

■ OVERPRESSURIZATION

1. Pressurization MANUAL/NORM Switch - MANUAL.
2. UP-DOWN Manual Control - UP.
3. Manual RATE Control - INCREASE as required.

Procedure completed

● **STILL OVERPRESSURIZED**

1. CKPT or CABIN PAC Switch - OFF.
2. Engine Power - REDUCE as required (on side with operating PAC).
3. PAC BLEED SELECT Switch - SELECT LP.

☐ **IF UNABLE TO CONTROL**

1. Oxygen Masks - DON and 100%.
2. Oxygen Microphone Switches - MIC OXY MASK.
3. Wheel Interphone Microphone Switches - INPH.
4. PASS OXY Switch - ON (assure passengers are receiving oxygen).
5. CABIN DUMP Switch - LIFT RED COVER/CABIN DUMP.
6. Remaining PAC Switch - OFF.
7. Descend as required. Consider minimum safe altitude, and oxygen duration.

Procedure completed

■ COCKPIT FORWARD OR SIDE WINDSHIELD CRACKED OR SHATTERED

1. Cabin Pressurization - ALT SEL/SET CABIN ALTITUDE TO 9500 FEET.
2. Altitude - AS REQUIRED.

NOTE

- If cabin altitude is above approximately 8500 feet, the CABIN ALTITUDE amber CAS message will illuminate. No action is required.
- Descend to the lowest practical altitude consistent with fuel range requirements; 41,000 feet or lower is recommended.
- Either windshield ply is structurally capable of maintaining cabin pressure.
- Refer to Operating Limitations, CRACKED WINDSHIELD.

(Continued Next Page)

■ COCKPIT FORWARD OR SIDE WINDSHIELD CRACKED OR SHATTERED (Continued)

3. Oxygen Masks - ONE PILOT (minimum) DON OXYGEN MASK (set regulator to normal).
4. Remain clear of or leave icing conditions.

- **IF EITHER FORWARD WINDSHIELD CRACKED/SHATTERED**

1. WINDSHIELD ANTI-ICE - BOTH SWITCHES OFF.
2. Land as soon as practical.

Procedure completed

- **IF A SIDE WINDSHIELD CRACKED/SHATTERED**

1. WINDSHIELD ANTI-ICE - TURN OPPOSITE SWITCH OFF.
2. Land as soon as practical.

Procedure completed

■ COCKPIT/CABIN TEMPERATURE CONTROL INOPERATIVE

1. Affected PAC Temperature Select Switch - SELECT MANUAL.
2. Temperature - CONTROL MANUALLY.

Procedure completed

- **IF STILL UNABLE TO CONTROL**

1. Affected PAC Switch - OFF (if required for comfort).
2. Altitude - FL410 Maximum (if one PAC off).
3. WEMAC Boost - ON.
4. PAC ISOL VALVE - OPEN.
5. Land as soon as practical.

Procedure completed

- **IF BOTH PACs FAILED - COLD**

1. Coldest PAC - OFF (if required for comfort).
2. Altitude - FL410 MAXIMUM (if one PAC off).
3. PAC ISOL VALVE - OPEN.
4. Land as soon as practical.

Procedure completed

- **IF BOTH PACs FAILED - HOT**

1. Hottest PAC (CKPT if equal) - OFF (if required for comfort).
2. Altitude - FL410 MAXIMUM (if one PAC off).
3. PAC ISOL VALVE - OPEN.
4. Operating PAC - HIGH.
5. WEMAC Boost - ON.
6. WEMACs - CLOSE UNNECESSARY CABIN WEMACS.
7. Land as soon as practical.

Procedure completed

■ PRESSURIZATION FAULT CONTROL LIGHT ILLUMINATED

Indicates the controller normal pressurization mode has faulted and automatically switched to manual mode, probably due to loss of MADC (Micro Air Data Computer) reference.

1. Pressuization - CONTROL MANUALLY (use Cabin Altitude UP/DN switch and Manual Rate Control as required).
2. Pressurization MANUAL/NORMAL Switch - MANUAL (to match controller mode).

Procedure completed

■ AILERON TRIM INOPERATIVE/RUNAWAY

1. AP/TRIM/NWS Disengage Button - PRESS (to turn autopilot off).
2. Either Control Wheel - APPLY OPPOSITE ROLL INPUT.
3. Rudder - TRIM as required for 1/2 ball sideslip to reduce roll control forces.
4. FUEL CROSSFEED - AS REQUIRED.

NOTE

If time permits, crossfeed to create a fuel imbalance, up to 400 lbs., to assist in reducing roll control forces.

5. Land as soon as practical. Refer to Normal Procedures, APPROACH AND LANDING.

Procedure completed

■ RUDDER TRIM INOPERATIVE/RUNAWAY

1. AP/TRIM/NWS Disengage Button - PRESS (to turn autopilot off).
2. Rudder - APPLY OPPOSING CONTROL INPUT as required.
3. Aileron - APPLY OPPOSING CONTROL INPUT and TRIM as required.
4. FUEL CROSSFEED - AS REQUIRED.

NOTE

If time permits, crossfeed to attain a fuel imbalance, up to 400 lbs., to assist in reducing roll forces.

5. Land as soon as practical. Refer to Normal Procedures, APPROACH AND LANDING.

Procedure completed

■ UPPER RUDDER JAM/HARDOVER

1. Directional Control - MAINTAIN.
2. EICAS - CTRL POS, CHECK UPPER POSITION.
3. Upper Yaw Damper - SELECT OPPOSITE CHANNEL A/B.

● **IF STILL NOT CENTERED**

1. Upper Rudder A and B Circuit Breakers - PULL.
2. Airspeed - 250 KIAS MAXIMUM.
3. Altitude - 41,000 FEET MAXIMUM.
4. Lower Rudder - TRIM as required.
5. Land as soon as practical. Refer to Normal Procedures, APPROACH AND LANDING.

NOTE

The upper rudder functions as a yaw damper only with flaps retracted.

■ LOWER RUDDER JAM

1. AP/TRIM/NWS Disengage Button - PRESS (to turn autopilot off).
2. Rudder Flight Control Shutoff Switch - PRESS.
3. Altitude - 41,000 FEET MAXIMUM.
4. Airspeed - MINIMUM 0.75 MACH until reaching 31,000 feet.

NOTE

- Shutting off the rudder PCU pressure should reduce the amount of rudder travel unless the PCU itself is jammed.
- Do not exceed flaps 15° for approach and landing.
- Select a wide and dry runway if available.
- Maximum crosswind component is 10 knots.

BEFORE LANDING

1. Landing Data - CONFIRM. Refer to, Section IV, Performance, of the FAA Approved Airplane Flight Manual.
   a. Airspeed - V_{APP}(Flaps 15˚)/V_{REF}(Flaps 15˚).
   b. Use the Normal **FLAPS 15°** Landing Distance.

CAUTION

AVOID LANDING WITH TAILWIND OR DOWNHILL RUNWAY GRADIENT.

2. Crew Briefing - COMPLETED.
3. Avionics and Flight Instruments - CHECK/SET.
4. Minimums - SET (RA/BARO).
5. FUEL CROSSFEED - OFF.
6. ENG SYNC - OFF.
7. Flaps - 15°MAXIMUM.
8. Speedbrakes - RETRACTED.
9. Passengers - BRIEF.
10. Seats/Seat Belts/Shoulder Harness/Aft Divider Sliding Doors - CHECK/SECURE/LATCHED OPEN (if belted toilet seat occupied).
11. Passenger Advisory Lights - PASS SAFETY.
12. IGNITION - NORM.
13. Pressurization - ZERO DIFFERENTIAL at touchdown.
14. Landing Gear - CHECK DOWN and LOCKED (3 green lights).
15. EICAS - CHECK.
16. Airspeed - V_{REF}.

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■ LOWER RUDDER JAM (Continued)

LANDING

WARNING

DO NOT USE THRUST REVERSERS ON LANDING.

1. Throttles - IDLE (pilot not flying).
2. Speed Brakes - EXTEND at touchdown (pilot not flying).
3. Elevator control - FORWARD PRESSURE at touchdown.
4. Nose Wheel Tiller - HOLD to center position.
5. Use differential braking as required.

Procedure completed

■ LOSS OF RUDDER FEEL AND CENTERING (NORMAL RUDDER RESPONSE WITH NO RUDDER PEDAL FEEL)

1. Pilot Not Flying - Place feet on rudder pedals to provide both force resistance and artificial rudder centering.

WARNING

DO NOT ATTEMPT TO PREVENT THE MOVEMENT OF THE RUDDER PEDALS WHEN THE FLYING PILOT IS APPLYING CORRECTIVE ACTION FOR FLIGHT PATH CONTROL. APPLY FORCE SUFFICIENT ONLY TO SIMULATE NORMAL RUDDER CONTROL LOADS AND PEDAL CENTERING. EFFECTIVE CREW COORDINATION IS CRITICAL.

NOTE

Lower rudder trim will be inoperative.

2. Land as soon as practical.

● **APPROACH AND LANDING**

1. Refer to Normal Procedures, APPROACH AND LANDING if not single-engine.

Procedure completed

● **SINGLE-ENGINE APPROACH AND LANDING**

1. Refer to Abnormal Procedures, SINGLE-ENGINE APPROACH AND LANDING.

WARNING

MAINTAIN A STABILIZED 3° APPROACH AND AVOID THE NEED FOR SUDDEN POWER TRANSIENTS WHICH COULD RESULT IN PILOT INDUCED DIRECTIONAL OSCILLATIONS.

Procedure completed

■ AILERON CONTROL FEEL AND CENTERING FAILURE

WARNING

WITH LOSS OF CENTERING, THE CONTROL WHEEL MUST BE CONSCIOUSLY RECENTERED BY THE FLYING PILOT. MAKE SMALL DELIBERATE ROLL INPUTS TO AVOID ROLL OSCILLATION. AILERON TRIM WILL BE INOPERATIVE.

1. Land as soon as practical.
2. Refer to Normal Procedures, APPROACH AND LANDING.

Procedure completed

■ UNCOMMANDED SLAT EXTENSION

1. Airspeed - REDUCE TO 250 KIAS MAXIMUM.
2. Flaps/Slats Handle - CHECK UP.
3. LH/RH Stall Warn Circuit Breakers - CYCLE ONE AT A TIME (monitor slat position).
4. If Slats Retract, Affected Stall Warn Circuit Breaker - PULL (verify slats remain retracted).

● IF SLATS REMAIN EXTENDED

1. LAND AS SOON AS PRACTICAL.
2. Refer to Normal Procedures, APPROACH AND LANDING.

Procedure completed

● IF SLATS RETRACT

1. Circuit Breaker reset prior to landing.
2. Refer to Normal Procedures, APPROACH AND LANDING.

Procedure completed

■ JAMMED STABILIZER TRIM SYSTEM

● JAMMED AT +1.6° TO -2°

1. Use Flaps 15° Landing.
2. Center Fuel Quantity - TRANSFER TO LESS THAN 100 LBS.
3. Maximum Landing Weight Not To Exceed 27,000 LBS.
4. Airspeed - 150 KIAS MINIMUM.
5. Copilot - APPLY ELEVATOR FORCE TO ASSIST PILOT as required.

NOTE

If time permits, shift passengers to the aft-most seats.

(Continued Next Page)

■ JAMMED STABILIZER TRIM SYSTEM (Continued)

BEFORE LANDING

1. Landing Data - CONFIRM.
   a. V_{REF} - 150 KIAS MINIMUM.
   b. Multiply Normal **FLAPS FULL** Landing Distance by 3.1 (use a factor of 2.3 if altitude is below 7,000 feet).

CAUTION

- AVOID LANDING WITH A TAILWIND OR DOWNHILL RUNWAY GRADIENT.
- LANDING DISTANCE FACTORS OF 3.0 OR GREATER MAY REQUIRE THE USE OF A RUNWAY WITH AN ARRESTING BARRIER.

2. Crew Briefing - COMPLETE.
3. Avionics and Flight Instruments - CHECK/SET.
4. Minimums - SET (RA/BARO).
5. FUEL CROSSFEED - AS REQUIRED, then OFF.
6. ENG SYNC - OFF.
7. Flaps - APPROACH SCHEDULE.
8. Passengers - BRIEF.
9. Seats/Seat Belts/Shoulder Harnesses/Aft Divider Sliding Doors - CHECK/SECURE/LATCHED OPEN (if belted toilet seat occupied).
10. Passenger Advisory Lights - PASS SAFETY.
11. IGNITION - NORM.
12. Pressurization - ZERO DIFFERENTIAL at touchdown.
13. Landing Gear - CHECK DOWN and LOCKED (3 green lights).
14. Flaps - 15°.
15. Speed Brakes - RETRACTED.
16. EICAS - CHECK.
17. Airspeed - 150 KIAS MINIMUM.

Procedure completed

● **JAMMED AT -2° TO -4°**

1. Use Flaps 15° Landing.
2. Airspeed - 145 KIAS MINIMUM.

BEFORE LANDING

1. Landing Data - CONFIRM.
   a. V_{REF} - 145 KIAS MINIMUM.
   b. Multiply Normal **FLAPS FULL** Landing Distance by 2.7 (use a factor of 2.0 is altitude is below 7,000 feet).

CAUTION

AVOID LANDING WITH A TAILWIND OR DOWNHILL RUNWAY GRADIENT.

(Continued Next Page)

■ JAMMED STABILIZER TRIM SYSTEM (Continued)

2. Crew Briefing - COMPLETE.
3. Avionics and Flight Instruments - CHECK/SET.
4. Minimums - SET (RA/BARO).
5. FUEL CROSSFEED - AS REQUIRED, then OFF.
6. ENG SYNC - OFF.
7. Flaps - APPROACH SCHEDULE.
8. Passengers - BRIEF.
9. Seats/Seat Belts/Shoulder Harnesses/Aft Divider Sliding Doors - CHECK/SECURE/LATCHED OPEN (if belted toilet seat occupied).
10. Passenger Advisory Lights - PASS SAFETY.
11. IGNITION - NORM.
12. Pressurization - ZERO DIFFERENTIAL at touchdown.
13. Landing Gear - CHECK DOWN and LOCKED (3 green lights).
14. Flaps - 15°.
15. Speed Brakes - RETRACTED.
16. EICAS - CHECK.
17. Airspeed - 145 KIAS MINIMUM.

Procedure completed

● JAMMED AT -4° TO -7°

1. Landing Data - CONFIRM. Refer to, Section IV, Performance, of the FAA Approved Airplane Flight Manual.
   a. Airspeed - V_{APP}(FLAPS 15°)/V_{REF}(FLAPS 15°).
   b. Use the Normal **FLAPS 15°** Landing Distance.

CAUTION

AVOID LANDING WITH A TAILWIND OR DOWNHILL RUNWAY GRADIENT.

2. Refer to Normal Procedures, APPROACH and LANDING.

Procedure completed

● JAMMED AT -7° TO -12°

1. If excessive push force is present - REDUCE AIRSPEED.
2. Land as soon as practical.
3. Refer to Normal Procedures, APPROACH and LANDING.

Procedure completed

■ SPEED BRAKES FAIL TO RETRACT

1. Speed Brakes Lever - FORWARD (or adjusted to achieve zero roll if asymmetrical condition exists).
2. Land as soon as practical. (Plan a flaps 15° landing. If enroute, consider effect on range.)

BEFORE LANDING

1. Landing Data - CONFIRM, Refer to the FAA Approved Airplane Flight Manual, Section IV, Performance.
   a. Airspeed - V_{APP}(FLAPS 15°)/V_{REF}(FLAPS 15°).
   b. Use the Normal **FLAPS 15°** Landing Distance.

CAUTION

AVOID LANDING WITH TAILWIND OR DOWNHILL RUNWAY GRADIENT.

2. Crew Briefing - COMPLETE.
3. Avionics and Flight Instruments - CHECK/SET.
4. Minimums - SET (RA/BARO).
5. FUEL CROSSFEED - AS REQUIRED, then OFF.
6. ENG SYNC - OFF.
7. Flaps - 15°.
8. Passengers - BRIEF.
9. Seats/Seat Belts/Shoulder Harnesses/Aft Divider Sliding Doors - CHECK/SECURE/LATCHED OPEN (if belted toilet seat occupied).
10. Passenger Advisory Lights - PASS SAFETY.
11. IGNITION - NORM.
12. Pressurization - ZERO DIFFERENTIAL at touchdown.
13. Landing Gear - DOWN AND LOCKED (3 green lights).

NOTE

SPEED BRAKES amber CAS message and the Master Caution will illuminate at 500 feet AGL with speed brakes not retracted.

14. EICAS - CHECK.
15. Airspeed - V_{REF}.
16. Thrust - AS REQUIRED to prevent high sink rate.

LANDING

1. Throttles - IDLE.
2. Elevator Control - FORWARD PRESSURE at touchdown.
3. Brakes - APPLY after nose wheel ground contact.
4. Thrust Reversers - DEPLOY after nose wheel ground contact.

■ SPEED BRAKES DEPLOY ASYMMETRICALLY

1. Speed Brakes Lever - ADJUST TO ACHIEVE ZERO ROLL.
2. Land as soon as practical.

● **IF SPEED BRAKES ARE NOT RETRACTED**

3. Refer to Abnormal Procedures, SPEED BRAKES FAIL TO RETRACT.

■ PFD DISPLAY TUBE FAILURE

1. Affected PFD DIM (Outer Concentric) Knob - OFF; PFD information is displayed on adjacent MFD.

NOTE

Refer to Limitations Section II regarding dispatch with Honeywell Primus 2000 System.

■ MFD DISPLAY TUBE FAILURE

1. Use opposite side MFD (no MFD backup mode is available).

■ EICAS DISPLAY TUBE FAILURE

1. EICAS DISPLAY Controller - SELECT L or R (EICAS will be displayed on selected MFD).

■ SINGLE MICRO AIR DATA COMPUTER FAILURE

Indicated by loss of affected side airspeed, altitude, and vertical speed.

1. Affected Side Display Controller - SELECT ADC REV.

■ COMPARISON MONITOR

Indicates one or more of the following parameters has exceeded its predetermined tolerance level:

COMPARED SIGNALS	PFD DISPLAYED EADI SYMBOL
Heading (±10°)	HDG
Localizer (±1/2 Dot)	LOC
Glideslope (±1/2 Dot)	GS
Pitch (±5°) and/or Roll (±6°) Attitude	ATT
Altitude (± 200 Feet)	ALT
Indicated Airspeed (± 20 Knots)	IAS

■ DISPLAY UNIT RED GUN FAILURE

NOTE

Affected display colors will be abnormal. Red color will be absent.

- **IF PFD**

1. Affected PFD Dim Knob (outer concentric) - OFF; PFD information is displayed on adjacent MFD.

- **IF MFD**

WARNING

AFFECTED MFD WILL NOT DISPLAY RED FUNCTIONS, i.e. WEATHER, TCAS, AND RED WARNINGS.

1. Opposite MFD - MONITOR.

- **IF EICAS**

1. EICAS DISPLAY Switch - SELECT LEFT. (Maintains normal redundant warning function of the RH MFD.)

■ SINGLE IRS FAILURE

1. Standby Flight Instruments - MONITOR.
2. Affected Side Display Controller - SELECT AHRS or IRS REV; Verify HDG 1 or 2 (AHRS), or MAG 1 or 2 or TRU 1 or 2 (IRS), and ATT 1 or 2 are displayed in both the pilot’s and copilot’s displays.

NOTE

- Autopilot must be disengaged and may not be reengaged.
- Heading and attitude comparator monitor functions will not be available.

RADIO ALTIMETER INOPERATIVE

APPROACH

1. RA/BARO Switch - ENSURE BARO.
2. Landing Gear - CHECK DOWN AND LOCKED (3 green lights) at or prior to landing gear warning.

NOTE

With radio altimeter failure, the landing gear warning is set by the angle of attack to approximately 1.6 V_{S1}.

■ LANDING GEAR WILL NOT EXTEND (NORMAL “A” SYSTEM HYDRAULIC PRESSURE)

1. Landing Gear Handle - DOWN (airspeed below 210 KIAS).
2. LANDING GEAR BLOWDOWN Handle - PULL.

NOTE

- If the gear handle is locked up, the blowdown will bypass the hydraulic system.
- After the gear blowdown has actuated, the gear cannot be retracted.

3. Landing Gear - CHECK DOWN and LOCKED (3 green lights).
4. Landing Gear Blowdown Handle - PUSH in to stow.

● IF GEAR FAILS TO EXTEND

1. Main Gear Uplock T-Handle - PULL if main gear is still up (located in aft cabin vanity).
2. Nose Gear Uplock “D” Ring - PULL if nose gear is still up; then STOW (located under copilot’s tilt panel next to LANDING GEAR BLOWDOWN knob).

NOTE

If either uplock handle is difficult to pull, force can be reduced by unloading the “A” hydraulic system, pulling the HYDR B/PTU CONT circuit breaker, and ensuring the auxiliary hydraulic pump is OFF.

3. Landing Gear - CHECK DOWN and LOCKED (3 green lights). Yaw airplane left and right as required to engage main gear downlocks.

■ LANDING WITH FLAPS OR SLATS INOPERATIVE

WARNING

- **IF BOTH SLATS AND FLAPS ARE RETRACTED, DO NOT REDUCE AIRSPEED BELOW THE CORRESPONDING V_{REF} SPEED GIVEN IN THE TABLE BELOW, EXCEPT FOR LANDING FLARE. STALL CHARACTERISTICS ARE DEGRADED.**
- **DO NOT EXTEND FLAPS BEYOND 15° WITH SLATS RETRACTED.**

NOTE

- Autopilot coupled ILS approaches with flaps retracted are prohibited.
- If flaps are not extended, drag is significantly reduced. Plan a stabilized final within 10 to 20 KIAS of V_{REF}.
- Use speed brakes as required.

BEFORE LANDING

1. Landing Data - CONFIRM.
   a. Airspeed - V_{REF}.

V_{REF} (KIAS)

FLAPS/SLATS	WEIGHT - POUNDS								LANDING DISTANCE FACTORS
	23,000	25,000	27,000	28,000	29,000	30,000	31,000	31,800	
0°/Retracted	134	140	146	149	151	154	157	160	3.9 (3.0)*
0°/Extended	124	130	136	139	141	144	147	150	3.1 (2.7)**
5°/Retracted	130	136	142	144	147	150	153	155	3.5 (2.2)*
5°/Extended	120	126	132	134	137	140	143	145	2.8 (2.3)**
15°/Retracted	123	129	134	137	139	142	145	147	2.5

   b. Multiply Normal **FLAPS FULL** Landing Distance by the appropriate landing distance factor in the above table. The factors in parenthesis () can be used if the following conditions apply:

      * Altitude under 5,000 feet, weight less than 29,000 pounds.
      ** Altitude under 5,000 feet.

CAUTION

- AVOID LANDING WITH TAILWIND OR DOWNHILL RUNWAY GRADIENT.
- LANDING DISTANCE FACTORS OF 3.0 OR GREATER MAY REQUIRE THE USE OF A RUNWAY WITH AN ARRESTING BARRIER.

2. Crew Briefing - COMPLETE.

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■ LANDING WITH FLAPS OR SLATS INOPERATIVE (Continued)

3. Avionics and Flight Instruments - CHECK/SET.
4. Minimums - SET (RA/BARO).
5. FUEL CROSSFEED - AS REQUIRED, then OFF.
6. Exterior Lights - AS REQUIRED.
7. Passengers - BRIEF.
8. Seats/Seat Belts/Shoulder Harnesses/Aft Divider Sliding Doors - CHECK/SECURE/LATCHED OPEN (if belted toilet seat occupied).
9. Passenger Advisory Lights - PASS SAFETY.
10. IGNITION - NORM.
11. Pressurization - ZERO DIFFERENTIAL at touchdown.
12. Landing Gear - DOWN AND LOCKED (3 green lights).
13. Speed Brakes - RETRACTED.
14. ENG SYNC - OFF.
15. EICAS - CHECK.
16. GPWS - FLAP OVRD SELECT.

NOTE

Ground Proximity Warning (If installed) - MFD MAIN 2/2 MENU/EGPWS PUSH/FLAP OVRD SELECT.

17. Airspeed - V_{REF}.

LANDING

1. Throttles - IDLE.
2. Speed Brakes - EXTEND at touchdown.
3. Elevator Control - FORWARD PRESSURE at touchdown.
4. Brakes - APPLY after nose wheel ground contact.
5. Thrust Reversers - DEPLOY after nose wheel ground contact.

Procedure completed

■ LANDING WITH RESIDUAL ICE (DUE TO FAILURE OF SLAT AND/OR HORIZONTAL STABILIZER ANTI-ICE)

● SINGLE SIDE HORIZONTAL STABILIZER ANTI-ICE FAILURE

WARNING

- **AFTER HAVING AN ICING ENCOUNTER WITH ONE HORIZONTAL STABILIZER LEADING EDGE ANTI-ICE SYSTEM INOPERATIVE, THE FLAPS MUST NOT BE EXTENDED BEYOND THE 15° POSITION FOR LANDING.**
- **EXTENDING THE FLAPS TO THE FULL POSITION COULD RESULT IN THE AIRPLANE PITCHING NOSE DOWN.**
- **IF THERE IS A REDUCTION OF ELEVATOR CONTROL, (AS INDICATED BY THE AIRPLANE NOT RESPONDING TO THE ELEVATOR INPUT) AS THE FLAPS ARE EXTENDED FROM THE 15° POSITION TO THE FULL POSITION, IMMEDIATELY RESELECT FLAPS TO THE 15° POSITION AND TRIM APPROXIMATELY ONE DEGREE NOSE DOWN.**

1. Land as soon as practical, flaps 15° maximum.
2. Refer to BEFORE LANDING, this procedure.

Procedure completed

(Continued Next Page)

■ LANDING WITH RESIDUAL ICE (DUE TO FAILURE OF SLAT AND/OR HORIZONTAL STABILIZER ANTI-ICE) (Continued)

● DUAL HORIZONTAL STABILIZER ANTI-ICE FAILURE

WARNING

- **AFTER HAVING AN ICING ENCOUNTER WITH BOTH HORIZONTAL STABILIZER LEADING EDGE ANTI-ICE SYSTEMS INOPERATIVE, THE FLAPS MUST NOT BE EXTENDED BEYOND THE 5° POSITION FOR LANDING.**

- **EXTENDING THE FLAPS BEYOND 5° TO THE FULL POSITION COULD RESULT IN THE AIRPLANE PITCHING NOSE DOWN.**

- **IF THERE IS A REDUCTION OF ELEVATOR CONTROL, (AS INDICATED BY THE AIRPLANE NOT RESPONDING TO THE ELEVATOR INPUT) AS THE FLAPS ARE EXTENDED FROM BEYOND THE 5° POSITION, IMMEDIATELY RESELECT FLAPS TO THE 5° POSITION.**

1. Land as soon as practical, Flaps 5° maximum.
2. Refer to BEFORE LANDING, this procedure.

● SLAT ANTI-ICE SYSTEM FAILURE

WARNING

IF ONE SIDE SLAT ANTI-ICE IS INOPERATIVE, BOTH SIDES MUST BE TURNED OFF TO AVOID ASYMMETRY.

NOTE

- Buffet is noticeable during operation with ice on both wing slats.

- After an icing encounter with failed slat anti-ice, the crew should visually confirm the presence of ice on the slats. If no ice is present, the landing with 15° flap restriction is not applicable.

1. Land as soon as practical, Flaps 15° maximum.
2. Refer to BEFORE LANDING, this procedure.

(Continued Next Page)

■ LANDING WITH RESIDUAL ICE (DUE TO FAILURE OF SLAT AND/OR HORIZONTAL STABILIZER ANTI-ICE) (Continued)

BEFORE LANDING

1. Landing Data - CONFIRM.
   a. Airspeed - V_{REF}.

V_{REF} (KIAS)

FLAPS/SLATS	WEIGHT - POUNDS							
	23,000	25,000	27,000	28,000	29,000	30,000	31,000	31,800
5°/Extended	120	126	132	134	137	140	143	145

   b. For FLAPS 5°, multiply normal **FLAPS FULL** landing distance by 2.8 (use a factor of 2.3 if altitude is below 5,000 feet).
   c. For FLAPS 15°, refer to Normal Procedures, Approach and Landing.

2. Crew Briefing - COMPLETE.
3. Avionics and Flight Instruments - CHECK/SET.
4. Minimums - SET (RA/BARO).
5. FUEL CROSSFEED - AS REQUIRED, then OFF.
6. ENG SYNC - OFF.
7. Exterior Lights - AS REQUIRED.
8. Flaps - AS REQUIRED (5° maximum for both STAB ANTI-ICE INOP, 15° maximum for single STAB ANTI-ICE or SLAT ANTI-ICE INOP).
9. Passengers - BRIEF.
10. Seats/Seat Belts/Shoulder Harnesses/Aft Divider Sliding Doors - CHECK/SECURE/LATCHED OPEN (if belted toilet seat occupied).
11. Passenger Advisory Lights - PASS SAFETY.
12. IGNITION - NORM.
13. Pressurization - ZERO DIFFERENTIAL at touchdown.
14. Landing Gear - DOWN and LOCKED (3 green lights).
15. Speed Brakes - RETRACTED.
16. EICAS - CHECK.
17. Airspeed - V_{REF}.
18. Autopilot - OFF above minimum use height.

LANDING

1. Throttles - IDLE.
2. Speed Brakes - EXTEND at touchdown.
3. Elevator Control - FORWARD PRESSURE at touchdown.
4. Brakes - APPLY after nose wheel ground contact.
5. Thrust Reversers - DEPLOY after nose wheel ground contact.

Procedure completed

■ SINGLE-ENGINE APPROACH AND LANDING

● IF BOTH HYDRAULIC SYSTEMS ARE INOPERATIVE

1. Refer to Emergency Procedures, DUAL HYDRAULIC SYSTEM FAILURE.

● IF LEFT ENGINE INOPERATIVE - HYDRAULIC PTU OPERATING ("A" PRESSURE CONFIRMED)

1. "A" AUX Hydraulic Pump - ON.
2. Hydraulic Pressure - ≥ 2700 PSI.

BEFORE LANDING

1. Landing Data - CONFIRM. Refer to, Section IV, Performance, of the FAA Approved Airplane Flight Manual.
   a. Airspeed - V_{APP}(FLAPS 15°)/V_{REF}(FLAPS 15°).
   b. Use the Normal **FLAPS 15°** Landing Distance.

CAUTION

IF LANDING WITH FLAPS 15°, AVOID LANDING WITH TAILWIND OR DOWNHILL RUNWAY GRADIENT.

NOTE

For single engine circling approaches, fly V_{REF} (Flaps 15°) +20 KIAS until landing is assured.

2. Airspeed - V_{REF}(FLAPS 15°) +10 KIAS MINIMUM until landing assured.
3. Crew Briefing - COMPLETE.
4. Avionics and Flight Instruments - CHECK/SET.
5. Minimums - SET (RA/BARO).
6. FUEL CROSSFEED - AS REQUIRED, then OFF.
7. Exterior Lights - AS REQUIRED.
8. Flaps - 15° MAXIMUM (5°/250 KIAS, 15°/210 KIAS).
9. Passengers - BRIEF.
10. Seats/Seat Belts/Shoulder Harnesses/Aft Divider Sliding Doors - CHECK/SECURE/LATCHED OPEN (if belted toilet seat occupied).
11. Passenger Advisory Lights - PASS SAFETY.
12. IGNITION - NORM.
13. Pressurization - ZERO DIFFERENTIAL at touchdown.
14. Landing Gear - DOWN and LOCKED (3 green lights).
15. Speed Brakes - RETRACTED.
16. EICAS - CHECK.

(Continued Next Page)

■ SINGLE-ENGINE APPROACH AND LANDING (Continued)

17. Airspeed - V_{REF}(Flaps 15°).
18. Autopilot - OFF.

Landing

1. Throttle - IDLE.
2. Speed Brakes - EXTEND at touchdown.
3. Elevator Control - FORWARD PRESSURE at touchdown.
4. Brakes - APPLY after nose wheel ground contact.
5. Thrust Reverser (RH only) - DEPLOY after nose wheel ground contact.

CAUTION

REVERSE THRUST MAY NEED TO BE REDUCED DURING CROSSWIND LANDINGS, OR ON WET OR ICY RUNWAYS, DUE TO ASYMMETRIC THRUST.

Procedure completed

● IF LEFT ENGINE INOPERATIVE - "A" HYDRAULIC SYSTEM INOPERATIVE

1. HYDRAULIC PUMP "A" Switch - UNLOAD.
2. HYDR B/PTU CONT Circuit Breaker - PULL.
3. "A" AUX HYDRAULIC PUMP - OFF.

WARNING

- **DO NOT EXTEND FLAPS BEYOND 15° WITH EITHER HYDRAULIC SYSTEM DEPRESSURIZED. IF A SPEED BRAKE OR ROLL SPOILER CHECK VALVE FAILS TO SEAT, UNCOMMANDED ROLL MAY RESULT. RETRACT FLAPS TO 15° IF EXTENDED.**

- **DO NOT USE SPEED BRAKES IN FLIGHT UNLESS "A" HYDRAULIC SYSTEM PRESSURE IS ZERO. OUTBOARD SPEED BRAKE PANELS MAY NOT RETRACT.**

NOTE

With "A" hydraulic system inoperative, the following subsystems will be inoperative: outboard roll spoilers, normal wheel brakes, anti-skid, LH thrust reverser, outboard speed brake panels, and normal landing gear extension. Nose wheel steering will have accumulator pressure only.

(Continued Next Page)

■ SINGLE-ENGINE APPROACH AND LANDING (Continued)

Before Landing (“A” Hydraulic System Inoperative)

1. Landing Data - CONFIRM.
   a. Airspeed - V_{REF}.

V_{REF} (KIAS)

FLAPS/SLATS	WEIGHT - POUNDS							
	23,000	25,000	27,000	28,000	29,000	30,000	31,000	31,800
15°/Extended	113	119	124	127	129	132	135	137

   b. Multiply Normal **FLAPS 15°** Landing Distance by 1.6.

CAUTION

AVOID LANDING WITH TAILWIND OR DOWNHILL RUNWAY GRADIENT.

NOTE

For single engine circling approaches, fly V_{REF}(Flaps 15°) +20 KIAS until landing is assured.

2. Airspeed - V_{REF}(Flaps 15°) +10 KIAS, MINIMUM until landing is assured.
3. Crew Briefing - COMPLETE.
4. Avionics and Flight Instruments - CHECK/SET.
5. Minimums - SET (RA/BARO).
6. FUEL CROSSFEED - AS REQUIRED, then OFF.
7. Exterior Lights - AS REQUIRED.
8. Flaps - 15° MAXIMUM (5°/250 KIAS, 15°/210 KIAS).
9. Passengers - BRIEF.
10. Seats/Seat Belts/Shoulder Harnesses/Aft Divider Sliding Doors - CHECK/SECURE/LATCHED OPEN (if belted toilet seat occupied).
11. Passenger Advisory Lights - PASS SAFETY.
12. IGNITION - NORM.
13. Pressurization - ZERO DIFFERENTIAL at touchdown.
14. Landing Gear - USE BLOWDOWN.
    a. Landing Gear Blowdown Handle - PULL (<210 KIAS).
    b. Landing Gear - CHECK DOWN and LOCKED (3 green lights).
    c. Landing Gear Handle - DOWN.

NOTE

Landing gear will not retract after blowdown.

15. Speed Brakes - RETRACTED.
16. EICAS - CHECK.
17. Airspeed - V_{REF} (Flaps 15°) when landing is assured.
18. Autopilot - OFF above minimum use height.

(Continued Next Page)

■ SINGLE-ENGINE APPROACH AND LANDING (Continued)

Landing

1. Throttle - IDLE.
2. Speed Brakes - EXTEND at touchdown.
3. Elevator Control - FORWARD PRESSURE at touchdown.
4. EMERGENCY BRAKES - PULL after nose wheel ground contact.
5. Thrust Reverser (RH only) - DEPLOY WITH IDLE THRUST ONLY.

CAUTION

WHEN CLEAR OF RUNWAY, STOP AND SHUT DOWN. DO NOT ATTEMPT TO TAXI IN CLOSE PROXIMITY TO BUILDINGS OR OTHER AIRCRAFT USING EMERGENCY BRAKES AND NOSEWHEEL STEERING ACCUMULATOR PRESSURE.

Procedure completed

● **IF RIGHT ENGINE INOPERATIVE**

1. HYDRAULIC PUMP “B” Switch - UNLOAD.

WARNING

- **DO NOT EXTEND FLAPS BEYOND 15° WITH EITHER HYDRAULIC SYSTEM DEPRESSURIZED. IF A SPEED BRAKE OR ROLL SPOILER CHECK VALVE FAILS TO SEAT, UNCOMMANDED ROLL MAY RESULT. RETRACT FLAPS TO 15° IF EXTENDED.**

- **DO NOT USE SPEED BRAKES IN FLIGHT UNLESS “B” HYDRAULIC SYSTEM PRESSURE IS ZERO. INBOARD AND MIDDLE SPEED BRAKE PANELS MAY NOT RETRACT.**

NOTE

- With “B” hydraulic system inoperative, the following subsystems will be inoperative: PTU, inboard roll spoilers, inboard and middle speed brake panels and RH thrust reverser.

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■ SINGLE-ENGINE APPROACH AND LANDING (Continued)

Before Landing

1. Landing Data - CONFIRM.
   a. Airspeed - V_{REF}(Flaps 15°).

V_{REF} (KIAS)

FLAPS/SLATS	WEIGHT - POUNDS							
	23,000	**25,000**	**27,000**	**28,000**	**29,000**	**30,000**	**31,000**	**31,800**
15°/Extended	113	119	124	127	129	132	135	137

   b. Multiply Normal **FLAPS 15°** Landing Distance by 1.3.

CAUTION

AVOID LANDING WITH TAILWIND OR DOWNHILL RUNWAY GRADIENT.

NOTE

For single engine circling approaches, fly V_{REF}(Flaps 15°) +20 KIAS until landing is assured.

2. Airspeed - V_{REF}(Flaps 15°) + 10 KIAS until landing is assured.
3. Crew Briefing - COMPLETE.
4. Avionics and Flight Instruments - CHECK/SET.
5. Minimums - SET (RA/BARO).
6. FUEL CROSSFEED - AS REQUIRED, then OFF.
7. Exterior Lights - AS REQUIRED.
8. Flaps - AS REQUIRED - 15° MAXIMUM (5°/250 KIAS, 15°/210 KIAS).
9. Passengers - BRIEF.
10. Seats/Seat Belts/Shoulder Harnesses/Aft Divider Sliding Doors - CHECK/SECURE/LATCHED OPEN (if belted toilet seat occupied).
11. Passenger Advisory Lights - PASS SAFETY.
12. IGNITION - NORM.
13. Pressurization - ZERO DIFFERENTIAL at touchdown.
14. Landing Gear - DOWN and LOCKED (3 green lights).
15. Speed Brakes - RETRACTED.
16. EICAS - CHECK.
17. Airspeed - V_{REF}(Flaps 15°) when landing is assured.
18. Autopilot - OFF above minimum use height.

(Continued Next Page)

SINGLE-ENGINE APPROACH AND LANDING (Continued)

LANDING

1. Throttle - IDLE.
2. Speed Brakes - EXTEND at touchdown.
3. Elevator Control - FORWARD PRESSURE at touchdown.
4. Brakes - APPLY after nose wheel ground contact.
5. Thrust Reverser (LH only) - DEPLOY after nose wheel ground contact.

CAUTION

DUE TO ASYMMETRIC THRUST, REVERSE THRUST SHOULD BE REDUCED TO IDLE BY 70 KIAS ON SLIPPERY RUNWAYS OR IF THE NOSE WHEEL STEERING IS INOPERATIVE.

Procedure completed

SINGLE-ENGINE GO-AROUND

1. Flight Director Go-Around Button (either throttle) - PRESS.

NOTE

The flight director go-around mode is recommended to establish the climb pitch attitude reference. Pressing the throttle mounted go-around button disengages the autopilot, if on, and engages the flight director to wings level, +10 degrees pitch up go-around mode.

2. Throttle (operating engine) - SET to TO detent.
3. Airplane Pitch Attitude - POSITIVE ROTATION to +10 degrees (flight director go-around pitch command).
4. Flaps - 15° (Flaps 5° if climb gradient is a factor).
5. Climb Speed - V_{APP} MINIMUM (Flaps 15° landing schedule).
6. Landing Gear - UP when positive climb is established.
7. Flaps - UP at V_{REF} +15 KIAS, when clear of obstacles above 1000 feet AGL.
8. Climb Speed - V_{ENR} (190 KIAS).

Procedure completed

■ SINGLE-ENGINE APPROACH AND LANDING (Continued)

Before Landing

1. Landing Data - CONFIRM.
   a. Airspeed - V_{REF}(Flaps 15°)

V_{REF} (KIAS)

FLAPS/SLATS	WEIGHT - POUNDS							
	23,000	25,000	27,000	28,000	29,000	30,000	31,000	31,800
15°/Extended	113	119	124	127	129	132	135	137

   b. Multiply normal **FLAPS 15°** landing distance by 1.3.

CAUTION

AVOID LANDING WITH TAILWIND OR DOWNHILL RUNWAY GRADIENT.

NOTE

For single engine circling approaches, fly V_{REF}(Flaps 15°) +20 KIAS until landing is assured.

2. Airspeed - V_{REF}(Flaps 15°) + 10 KIAS until landing is assured.
3. Crew Briefing - COMPLETE.
4. Avionics and Flight Instruments - CHECK/SET.
5. Minimums - SET (RA/BARO).
6. FUEL CROSSFEED - AS REQUIRED, then OFF.
7. Exterior Lights - AS REQUIRED.
8. Flaps - AS REQUIRED - 15° MAXIMUM (5°/250 KIAS, 15°/210 KIAS).
9. Passengers - BRIEF.
10. Seats/Seat Belts/Shoulder Harnesses/Aft Divider Sliding Doors - CHECK/SECURE/LATCHED OPEN (if belted toilet seat occupied).
11. Passenger Advisory Lights - PASS SAFETY.
12. IGNITION - NORM.
13. Pressurization - ZERO DIFFERENTIAL at touchdown.
14. Landing Gear - DOWN and LOCKED (3 green lights).
15. Speed Brakes - RETRACTED.
16. EICAS - CHECK.
17. Airspeed - V_{REF}(Flaps 15°) when landing is assured.
18. Autopilot - OFF above minimum use height.

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■ SINGLE-ENGINE APPROACH AND LANDING (Continued)

LANDING

1. Throttle - IDLE.
2. Speed Brakes - EXTEND at touchdown.
3. Elevator Control - FORWARD PRESSURE at touchdown.
4. Brakes - APPLY after nose wheel ground contact.
5. Thrust Reverser (LH only) - DEPLOY after nose wheel ground contact.

CAUTION

DUE TO ASYMMETRIC THRUST, REVERSE THRUST SHOULD BE REDUCED TO IDLE BY 70 KIAS ON SLIPPERY RUNWAYS OR IF THE NOSE WHEEL STEERING IS INOPERATIVE.

Procedure completed

■ SINGLE-ENGINE GO-AROUND

1. Flight Director Go-Around Button (either throttle) - PRESS.

NOTE

The flight director go-around mode is recommended to establish the climb pitch attitude reference. Pressing the throttle mounted go-around button disengages the autopilot, if on, and engages the flight director to wings level, +13 degrees pitch up go-around mode.

2. Throttle (operating engine) - SET to TO detent.
3. Airplane Pitch Attitude - POSITIVE ROTATION to +10 degrees intially. When V_{APP} (minimum) is achieved increase pitch to +13 degrees or AS REQUIRED.
4. Flaps - 15° (Flaps 5° if climb gradient is a factor).
5. Climb Speed - V_{APP} MINIMUM (Flaps 15° landing schedule).
6. Landing Gear - UP when positive climb is established.
7. Flaps - UP at V_{REF} +15 KIAS, when clear of obstacles above 1000 feet AGL.
8. Climb Speed - V_{ENR} (190 KIAS).

Procedure completed

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* Denotes Primus 2000 messages

AMBER ABNORMAL PROCEDURES (Continued)

AMBER ABNORMAL PROCEDURES

This section lists procedures for specific individual Amber CAS and Primus messages. Procedure titles are listed alphabetically with the titles spelled out in parenthesis if needed.

NOTE

Except when dispatching in accordance with an approved Minimum Equipment List, conditions resulting in an amber CAS message on the ground, should be corrected prior to flight.

■ ADC1/ADC2 (AIR DATA COMPUTER 1/AIR DATA COMPUTER 2)*

Indicates both pilot and copilot displayed air data sources are the same or both pilot and copilot displayed air data sources are cross-side. (Displayed above attitude sphere in both PFDs.)

1. Cross reference standby instruments.

■ ALT (ALTIMETER)*

Indicates FWC detects altitude miscompare. (Displayed in top half of altitude scale in both PFDs.)

1. Altimeter Settings - VERIFY (ensure both pilot and copilot have correct altimeter setting).

● **IF STILL MISCOMPARED**

1. Pilot and Copilot Altitude - COMPARE WITH STANDBY INSTRUMENTS.
2. Pilot or Copilot ADC REV - SELECT SOURCE WHICH AGREES WITH STANDBY ASI/ALT.
3. Confirm ADC 1 or ADC 2 displayed in both PFDs.

Procedure completed

* Denotes Primus 2000 message

AMBER ABNORMAL PROCEDURES

This section lists procedures for specific individual Amber CAS and Primus messages. Procedure titles are listed alphabetically with the titles spelled out in parenthesis if needed.

NOTE

Except when dispatching in accordance with an approved Minimum Equipment List, conditions resulting in an amber CAS message on the ground, should be corrected prior to flight.

■ ADC1/ADC2 (AIR DATA COMPUTER 1/AIR DATA COMPUTER 2)*

Indicates both pilot and copilot displayed air data sources are the same or both pilot and copilot displayed air data sources are cross-side. (Displayed above attitude sphere in both PFDs.)

1. Cross reference standby instruments.

■ AILERON LATCHED

Indicates the AILERON LATCH handle is not properly stowed. Used only for manual reversion flight.

● **IF NOT FLYING MANUAL REVERSION**

1. AILERON LATCH Handle - PUSH DOWN.

■ ALT (ALTIMETER)*

Indicates FWC detects altitude miscompare. (Displayed in top half of altitude scale in both PFDs.)

1. Altimeter Settings - VERIFY (ensure both pilot and copilot have correct altimeter setting).

● **IF STILL MISCOMPARED**

1. Pilot and Copilot Altitude - COMPARE WITH STANDBY INSTRUMENTS.
2. Pilot or Copilot ADC REV - SELECT SOURCE WHICH AGREES WITH STANDBY ASI/ALT.
3. Confirm ADC 1 or ADC 2 displayed in both PFDs.

Procedure completed

* Denotes Primus 2000 message

■ ANTISKID FAIL

1. ANTISKID Switch - CHECK NORM.

● **IF STILL INOPERATIVE**

1. ANTISKID Switch - OFF.
2. Multiply **(FLAPS FULL)** Landing Distance by 1.4.

CAUTION

WITH ANTISKID OFF, IT IS POSSIBLE TO SKID THE MAIN GEAR TIRES RESULTING IN TIRE FAILURE. APPLY BRAKES ONLY AFTER NOSE WHEEL CONTACT. GRADUALLY INCREASE BRAKE PEDAL FORCE TO ACHIEVE THE DESIRED DECELERATION AND AVOID SKIDDING TIRES.

Procedure completed

■ AOA HEAT FAIL L-R (ANGLE-OF-ATTACK HEAT FAILURE L-R)

1. LH/RH PITOT/STATIC Switches - CHECK ON.
2. Leave icing environment as soon as possible.

NOTE

Affected side stall warning and low speed awareness may be unreliable in icing conditions.

Procedure completed

■ AOA PROBE FAIL L-R (ANGLE-OF-ATTACK PROBE FAILURE L-R)

● **IF ONE SIDE ONLY**

1. Opposite side AOA - MONITOR.

NOTE

Affected side stall warning and low speed awareness will be unreliable.

Procedure completed

● **IF BOTH SIDES FAILED**

1. Airspeed - 150 KIAS MINIMUM ABOVE 15,000 FEET MSL.
   - V_{APP}/V_{REF} MINIMUM (per flap schedule).

WARNING

THE FOLLOWING SYSTEMS WILL BE INOPERATIVE:

- **AUTOSLAT SYSTEM**
- **BOTH STICK SHAKERS**
- **MINIMUM SPEED WARNING SYSTEM**
- **LOW SPEED AWARENESS SYSTEM**

2. Land as soon as practical.

Procedure completed

* Denotes Primus 2000 message

■ AP STAB TRIM INOP (AUTOPILOT STABILIZER TRIM INOPERATIVE)

1. Control Column - GRIP.
2. AP/TRIM/NWS Disengage Button - PRESS (expect small force).
3. Stabilizer Trim - RETRIM.

NOTE

Primary stabilizer trim may be inoperative.

Procedure completed

■ APU GEN OFF (APU GENERATOR OFF)

In flight indicates APU generator is running AND that BOTH the APU and right-hand generators are off-line.

1. Generator Switches - CHECK/AS REQUIRED.

■ ATT (ATTITUDE)*

Indicates FWC detects attitude miscompare. (Displayed in top half of attitude sphere in both PFDs.)

1. AP/TRIM/NWS Disengage Button - PRESS.
2. Pilot and Copilot Attitude Indicators - COMPARE WITH STANDBY ATTITUDE INDICATOR.
3. Pilot or Copilot AHRS REV - SELECT SOURCE THAT AGREES WITH STANDBY ATTITUDE.
4. Confirm ATT1 or ATT2 displayed on both PFDs.

■ ATT1/ATT2 (ATTITUDE 1/ATTITUDE 2)*

Indicates both pilot and copilot displayed attitude sources are the same or both pilot and copilot displayed attitude sources are cross-side. (Displayed in both PFD attitude spheres.)

■ ANTISKID FAIL

1. ANTISKID Switch - CHECK NORM.

● **IF STILL INOPERATIVE**

1. ANTISKID Switch - OFF.
2. Multiply **(FLAPS FULL)** Landing Distance by 1.4.

CAUTION

WITH ANTISKID OFF, IT IS POSSIBLE TO SKID THE MAIN GEAR TIRES RESULTING IN TIRE FAILURE. APPLY BRAKES ONLY AFTER NOSE WHEEL CONTACT. GRADUALLY INCREASE BRAKE PEDAL FORCE TO ACHIEVE THE DESIRED DECELERATION AND AVOID SKIDDING TIRES.

Procedure completed

■ AOA HEAT FAIL L-R (ANGLE-OF-ATTACK HEAT FAILURE L-R)

1. LH/RH PITOT/STATIC Switches - CHECK ON.
2. Leave icing environment as soon as possible.

NOTE

Affected side stall warning and low speed awareness may be unreliable in icing conditions.

Procedure completed

■ AOA PROBE FAIL L-R (ANGLE-OF-ATTACK PROBE FAILURE L-R)

● **IF ONE SIDE ONLY**

1. Opposite side AOA - MONITOR.

NOTE

Affected side stall warning and low speed awareness will be unreliable.

Procedure completed

● **IF BOTH SIDES FAILED**

1. Airspeed - 150 KIAS MINIMUM ABOVE 15,000 FEET MSL.
   - V_{APP}/V_{REF} MINIMUM (per flap schedule).

WARNING

THE FOLLOWING SYSTEMS WILL BE INOPERATIVE:

- **AUTOSLAT SYSTEM**
- **BOTH STICK SHAKERS**
- **MINIMUM SPEED WARNING SYSTEM**
- **LOW SPEED AWARENESS SYSTEM**

2. Land as soon as practical.

Procedure completed

* Denotes Primus 2000 message

■ AP STAB TRIM INOP (AUTOPILOT STABILIZER TRIM INOPERATIVE)

1. Control Column - GRIP.
2. AP/TRIM/NWS Disengage Button - PRESS (expect small force).
3. Stabilizer Trim - RETRIM.

NOTE

Primary stabilizer trim may be inoperative.

Procedure completed

■ APU GEN OFF (APU GENERATOR OFF)

Indicates an APU generator is OFF (or failed), APU is running, and either main generator is OFF (in flight only).

1. Generator Switches - CHECK/AS REQUIRED.

■ ATT (ATTITUDE)*

Indicates FWC detects attitude miscompare. (Displayed in top half of attitude sphere in both PFDs.)

1. AP/TRIM/NWS Disengage Button - PRESS.
2. Pilot and Copilot Attitude Indicators - COMPARE WITH STANDBY ATTITUDE INDICATOR.
3. Pilot or Copilot AHRS REV - SELECT SOURCE THAT AGREES WITH STANDBY ATTITUDE.
4. Confirm ATT1 or ATT2 displayed on both PFDs.

■ ATT1/ATT2 (ATTITUDE 1/ATTITUDE 2)*

Indicates both pilot and copilot displayed attitude sources are the same or both pilot and copilot displayed attitude sources are cross-side. (Displayed in both PFD attitude spheres.)

■ AURAL WARNING FAIL

Indicates that both aural warning computers have failed. All aural warnings will be inoperative.

■ BAGGAGE ALTITUDE

1. Pressurization ISO VLV Switch - CLOSE (lift cover).
2. Altitude - FL410 MAXIMUM.
3. Cabin Pressure - MONITOR.

NOTE

- Indicates either the baggage compartment altitude is above approximately 14,000 feet or delta pressure between the cabin and the baggage compartment exceeds 1.0 PSID.
- Baggage isolation valve should close automatically with actual loss of baggage compartment pressure.
- Baggage compartment will not repressurize until delta pressure between the cabin and the baggage compartment is less than 1.0 PSID and baggage compartment pressure is below 14,000 feet.
- After landing, refer to AFM limitations for logging flights (cycles) with baggage compartment not pressurized.
- Determine the cause of the baggage compartment pressure loss before further dispatch.

Procedure completed

■ BAGGAGE DOOR OPEN

NOTE

Baggage door not latched.

1. Pressurization ISO VLV Switch - CLOSE (lift cover).
2. Altitude - FL410 MAXIMUM.
3. Cabin Pressure - MONITOR.

NOTE

After landing, refer to AFM limitations for logging flights (cycles) with baggage compartment not pressurized.

Procedure completed

■ BAGGAGE DOOR SEAL

NOTE

Baggage door seal not properly inflated.

1. Cabin Pressure - MONITOR.

● **IF CABIN ALTITUDE IS NOT MAINTAINED**

1. Pressurization ISO VLV Switch - CLOSE (lift cover).

NOTE

- The pressurization ISO VLV will automatically close if baggage compartment altitude is above approximately 14,000 feet, or delta pressure between the cabin and the baggage compartment exceeds approximately 1.0 PSID. A slow leak may not result in >1. PSID.

- Refer to Abnormal Procedures, BAGGAGE ALTITUDE, and after landing, refer to AFM limitations for logging flights (cycles) with baggage compartment not pressurized

2. Altitude - FL410 MAXIMUM.

Procedure completed

■ BATT 1-2 OFF

1. BATT Switch - CHECK.

NOTE

This message will be cyan if the battery has been selected OFF due to a battery overtemperature and the overtemperature condition still exists.

■ BATT 1-2 O'CURRENT

1. Affected DC Power Bus 1 or Bus 2 Switch - VERIFY EMER.

● **IF BATTERY DISCHARGE DROPS**

1. Land as soon as practical.

Battery overcurrent may follow the respective side DC OVERCURRENT if a fault exists on the affected battery bus or associated emergency bus. In this case, the automatic DC overcurrent protection should have opened the respective DC Power Bus 1 or Bus 2 relay, as indicated by the respective DC BUS EMER 1-2 CAS message and by the respective DC Power Bus 1 or Bus 2 switch illuminated EMER. However, if a fault existed on the affected feed bus or other associated distribution busses, and the crew selected the overcurrent generator off prior to automatic protection activation, the fault would transfer to the battery. Selecting the affected DC Power Bus 1 or Bus 2 switch to EMER will then isolate the circuit.

(Continued Next Page)

■ BAGGAGE ALTITUDE

1. Pressurization ISO VLV Switch - CLOSE (lift cover).
2. Altitude - FL410 MAXIMUM.
3. Cabin Pressure - MONITOR.

NOTE

- Indicates either the baggage compartment altitude is above approximately 14,000 feet or delta pressure between the cabin and the baggage compartment exceeds 1.0 PSID.
- Baggage isolation valve should close automatically with actual loss of baggage compartment pressure.
- Baggage compartment will not repressurize until delta pressure between the cabin and the baggage compartment is less than 1.0 PSID and baggage compartment pressure is below 14,000 feet.
- After landing, refer to AFM limitations for logging flights (cycles) with baggage compartment not pressurized.
- Determine the cause of the baggage compartment pressure loss before further dispatch.

Procedure completed

■ BAGGAGE DOOR OPEN

NOTE

Baggage door not latched.

1. Pressurization ISO VLV Switch - CLOSE (lift cover).
2. Altitude - FL410 MAXIMUM.
3. Cabin Pressure - MONITOR.

NOTE

After landing, refer to AFM limitations for logging flights (cycles) with baggage compartment not pressurized.

Procedure completed

■ BAGGAGE DOOR SEAL

NOTE

Baggage door seal not properly inflated.

1. Cabin Pressure - MONITOR.

● **IF CABIN ALTITUDE IS NOT MAINTAINED**

   1. Pressurization ISO VLV Switch - CLOSE (lift cover).

NOTE

- The pressurization ISO VLV will automatically close if baggage compartment altitude is above approximately 14,000 feet, or delta pressure between the cabin and the baggage compartment exceeds approximately 1.0 PSID. A slow leak may not result in >1. PSID.

- Refer to Abnormal Procedures, BAGGAGE ALTITUDE, and after landing, refer to AFM limitations for logging flights (cycles) with baggage compartment not pressurized

   2. Altitude - FL410 MAXIMUM.

Procedure completed

■ BATT 1-2 OFF

1. BATT Switch - CHECK.

NOTE

This message will be cyan if the battery has been selected OFF due to a battery overtemperature and the overtemperature condition still exists.

■ BATT 1-2 O'CURRENT

1. Affected DC Power Bus 1 or Bus 2 Switch - VERIFY EMER.

● **IF BATTERY DISCHARGE DROPS**

   1. Land as soon as practical.

Battery overcurrent may follow the respective side DC OVERCURRENT if a fault exists on the affected battery bus or associated emergency bus. In this case, the automatic DC overcurrent protection should have opened the respective DC Power Bus 1 or Bus 2 relay, as indicated by the respective DC BUS EMER 1-2 CAS message and by the respective DC Power Bus 1 or Bus 2 switch illuminated EMER. However, if a fault existed on the affected feed bus or other associated distribution busses, and the crew selected the overcurrent generator off prior to automatic protection activation, the fault would transfer to the battery. Selecting the affected DC Power Bus 1 or Bus 2 switch to EMER will then isolate the circuit.

(Continued Next Page)

■ BATT 1-2 O'CURRENT (Continued)

2. Affected DC BATT Ammeter - CHECK (forward of pilot's CB panel).

Procedure completed

● **IF STILL HIGH DISCHARGE (>200 amps, fault on battery bus)**

1. Affected BATT Switch - OFF.

NOTE

Equipment on the associated battery/emergency bus will be inoperative.

Procedure completed

☐ **IF BATTERY DISCHARGE IS STILL HIGH (battery feed short)**

1. Land as soon as possible.

Procedure completed

■ BUS CTRL 1-2 FAIL (BUS CONTROLLER 1-2 FAILURE)

1. Land as soon as practical.

NOTE

- Digital data bus controller has failed and opposite controller is automatically selected.
- Loss of the second controller will result in loss of all PFD, MFD and EICAS displays, FADECs ADC reversionary mode, and loss of FGCs, lower rudder yaw dampers, primary trim, and Mach trim.

Procedure completed

● **IF SECOND FAILURE OCCURS**

1. Refer to Standby Instruments; ASI/ALT, Attitude, HSI and engine.
2. Altitude - FL410 MAXIMUM.
3. Airspeed - PER STANDBY ASI/ALT PLACARD.
4. Land as soon as possible.

Procedure completed

■ CABIN ALTITUDE (CABIN ALTITUDE ABOVE 8500 FEET) (10,000 FEET RED CABIN ALTITUDE MESSAGE NOT ON)

1. Pressurization Controls - CHECK PROPER SETTINGS.
2. PAC TEMP SEL Switches - SELECT FULL HOT (auto or manual, if above FL470).

Procedure completed

● **IF CABIN ALTITUDE NOT ARRESTED**

1. Pressurization ISO VLV Switch - CLOSE (lift cover).

Procedure completed

● **IF CABIN ALTITUDE STILL NOT ARRESTED**

1. Pressurization NORM/ALT SEL Switch - SELECT ALT SEL.
2. Cabin Altitude Selector - SET CABIN ALTITUDE ≤8000 FEET/MAX RATE.
3. PAC BLEED SELECT Switch - HP.

Procedure completed

● **IF CABIN ALTITUDE STILL NOT ARRESTED IN ALT SEL MODE**

1. Pressurization NORM/MANUAL Switch - MANUAL.
2. Manual UP/DN Switch - DN, RATE - MAX.
3. PAC Select Switches - HIGH (if required).

Procedure completed

● **IF NOT ARRESTED BY 10,000 FEET CABIN ALTITUDE (IN ALT SEL OR MANUAL MODE)**

NOTE

If CABIN ALTITUDE red CAS message illuminates indicating cabin altitude is above 10,000 feet.

1. Refer to Emergency Procedures, LOSS OF CABIN PRESSURE.

Procedure completed

■ CABIN DOOR OPEN

WARNING

CABIN DOOR LATCH AND/OR ONE OR MORE DOOR PIN SWITCHES ARE NOT SEATED, OR THE DOOR MECHANISM OR SWITCH SEQUENCING WAS NOT CORRECT. STAY CLEAR OF CABIN DOOR.

1. MASTER CAUTION RESET - PRESS.

(Continued Next Page)

■ CABIN DOOR OPEN (Continued)

● IF MESSAGE CLEARS

1. Cabin Door Pins - INSPECT.

NOTE

Pressing the MASTER CAUTION RESET will inhibit the message for any one switch, or sequencing problem. Dispatch is permitted if the message clears and visual inspection confirms all door pins to be seated.

Procedure completed

● IF MESSAGE REMAINS

1. Pressurization NORM/ALT SEL Switch - SELECT ALT SEL.
2. Cabin Altitude Selector - SET 10,000 FEET.
3. Descend as soon as practical - ≤41,000 FEET.

Procedure completed

■ CABIN DOOR SEAL

Indicates cabin door primary seal pressure is low.

1. Descend as soon as practical - ≤41,000 feet.

Procedure completed

■ CABIN PAC O'TEMP (CABIN PAC OVERTEMPERATURE)

NOTE

The PAC will automatically shut down. The following procedure is to reset the PAC.

1. CAB PAC Switch - OFF.
2. Cabin Temperature - SELECT WARMER TEMPERATURE.
3. CAB PAC Switch - ON (after O'TEMP message is out).

● IF PAC DOES NOT RESET (NO AIRFLOW EVIDENT)

1. Descend as soon as practical - ≤41,000 FEET.

Procedure completed

■ CBN VENT DOOR OPEN (CABIN VENT DOOR OPEN)

● IN FLIGHT - IF CABIN PRESSURE NOT LOST

1. Pressurization NORM/ALT SEL Switch - SELECT ALT SEL.
2. Cabin Altitude Selector - SET 10,000 FEET.
3. Descend as soon as practical - ≤41,000 FEET.
4. Cabin Altitude - MONITOR.

NOTE

- May indicate a cabin door sequencing problem. Check for CABIN DOOR OPEN message.
- If the vent door opens, cabin pressurization will be lost.

Procedure completed

● ON GROUND

1. Cabin Door - OPEN.
2. Cabin Vent Door - CLOSE.
3. Visual Door Pin Indicators - CHECK PROPER INDICATION.

Procedure completed

☐ IF MESSAGE STILL ILLUMINATED

1. Refer to CABIN ALTITUDE amber and/or red message procedures.
2. Descend as required if unable to control pressure loss.

NOTE

The cabin vent door can be manually closed using a lever located inside the door assembly. The lever is accessible through a plug in the aft side of the stair assembly.

Procedure completed

■ CHECK AP ENGAGE (CHECK AUTOPILOT ENGAGE)

Indicates FWC and AFCS monitors disagree on autopilot clutch status.

1. Autopilot - DISENGAGE, REENGAGE.

● IF AUTOPILOT WILL NOT DISENGAGE

1. AP - A and AP - B Circuit Breakers - PULL (RH circuit breaker panel).

Procedure completed

■ CHECK DU 1-2-3-4-5 (CHECK DISPLAY UNIT 1-2-3-4-5)

Indicates display unit wrap around monitor has failed. If the affected display unit is used as a PFD, it may be presenting misleading Mach, altitude, airspeed, attitude or baro-set information. DU's are numbered left to right.

1. Display Unit - VERIFY PROPER INFORMATION DISPLAYED.
2. Display Controllers - SELECT REVERSIONARY IF REQUIRED.

Procedure completed

■ CHIP DETECT L-R (CHIP DETECTOR L OR R ENGINE OIL)

1. Land as soon as practical (within 4 hours).
2. Chip Detectors - VISUALLY INSPECT AFTER LANDING.

Procedure completed

■ COCKPIT PAC O'TEMP (COCKPIT PAC OVERTEMPERATURE)

NOTE

The PAC will automatically shut down. The following procedure is to reset the PAC.

1. CKPT PAC Switch - OFF.
2. Cockpit Temperature - SELECT WARMER TEMPERATURE.
3. CKPT PAC Switch - ON (after O'TEMP message is out).

● **IF PAC RESETS**

Procedure completed

● **IF PAC DOES NOT RESET (NO AIRFLOW EVIDENT)**

1. Descend as soon as practical - ≤41,000 FEET.

Procedure completed

■ CONFIG MISMTCH 1-2 (CONFIGURATION MISMATCH 1-2)

NOTE

Indicates Primus 2000 system is detecting mismatched software in the IACs. This message is inhibited in flight.

1. Correct prior to flight.

Procedure completed

■ CTR XFER OFF L-R (CENTER TRANSFER OFF L-R)

Indicates affected center tank to wing tank fuel transfer is off.

1. CTR WING XFER Switch - AS REQUIRED.

NOTE

Center tank to wing transfer must be initiated prior to reaching 3100 lbs per side wing fuel.

Procedure completed

■ CBN VENT DOOR OPEN (CABIN VENT DOOR OPEN)

● **IN FLIGHT**

☐ **IF CABIN PRESSURE NOT LOST**

1. Pressurization NORM/ALT SEL Switch - SELECT ALT SEL.
2. Cabin Altitude Selector - SET 10,000 FEET.
3. Descend as soon as practical - ≤41,000 FEET.
4. Cabin Altitude - MONITOR.

NOTE

May indicate a cabin door sequencing problem. Check for CABIN DOOR OPEN message.

Procedure completed

☐ **LOSS OF CABIN PRESSURE**

1. Refer to CABIN ALTITUDE amber and/or red message procedures.
2. Descend as required if unable to control pressure loss.

Procedure completed

● **ON GROUND**

1. Cabin Door - CLOSE.
2. Cabin Vent Door - CLOSE MANUALLY.
3. Cabin Door EICAS Messages - VERIFY EXTINGUISHED.

NOTE

The cabin vent door can be manually closed using a lever located inside the door assembly. The lever is accessible through a plug in the aft side of the stair assembly.

Procedure completed

■ CHECK AP ENGAGE (CHECK AUTOPILOT ENGAGE)

Indicates FWC and AFCS monitors disagree on autopilot clutch status.

1. Autopilot - DISENGAGE, REENGAGE.

● **IF AUTOPILOT WILL NOT DISENGAGE**

1. AP - A and AP - B Circuit Breakers - PULL (RH circuit breaker panel).

Procedure completed

■ CHECK DU 1-2-3-4-5 (CHECK DISPLAY UNIT 1-2-3-4-5)

Indicates display unit wrap around monitor has failed. If the affected display unit is used as a PFD, it may be presenting misleading Mach, altitude, airspeed, attitude or baro-set information. DU's are numbered left to right.

1. Display Unit - VERIFY PROPER INFORMATION DISPLAYED.
2. Display Controllers - SELECT REVERSIONARY IF REQUIRED.

Procedure completed

■ CHIP DETECT L-R (CHIP DETECTOR L OR R ENGINE OIL)

1. Land as soon as practical (within 4 hours).
2. Chip Detectors - VISUALLY INSPECT AFTER LANDING.

Procedure completed

■ COCKPIT PAC O'TEMP (COCKPIT PAC OVERTEMPERATURE)

NOTE

The PAC will automatically shut down. The following procedure is to reset the PAC.

1. CKPT PAC Switch - OFF.
2. Cockpit Temperature - SELECT WARMER TEMPERATURE.
3. CKPT PAC Switch - ON (after O'TEMP message is out).

● **IF PAC RESETS**

Procedure completed

● **IF PAC DOES NOT RESET (NO AIRFLOW EVIDENT)**

1. Descend as soon as practical - ≤41,000 FEET.

Procedure completed

■ CONFIG MISMTCH 1-2 (CONFIGURATION MISMATCH 1-2)

NOTE

Indicates Primus 2000 system is detecting mismatched software in the IACs. This message is inhibited in flight.

1. Correct prior to flight.

Procedure completed

■ CTR XFER OFF L-R (CENTER TRANSFER OFF L-R)

Indicates affected center tank to wing tank fuel transfer is off.

1. CTR WING XFER Switch - AS REQUIRED.

NOTE

Center tank to wing transfer must be initiated prior to reaching 3100 lbs per side wing fuel.

Procedure completed

■ CTR XFER XSIT L-R (CENTER TRANSFER IN TRANSIT L-R)

Indicates that the affected center tank transfer valve is neither open nor closed. If fuel is in the center tank, fuel transfer to the affected wing may be reduced.

1. Affected CTR WING XFER Switch - ON.
2. Wing Fuel Quantity - MONITOR.
3. CROSSFEED - AS REQUIRED.

Procedure completed

■ CROSSTIE CLOSED

1. DC Power XTIE Switch Annunciator - CHECK/AS REQUIRED.

NOTE

- Indicates the crosstie relay has been selected closed when the normal position is open, i.e. in flight.
- This message will be cyan if the left generator or both right and APU generators are off line and the crosstie relay has been selected closed.

Procedure completed

■ DAU 1-2 MISCMP (DATA ACQUISITION UNITS 1-2 MISCOMPARE)

Indicates A and B channels of the affected DAU do not agree (except engine parameters).

1. EICAS - CHECK DISPLAY.
2. DAU REV Switch (affected side) - SELECT DAU REV, CHECK DISPLAY FOR DIFFERENCES.
3. DAU REV Switch - SELECT CHANNEL WHICH IS CORRECT.
4. Red CAS Messages - TREAT AS REAL if not positively verified to be invalid.

NOTE

Red CAS messages, valid or invalid, will always be displayed.

Procedure completed

■ DAU 1-2 MISCMP-ENG (DATA ACQUISITION UNITS 1-2 MISCOMPARE -ENGINE)

Indicates A and B channels of the affected DAU do not agree with respect to engine data (N_1, N_2, ITT, oil temperature, oil pressure, oil quantity and fuel flow).

1. EICAS - CHECK AFFECTED SIDE ENGINE DATA (compare to standby).

- **IF ENGINE DATA IS NOT ACCURATE**

  1. DAU REV Switch (affected side) - SELECT DAU REV.

  Procedure completed

■ DAU 1A - 1B - 2A - 2B FAIL (DATA ACQUISITION UNIT 1A - 1B - 2A - 2B FAILURE)

● IF 1A OR 2A

1. Affected DAU - SELECT DAU REV.

NOTE

If either DAU "A" Channel is failed, the following information, which receives "A" channel excitation, will not be available from the affected DAU, even if DAU reversionary is selected:

Engine Oil Pressure	Battery 1 Temperature
Engine Oil Level	Fuel Tank Temperature
Hydraulic Pressure	Engine Fuel Temperature
Hydraulic Temperature	Rudder (RSS) Hydraulic Pressure
Hydraulic Volume	Start Duct Pressure

Procedure completed

● IF 1B OR 2B

1. Do not select DAU REV.

NOTE

DAU 1 and 2 normally power up on "A" channel. Selecting REVERSIONARY will select the "B" channel.

Procedure completed

● IF BOTH A AND B ON SAME DAU

NOTE

Affected side EICAS engine data and numerous CAS messages will be inoperative.

1. Engine Data - USE STANDBY instruments.
2. Land as soon as practical.

Procedure completed

■ DAU ALL FAIL (DATA ACQUISITION UNITS ALL FAIL)

NOTE

EICAS engine data and most CAS messages will be inoperative.

1. Engine Data - USE STANDBY instruments.
2. Land as soon as practical.

Procedure completed

■ DC BUS EMER 1-2

NOTE

Indicates the respective battery Bus 1 or Bus 2 isolation relay is open, either automatically by DC OVERCURRENT or by pilot selection of the affected DC Power Bus 1 or Bus 2 switch to EMER.

1. Affected DC Power Bus 1 or Bus 2 Switch - CHECK/AS REQUIRED.
2. Refer to Amber Abnormal Procedures, DC OVERCURRENT L-R - APU.

■ DC OVERCURRENT L-R - APU

1. Generator Current - CHECK.

NOTE

- Do not turn off the affected generator immediately. If the overcurrent is excessive, >800 amp/≥ 15 seconds, automatic monitoring will shut off the affected generator and open the affected battery bus isolation relay. The generator will be latched off; bus isolation relay and crosstie relay will be latched open to protect against powering a short. Pilot selection of the generator off prior to automatic activation will disable automatic relay opening and latching and transfer the load to the battery resulting in BATT O'CURRENT. If current is high and pilot intervention is desired before 15 seconds, follow the procedure below for No Auto Shutoff.

- Momentary overcurrent, >400 amps, is possible in some high-current demands such as charging both batteries and APU start on a single generator.

- **IF CURRENT >400 AMPS SUSTAINED OR >800 AMPS AND NO AUTO SHUTOFF AFTER 15 SECONDS**

1. DC Power Affected Bus 1 or Bus 2 Switch Annunciator - EMER.

NOTE

The APU generator feeds battery 2 through the DC Power Bus 2 isolation relay and BATT 2 Bus.

2. Affected Generator Switch - OFF.

(Continued Next Page)

■ DC OVERCURRENT L-R-APU (Continued)

WARNING

DO NOT ATTEMPT TO RESET GENERATOR OR TO CLOSE THE CROSSTIE OR BUS ISOLATION RELAYS.

Procedure completed

● IF MONITOR AUTOMATICALLY SHUT OFF GENERATOR

1. Affected DC Power Bus 1 or Bus 2 Switch - Verify EMER.
2. Affected Generator - Verify OFF (EICAS)/Switch - OFF.

NOTE

If the generator has been automatically shut off, it cannot be selected back on line. If the APU generator is on (but not on line) and the RH generator is automatically shut off, the APU generator will not be allowed to come on line. However, if the RH generator is reset, the APU generator will be allowed to come on line, probably resulting in a DC OVERCURRENT APU.

3. Affected Battery Ammeter - CHECK (forward of pilot's CB panel).

☐ IF EXCESSIVE BATTERY DISCHARGE/BATT 1-2 O'CURRENT CAS MESSAGE ON

1. Affected Battery Switch - OFF.
2. Land as soon as practical. All affected side battery/emergency bus and main distribution bus equipment will be inoperative.
3. Battery Temperature - MONITOR.

NOTE

- Refer to Figure 3-1 of the FAA Approved Flight Manual for operative and inoperative equipment.
- While in this condition, transponder and external lighting are not operative. Advise Air Traffic Control.

Procedure completed

☐ IF BATTERY DISCHARGE NORMAL/NO BATT 1-2 O'HEAT

1. Land as soon as practical. All affected side main bus and distribution bus equipment will be inoperative. Emergency and battery bus equipment will operate using battery power.

NOTE

- Refer to Figure 3-1 of the FAA Approved Flight Manual for operative and inoperative equipment.
- While in this condition, transponder and external lighting are not operative. Advise Air Traffic Control.

Procedure completed

■ DG1/DG2 (DIRECTIONAL GYRO 1/DIRECTIONAL GYRO 2)*

Indicates the respective AHRS switch is in DG. (Displayed above the HSI compass rose on the PFDs and MFDs.)

Procedure completed

■ DGR (FMS DEGRADED MODE)*

Indicates FMS operating in degraded mode. (Displayed to the left of the HSI compass rose in the PFDs.)

1. Check FMS sensors reception.
2. Terminal area FMS navigation is prohibited.

Procedure completed

■ DR (DEAD RECKONING)*

Indicates FMS operating in Dead Reckoning mode. (Displayed to the left of the HSI compass rose in the PFDs.)

1. Navigation - USE OTHER SOURCES.
2. Check FMS sensors reception.

Procedure completed

* Denotes Primus 2000 message

■ DU 1-2-3-4-5 HOT (DISPLAY UNIT 1-2-3-4-5 HOT)

● **IF 1 OR 5 (PFDS)**

1. Affected Display Dim Knob - OFF (transfer PFD function to adjacent MFD).

Procedure completed

☐ **IF MESSAGE DOES NOT CLEAR**

1. Affected PFD Circuit Breaker - PULL.

NOTE

Selecting the PFD DIM knob to OFF only removes partial power from the DU.

Procedure completed

● **IF 2 OR 4 (MFDS)**

1. Affected MFD Circuit Breaker - PULL.

Procedure completed

● **IF 3 (EICAS)**

1. EICAS DISPLAY Switch - LEFT (retains RH MFD for FWC2 red messages).
2. If message does not clear, EICAS Circuit Breaker - PULL.

Procedure completed

■ DUCT O'TEMP CABIN/CKPT (DUCT OVERTEMPERATURE CABIN OR COCKPIT)

1. Affected PAC TEMP SEL Switch - SELECT COOLER TEMPERATURE.

Procedure completed

● **IF CONDITION DOES NOT CLEAR**

1. Affected PAC TEMP SEL Switch - MANUAL FULL COLD.

Procedure completed

☐ **IF CONDITION DOES NOT CLEAR**

1. Refer to Abnormal Procedures, COCKPIT/CABIN TEMPERATURE CONTROL INOPERATIVE.

Procedure completed

■ EICAS (ENGINE INDICATING CREW ALERTING SYSTEM)*

Indicates FWC wrap-around monitor detects difference in engine parameters: N_1, N_2 or ITT. (Displayed above and left of the HSI compass rose in PFD.)

1. EICAS Engine Data - COMPARE WITH STANDBY INSTRUMENTS.
2. If EICAS instruments are in error - USE STANDBY ENGINE INSTRUMENTS.

Procedure completed

* Denotes Primus 2000 message

■ ENG A/I COLD L-R (ENGINE ANTI-ICE COLD L-R)

1. Engine Anti-Ice Switches - CHECK.
2. Throttle (affected engine) - INCREASE POWER.

Procedure completed

● IF MESSAGE REMAINS AND PAC HP VLV OPEN CAS MESSAGE IS DISPLAYED

1. PAC BLEED SELECT Switch - LP.

Procedure completed

☐ IF MESSAGE REMAINS

1. Affected ENG/WING Anti-Ice Circuit Breaker - PULL.
2. Visually verify inlet is anti-icing.

Procedure completed

● IF IT CANNOT BE VISUALLY VERIFIED THAT INLET IS ANTI-ICING

1. Leave icing environment as soon as possible.

NOTE

- This message will be cyan if the PYLON BLD LEAK L-R message is on. Refer to Emergency Procedures, PYLON BLEED LEAK.
- This message will also be illuminated if the respective engine anti-ice switch is off and the opposite engine anti-ice or either stabilizer anti-ice switch is on.

Procedure completed

■ ENG A/I HOT L-R (ENGINE ANTI-ICE HOT L-R)

● IF MESSAGE CYCLES

1 Engine Anti-Ice - CONTINUE TO MONITOR.

NOTE

Cycling ENG A/I HOT message indicates the automatic overheat protection is functioning. Continue to monitor EICAS and periodically have a crew member visually verify that the inlet is anti-icing.

Procedure completed

● IF MESSAGE IS STEADY

1. Affected Engine - REDUCE POWER.
2. Leave icing environment as soon as practical.

NOTE

The ENG A/I HOT monitor is enabled whether or not anti-ice is on. If engine anti-ice can be verified to be off (switches, N_2, ITT), this message may be a monitor failure.

Procedure completed

■ ENG MTR VLV FAIL L-R (ENGINE METERING VALVE FAILURE L-R)

Indicates the metering valve has failed at the last controlled position. Thrust control is not possible.

● **IF THRUST REDUCTION IS REQUIRED**

1. Throttle (affected engine) - CONFIRM, then CUTOFF.
2. Refer to Abnormal Procedures, ENGINE FAILURE/PRECAUTIONARY SHUTDOWN and SINGLE ENGINE APPROACH AND LANDING.

Procedure completed

■ ENG O'SPD SHUTDN L-R (ENGINE OVERSPEED SHUTDOWN L-R)

CAUTION

DO NOT ATTEMPT TO RESTART.

1. Refer to Abnormal Procedures, ENGINE FAILURE/PRECAUTIONARY SHUTDOWN and SINGLE ENGINE APPROACH AND LANDING.

Procedure completed

■ ENG TLA FAILED L-R (ENGINE THROTTLE LEVER ANGLE FAILED L-R)

Indicates engine thrust will not respond to throttle movement. Thrust control is not possible from the failed position except CUTOFF.

● **IF THRUST REDUCTION IS REQUIRED**

1. Throttle (affected engine) - CONFIRM, then CUTOFF.
2. Refer to Abnormal Procedures, ENGINE FAILURE/PRECAUTIONARY SHUTDOWN and SINGLE ENGINE APPROACH AND LANDING.

Procedure completed

■ ENGINE TR SW FAULT L-R (ENGINE THRUST REVERSER SWITCH FAULT L-R)

1. FADEC Select Switch - SELECT OPPOSITE FADEC.
2. Land as soon as practical.

NOTE

If message does not clear on opposite FADEC, inadvertent thrust reverser deployment may not automatically retard the engine thrust. Auto stow may not be operational. Emergency stow will be operational.

Procedure completed

■ ENG VIBRATION L-R (ENGINE VIBRATION L-R)

CAUTION

ENGINE VIBRATION RED CAS MESSAGE INDICATES A HIGHER LEVEL OF VIBRATION. REFER TO EMERGENCY PROCEDURES, ENGINE VIBRATION L-R.

1. Vibration - CONFIRM (Audible and tactile indications).

● **IF NO VIBRATION EXISTS**

1. Engine - MONITOR FOR OTHER EVIDENCE OF MALFUNCTION.

Procedure completed

● **IF VIBRATION EXISTS**

1. Engine - MONITOR FOR OTHER EVIDENCE OF MALFUNCTION. Consider reducing RPM
2. Land as soon as practical.

Procedure completed

□ **IF VIBRATION INCREASES OR OTHER EVIDENCE OF ENGINE MALFUNCTION**

1. Consider the possibility of shutting down the engine. Refer to Abnormal Procedures, ENGINE FAILURE/PRECAUTIONARY SHUTDOWN and SINGLE ENGINE APPROACH AND LANDING.
2. Land as soon as possible.

CAUTION

IF SIGNIFICANT VIBRATION CONTINUES WITH THE ENGINE RUNNING, ENGINE FAILURE MAY RESULT.

Procedure completed

■ ESCAPE HATCH OPEN

Indicates escape hatch door proximity switch is open.

● **IN FLIGHT**

1. Escape Hatch - VERIFY SECURE.
2. Descend as soon as practical - ≤41,000 FEET.

Procedure completed

● **IF HATCH IS NOT SECURE**

1. Land as soon as possible.

Procedure completed

■ FADEC BUS FAIL L-A, L-B, R-A, R-B

● **IF ONLY A OR B**

1. FADEC Select Switch - SELECT OPPOSITE FADEC.

Procedure completed

(Continued Next Page)

■ FADEC BUS FAIL L A-B, R A-B (continued)

● IF BOTH A AND B ON SAME FADEC

NOTE

Indicates electrical connection between FADECs is compromised which could affect engine stability. Both FADECs may be in control.

1. Avoid rapid throttle movements.
2. Land as soon as practical.

Procedure completed

■ FADEC FAIL L A-B, R A-B

● ALTITUDE FL ≥ 450 AND MACH ≤ 0.6

Indicates affected FADEC CVG monitor has declared the FADEC incapable or the FADEC has failed, and the engine has automatically switched to the opposite FADEC. The opposite FADEC will continue to operate normally and the affected FADEC may reset when Mach is increased above 0.6 or altitude is below FL450.

1. Accelerate to Mach greater than 0.6.
2. Reset affected FADEC(s).

Procedure completed

◻ IF THE MESSAGE DOES NOT EXTINGUISH

1. Land as soon as practical.

Procedure completed

● N_1 TARGET INDICATOR IS AMBER

1. Takeoff/Go-Around N_1 Thrust Setting - CONFIRM.
2. Land as soon as practical.

Procedure completed

● ALL OTHER FLIGHT CONDITIONS

Indicates affected FADEC has failed, and the engine has automatically switched to the opposite FADEC. Failure of the second FADEC could result in engine flameout.

1. Land as soon as practical.

Procedure completed

■ FADEC FAULT L A-B, R A-B

1. Affected FADEC Switch - RESET.

Procedure completed

● IF ONLY A OR B AND WILL NOT RESET

1. Affected FADEC Switch - SELECT OPPOSITE FADEC.

Procedure completed

(Continued Next Page)

■ FADEC FAULT L A-B, R A-B (Continued)

● **IF BOTH A AND B AND WILL NOT RESET**

1. Affected Engine - MONITOR.

NOTE

The FADEC in control is unable to monitor itself, or the FADEC in control and FADEC not in control are detecting differences; or faulty data is being received from the air data computers, compressor inlet temperature, or pressure sensors. The engine should continue to operate normally. This message will occur during the OVER SPD warning test on the ground if the throttle(s) was (were) above idle when power was applied to the FADEC. It will also occur if the SG REV switch is selected to SG1 or SG2. If the message does not automatically clear after the SG switch is placed to NORM it can be RESET.

Procedure completed

■ FADEC REV ADC L-R OR FADEC REV N_1 L-R (FADEC REVERSIONARY AIR DATA COMPUTER OR N_1, L-R)

Indicates engine is operating in reversionary mode due to loss of or faulty MADC data, (ADC REV), and/or FADEC N_1 data, (N_1 REV).

1. Affected engine FADEC - RESET.

Procedure completed

● **IF STILL REVERSIONARY**

1. Avoid rapid throttle movements (N_1 Reversionary).

NOTE

- If the FADEC is in ADC reversionary mode (due to loss of both MADCs or faulty MADC data), significant thrust loss may be experienced at high altitude. At lower altitudes, within the takeoff envelope, full takeoff thrust is available. Engine response to throttle movement is normal.
- In ADC or N_1 reversionary mode, idle N_1 will not automatically increase when engine anti-ice is on. Idle N_1 will have to be manually increased in icing to keep ANTI-ICE COLD CAS messages extinguished.
- If the FADEC is in N_1 reversionary due to loss of N_1 signal, N_1 speed schedule is derived from N_2 speed. Rapid throttle movements should be avoided. Some thrust loss may be experienced at high altitude or high ambient temperatures. N_1 will not be displayed. FADEC will continue to provide engine limit protection.

Procedure completed

■ FAN DAMAGE L-R

1. Avoid rapid throttle movements.
2. Land as soon as practical.

NOTE

- FADEC has detected possible fan damage (from bird strike, etc.) and increased thrust schedule to compensate. If actual fan damage has occurred, N_1 (thrust) may be reduced from the pre-damage setting.
- Idle N_1 will not automatically increase when engine anti-ice is on. Idle N_1 will have to be manually increased in icing to keep ANTI-ICE COLD CAS messages extinguished.

Procedure completed

■ FD FAIL (FLIGHT DIRECTOR FAIL)*

Indicates loss of valid pitch or roll command data from AFCS. (Displayed centered above attitude sphere on PFDs.)

1. Select opposite flight guidance computer.

Procedure completed

■ FGC A-B FAIL (FLIGHT GUIDANCE COMPUTER A AND B FAILURE)

NOTE

Indicates failure of both flight guidance computers. Depending on the cause, one or both computers may automatically reset in about 30 seconds.

● **IF ONE FGC RESETS (REMAINING FGC FAIL MESSAGE WILL BE CYAN)**

1. Land as soon as practical using operating FGC.

NOTE

Transfer to the inoperative FGC will not be possible.

Procedure completed

● **IF BOTH FGCs REMAIN INOPERATIVE**

1. SECONDARY TRIM - ON, TRIM AS REQUIRED.
2. Altitude/Airspeed - FL410/0.82 MACH MAXIMUM.
3. Land as soon as practical.

NOTE

If both FGCs have failed, the PRI STAB TRIM FAIL amber CAS message will also be on. The following systems will be inoperative. Refer to appropriate procedures.

- Primary Stabilizer Trim
- Autopilot
- Flight Guidance
- Mach Trim
- Both Lower Yaw Dampers

Procedure completed

* Denotes Primus 2000 message

■ FIRE DETECT FAIL L-R-A (FIRE DETECTION SYSTEM FAILURE L-R OR APU)

NOTE

Affected fire detection system is inoperative (L or R engine, or APU).

- **IN FLIGHT**
  - ☐ **IF L-R ENGINE**
    1. Land as soon as practical.

    Procedure completed
  - ☐ **IF APU**
    1. Do not use APU.

    Procedure completed
- **ON GROUND**
  - ☐ **IF L-R ENGINE**
    1. Correct condition prior to dispatch.

    Procedure completed
  - ☐ **IF APU**
    1. Do not use APU.

    Procedure completed

■ FLAPS FAIL

1. Flap Handle - ENSURE HANDLE IS IN A DETENT (UP, SLAT, 5, 15, FULL).
2. FLAP RESET Switch - PRESS.

Procedure completed

- **IF FLAPS REMAIN INOPERATIVE**
  1. Refer to Abnormal Procedures, LANDING WITH FLAPS OR SLATS INOPERATIVE.

■ FLT CONTROL FAULT (FLIGHT CONTROL FAULT)

WARNING

DO NOT UNLOAD HYDRAULIC SYSTEMS; ONE PCU MAY BE HARDOVER.

NOTE

This message and associated illuminated FLT CONTROL SHUTOFF switch(es) could mean that one (or more) FLT CONTROL SHUTOFF switch(es) has/have been inadvertently pressed. In this case both the top and bottom (OFF) halves of the FLT CONTROL SHUTOFF switch(es) would be illuminated. Press the illuminated FLT CONTROL SHUTOFF switch(es) to restore normal operation. The CAS message and switch(es) will extinguish.

1. Autopilot - OFF.
2. Flight Controls - CHECK FOR NORMAL RESPONSE AND FEEL.

(Continued Next Page)

■ FLT CONTROL FAULT (FLIGHT CONTROL FAULT) (Continued)

● **IF FLIGHT CONTROLS ARE NORMAL AND HYDRAULIC SYSTEMS ARE NORMAL (PROBABLE FLIGHT CONTROL MONITOR FAILURE)**

1. Do not press FLT CONTROL SHUTOFF Switch.

WARNING

DO NOT UNLOAD ANY HYDRAULIC SYSTEM. A HARDOVER MAY NOT ALWAYS BE DETECTABLE BY PILOT FEEL. IF A HYDRAULIC FAILURE SUBSEQUENTLY OCCURS ON THE SIDE OPPOSITE THE HARDOVER, THE AFFECTED FLIGHT CONTROL WILL RESPOND TO THE HARDOVER. BE PREPARED TO RESIST THE CONTROL MOTION AND IMMEDIATELY PRESS THE ILLUMINATED FLT CONTROL SHUTOFF SWITCH.

2. Land as soon as practical.

Procedure completed

● **IF FLIGHT CONTROLS DO NOT RESPOND OR NOT NORMAL**

1. Affected (Illuminated) FLT CONTROL SHUTOFF Switch - LIFT COVER AND PRESS.
2. Land as soon as practical.

NOTE

Plan for the longest available runway which minimizes crosswind.

□ **IF AILERON PCU**

NOTE

Ailerons will be in manual reversion and all roll spoilers will be operational, however, control response will be slow due to high forces. Crosswind limit, 10 knots.

1. Use NORMAL LANDING procedure.

Procedure completed

□ **IF ELEVATOR PCU**

1. Opposite Side PCUs - VERIFY OPERATIONAL.

CAUTION

ENSURE THAT THE NOSE WHEEL IS FIRMLY ON THE GROUND BEFORE DEPLOYING THRUST REVERSERS.

NOTE

Elevator forces will not be significantly increased, however, control response will be slower due to only one set of PCUs powering the elevator.

2. Use NORMAL LANDING procedure.

Procedure completed

(Continued Next Page)

■ FIRE DETECT FAIL L-R-A (FIRE DETECTION SYSTEM FAILURE L-R OR APU)

NOTE

Affected fire detection system is inoperative (L or R engine, or APU).

- **IN FLIGHT**
  - ☐ **IF L-R ENGINE**
    1. Land as soon as practical.

    Procedure completed
  - ☐ **IF APU**
    1. Do not use APU.

    Procedure completed
- **ON GROUND**
  - ☐ **IF L-R ENGINE**
    1. Correct condition prior to dispatch.

    Procedure completed
  - ☐ **IF APU**
    1. Do not use APU.

    Procedure completed

■ FLAPS FAIL

1. Flap Handle - ENSURE HANDLE IS IN A DETENT (UP, SLAT, 5, 15, FULL).
2. FLAP RESET Switch - PRESS.

Procedure completed

- **IF FLAPS REMAIN INOPERATIVE**
  1. Refer to Abnormal Procedures, LANDING WITH FLAPS OR SLATS INOPERATIVE.

■ FLT CONTROL FAULT (FLIGHT CONTROL FAULT)

WARNING

DO NOT UNLOAD HYDRAULIC SYSTEMS; ONE PCU MAY BE HARDOVER.

NOTE

This message and associated illuminated FLT CONTROL SHUTOFF switch(es) could mean that one (or more) FLT CONTROL SHUTOFF switch(es) has/have been inadvertently pressed. In this case both the top and bottom (OFF) halves of the FLT CONTROL SHUTOFF switch(es) would be illuminated. Press the illuminated FLT CONTROL SHUTOFF switch(es) to restore normal operation. The CAS message and switch(es) will extinguish.

1. Autopilot - OFF.
2. Flight Controls - CHECK FOR NORMAL RESPONSE AND FEEL.

(Continued Next Page)

■ FLT CONTROL FAULT (FLIGHT CONTROL FAULT) (Continued)

● **IF FLIGHT CONTROLS ARE NORMAL AND HYDRAULIC SYSTEMS ARE NORMAL (PROBABLE FLIGHT CONTROL MONITOR FAILURE)**

1. Do not press FLT CONTROL SHUTOFF Switch.

WARNING

DO NOT UNLOAD ANY HYDRAULIC SYSTEM. A HARDOVER MAY NOT ALWAYS BE DETECTABLE BY PILOT FEEL. IF A HYDRAULIC FAILURE SUBSEQUENTLY OCCURS ON THE SIDE OPPOSITE THE HARDOVER, THE AFFECTED FLIGHT CONTROL WILL RESPOND TO THE HARDOVER. BE PREPARED TO RESIST THE CONTROL MOTION AND IMMEDIATELY PRESS THE ILLUMINATED FLT CONTROL SHUTOFF SWITCH.

2. Land as soon as practical.

Procedure completed

● **IF FLIGHT CONTROLS DO NOT RESPOND OR NOT NORMAL**

1. Affected (Illuminated) FLT CONTROL SHUTOFF Switch - LIFT COVER AND PRESS.
2. Land as soon as practical.

NOTE

Plan for the longest available runway which minimizes crosswind.

□ **IF AILERON PCU**

1. AILERON LATCH Handle - PULL.

NOTE

Ailerons will be in manual reversion and all roll spoilers will be operational, however, control response will be slow due to high forces. Crosswind limit, 10 knots.

2. Use NORMAL LANDING procedure.

Procedure completed

□ **IF ELEVATOR PCU**

1. Opposite Side PCUs - VERIFY OPERATIONAL.

CAUTION

ENSURE THAT THE NOSE WHEEL IS FIRMLY ON THE GROUND BEFORE DEPLOYING THRUST REVERSERS.

NOTE

Elevator forces will not be significantly increased, however, control response will be slower due to only one set of PCUs powering the elevator.

2. Use NORMAL LANDING procedure.

Procedure completed

(Continued Next Page)

■ FLT CONTROL FAULT (FLIGHT CONTROL FAULT) (Continued)

☐ IF RUDDER PCU

1. Altitude/Airspeed - 41,000 FEET/250 KIAS/0.82M MAXIMUM, DESCEND/SLOW AS REQUIRED.

NOTE

- Maximum crosswind is 10 Knots.
- Rudder forces will be high and response slow. Rudder trim will be ineffective. Maintain equal thrust. Single-engine go-around may not be possible from slow airspeed.
- Lateral control input is effective in aiding directional control, particularly if one engine is shut down.
- Copilot can reduce work load by assisting the pilot in reducing rudder force if required.
- Lower rudder yaw damper will be ineffective.

2. Use Normal Procedures for DESCENT, APPROACH, BEFORE LANDING, and LANDING.

■ FUEL BOOST ON L-R

1. FUEL BOOST Switch (affected side) - ON.
2. Land as soon as practical.

NOTE

- Do not turn the fuel boost switch off. Engine flameout may result. Amber CAS message indicates fuel boost pump has tripped on due to low fuel pressure.
- Except in an emergency, do not crossfeed when either fuel boost pump has been turned on by low pressure, i.e., amber CAS message.
- FUEL BOOST ON white CAS message indicates normal operation.
- Gravity crossflow is preferred to balance fuel. Sideslipping the airplane will increase rate.

Procedure completed

● IF WING BALANCE REQUIRED

1. GRVTY XFLOW Switch - ON.
2. Sideslip Aircraft - BALL TO LOW TANK QUANTITY.
3. Check Balance - STRAIGHT FLIGHT, REPEAT STEP 2 IF REQUIRED.
4. GRVTY XFLOW Switch - OFF.

Procedure Completed

(Continued Next Page)

■ FUEL BOOST ON L-R (Continued)

● IF CROSSFEED IS REQUIRED FROM AFFECTED SIDE

1. FUEL BOOST Switch (opposite side) - NORM.
2. FUEL CROSSFEED Switch - SELECT AFFECTED TANK.
3. FUEL CROSSFEED Switch - OFF when crossfeed is completed.

Procedure completed

□ IF OPPOSITE FUEL BOOST PUMP COMES ON

1. Throttles - REDUCE to safe thrust.
2. FUEL BOOST Switch (opposite side) - OFF, then NORM.

NOTE

A single boost pump may not supply required pressure to both engines at high fuel flow.

3. FUEL CROSSFEED Switch - OFF when crossfeed is completed.

Procedure completed

● IF CROSSFEED IS REQUIRED FROM OPPOSITE SIDE

1. FUEL CROSSFEED Switch - SELECT OPPOSITE TANK; VERIFY BOTH FUEL BOOST PUMPS ARE ON.
2. FUEL BOOST Switch (affected side) - OFF, then NORM.

NOTE

The amber FUEL BOOST ON L-R CAS message will extinguish.

WHEN CROSSFEED IS COMPLETED

1. FUEL BOOST Switch (affected side) - ON before selecting crossfeed off.
2. FUEL CROSSFEED Switch - OFF.

Procedure completed

■ FUEL DOOR OPEN

Indicates that either the single point pressure refueling door or the center tank overwing transfer valve access door is open.

1. Land as soon as practical.

Procedure completed

■ FUEL FLTR BYPASS L-R (FUEL FILTER BYPASS L-R)

Indicates impending bypass of the fuel filter due to fuel contamination.

1. Land as soon as practical.

WARNING

IT IS POSSIBLE THAT CONTAMINATED FUEL COULD HAVE BEEN INTRODUCED INTO ALL FUEL TANKS. MONITOR OPPOSITE ENGINE, RESTRICT CROSSFEED AND CONSIDER POSSIBLE PARTIAL OR TOTAL LOSS OF THRUST FROM BOTH ENGINES. INSPECT FILTERS AFTER LANDING.

Procedure completed

■ FUEL FW VLV XSIT L-R (FUEL FIREWALL VALVE IN TRANSIT L-R)

Indicates that the respective fuel firewall shutoff valve is neither fully open nor fully closed.

WARNING

IF THE FIREWALL VALVE WAS ACTUATED DUE TO AN ENGINE FIRE, FUEL MAY STILL BE SUPPLIED TO THE ENGINE IF THE BOOST PUMP IS ON OR THE ENGINE IS WINDMILLING. DO NOT CROSSFEED IF FIRE IS STILL PROBABLE.

Procedure completed

■ FUEL IMBALANCE

Indicates lateral fuel imbalance is 400 lbs. or more.

NOTE

- Safe return and landing has been demonstrated with up to 800 lbs. imbalance. Emergency imbalance is 800 lbs. Roll response away from heavy wing is reduced.
- Check FMS fuel quantity verses indicated. A large difference could indicate a fuel leak. Indicated fuel quantity may vary in climb or descent.

1. Aileron Trim - AS REQUIRED.

Procedure completed

● **IF FUEL REMAINS IN CENTER TANK AND ONE WING TANK IS MORE THAN 3300 LBS AND THE OTHER IS MORE THAN OR EQUAL TO 3000 LBS.**

NOTE

Indicates probable failure of center-to-wing transfer shutoff float valve in wing with the most fuel.

1. CTR WING XFER (tank with most fuel) - OFF.
2. FUEL CROSSFEED Switch - AS REQUIRED, select tank with most fuel.

□ **WHEN FUEL QUANTITY IS BALANCED**

1. FUEL CROSSFEED Switch - OFF.
2. CTR WING XFER (affected side) - CYCLE MANUALLY TO MAINTAIN FUEL BALANCE until center tank transfer is complete.

Procedure completed

(Continued Next Page)

■ FUEL IMBALANCE (Continued)

● **IF FUEL REMAINS IN CENTER TANK AND ONE WING TANK FUEL QUANTITY IS LESS THAN APPROXIMATELY 2900 LBS. WITH BOTH CTR WING XFER SWITCHES NORM OR ON**

NOTE

Indicates probable failure of center-to-wing transfer system to transfer fuel into the low quantity wing.

1. GRVTY XFLOW Switch - L WING-R WING.

NOTE

Gravity crossflow will open the wing tanks to each other and to the engine feed tanks. Use sideslip as required to aid in crossflow rate.

2. FUEL CROSSFEED Switch - AS REQUIRED, select tank with most fuel.

☐ **WHEN CENTER TANK TRANSFER IS COMPLETE AND WING FUEL QUANTITIES ARE BALANCED**

1. GRVTY XFLOW Switch - OFF.
2. FUEL CROSSFEED Switch - OFF.

Procedure completed

● **IF FUEL REMAINS IN CENTER TANK AND BOTH WING TANK FUEL QUANTITIES ARE LESS THAN APPROXIMATELY 2900 LBS. EACH**

NOTE

This procedure assumes that, in addition to a wing fuel imbalance, the pilot placed the CTR WING XFER switches to OFF and inadvertantly left them in that position. With normal fuel system operation, neither wing tank fuel quantity should be less than 2900 lbs. with fuel remaining in the center tank.

1. CTR WING XFER Switch (tank with least fuel) - NORM or ON; opposite wing XFER switch - OFF. Ensure center tank fuel is being transferred.

☐ **WHEN FUEL QUANTITY IS BALANCED**

1. CTR WING XFER Switch (opposite tank) - NORM or ON.

WARNING

SIMULTANEOUS USE OF CROSSFEED AND CENTER-TO-WING TRANSFER IS PROHIBITED WHEN BOTH WING FUEL QUANTITIES ARE LESS THAN 2900 LBS. GREATER FUEL IMBALANCE WILL OCCUR.

Procedure completed

● **NO FUEL IN CENTER TANK**

1. FUEL CROSSFEED Switch - AS REQUIRED select tank with most fuel.

Procedure completed

■ FUEL LEVEL LOW L-R

Indicates affected tank fuel quantity is less than 450 ±50 pounds. EICAS fuel quantity will turn amber at 500 pounds remaining.

● **FUEL IN CENTER TANK (DUE TO CENTER WING XFER SWITCHES BEING OFF)**

1. Both Center Wing XFER Switches - ON.

NOTE

A center-to-wing transfer valve may not open in NORM if the associated wing tank fuel quantity is less than 500 lbs.

2. Both Center Wing XFER Switches - NORM.

Procedure completed

● **IF NO FUEL IN CENTER TANK**

1. Fuel Crossfeed and/or Gravity XFLOW Transfer - AS REQUIRED.

Procedure completed

● **IF OPPOSITE TANK AND/OR CENTER TANK FUEL NOT AVAILABLE**

1. FUEL BOOST Switches - BOTH ON.
2. Land as soon as possible.

Procedure completed

■ FUEL MOTV FAIL L-R (FUEL MOTIVE FLOW SHUTOFF VALVE FAIL L-R)

Indicates the respective fuel motive flow shutoff valve has failed to close when crossfeed has been selected. Crossfeed from the opposite tank may not occur. Fuel will continue to feed from the affected tank.

1. FUEL CROSSFEED Switch - OFF (amber CAS message should clear).

● **IF FUEL BALANCE IS NEEDED**

1. GRVTY XFLOW Switch - L WING-R WING until fuel is balanced.

NOTE

Gravity crossflow will open the wing tanks to each other and to the engine feed tanks. Fuel balance is highly affected by sideslipping the airplane.

Procedure completed

■ FUEL PRESS LOW L-R (FUEL PRESSURE LOW L-R)

Indicates fuel supply pressure is low.

NOTE

If the respective FUEL BOOST switch is selected to NORM, a below normal fuel pressure condition should automatically turn on the respective fuel boost pump. The corresponding amber FUEL BOOST ON message should appear. When fuel pressure is restored by the fuel boost pump, the amber FUEL PRESS LOW L-R message should extinguish.

1. FUEL BOOST Switch (affected side) - ON.

● **IF FUEL PRESS LOW L-R MESSAGE CLEARS**

1. Refer to Amber Abnormal Procedures, FUEL BOOST ON L-R.

Procedure completed

● **IF FUEL BOOST PUMP IS INOPERATIVE (FUEL BOOST ON CAS MESSAGE DOES NOT APPEAR)**

1. Altitude - MAINTAIN, or DESCEND if practical. DO NOT CLIMB.

NOTE

- If fuel pressure is low, and the boost pump is failed, the engine may flame out at higher altitude.
- Do not attempt to crossfeed from the tank on the side with low pressure and a failed boost pump.

2. Land as soon as practical.

Procedure completed

● **IF ENGINE FLAMES OUT**

1. Throttle (affected engine) - CUTOFF.
2. FUEL CROSSFEED Switch - SELECT OPPOSITE TANK.
3. Affected Engine - RESTART (at or below FL250), Refer to Abnormal Procedure INFLIGHT RESTART (NORMAL OR REVERSIONARY MODE).
   a. PAC ISOL VALVE - OPEN.
   b. Engine START BUTTON (affected engine) - PRESS.
   c. Throttle (affected engine) - IDLE at 10% N_2.
   d. Engine Instruments - MONITOR.
4. GRVTY XFLOW Switch - L WING-R WING.

NOTE

Maintain fuel balance using center-to-wing transfer and gravity crossflow. Gravity crossflow is highly sensitive to sideslipping the airplane.

5. Land as soon as practical.

Procedure completed

■ FUEL TEMP L-R (FUEL TEMPERATURE L-R)

Indicates fuel temperature (engine and/or tank) is above the maximum temperature limit or below the minimum temperature limit.

1. EICAS - CHECK FUEL (engine and tank) TEMPERATURES and engine oil temperature.

● **IF ENGINE FUEL TEMPERATURE IS BELOW MINIMUM**

1. Engine Instruments - CONTINUE TO MONITOR fuel and oil temperatures.

NOTE

This condition may occur during initial takeoff thrust application if engine oil temperature is low and fuel tank temperature is below -30°C. Refer to Normal Procedures, EXTREME COLD WEATHER OPERATION.

2. Land as soon as practical.

Procedure completed

● **IF ENGINE FUEL TEMPERATURE IS ABOVE MAXIMUM**

1. Throttle (affected engine) - REDUCE.

NOTE

- If fuel temperature is high, consider possible engine flameout due to vaporization.
- This condition may indicate faulty air cooled, or fuel cooled, engine oil cooler.

2. Land as soon as practical.

Procedure completed

● **IF TANK FUEL TEMPERATURE IS ABOVE OR BELOW LIMITS**

1. Modify flight profile to maintain temperature within limits.

NOTE

Refer to Section I, Figure 1-7 Fuel Limitations for type of fuel being used. CAS is set for the following fuel temperature limits: Tank fuel, +52°C maximum, -37°C minimum; engine fuel, +99°C maximum, +4°C minimum. These limits are applicable to Jet A, Jet A-1, JP-5 and JP-8 fuels.

Procedure completed

■ FUEL XFEED OPEN (FUEL CROSSFEED OPEN)

1. Fuel Quantity - CHECK.
2. Fuel Crossfeed - AS REQUIRED.

NOTE

Indicates that the fuel crossfeed valve is open and the non-feed fuel quantity is more than 50 lbs. greater than the feed tank quantity.

Procedure completed

■ FUEL XFEED XSIT (FUEL CROSSFEED IN TRANSIT)

Indicates that the fuel crossfeed valve is neither fully open nor fully closed. Crossfeed may not occur, depending on actual valve position.

● IF NO CROSSFEED DESIRED OR UNABLE TO CROSSFEED

1. FUEL BOOST Switches - BOTH ON.
2. FUEL CROSSFEED Switch - OFF.
3. GRVTY XFLOW Switch - L WING-R WING.

NOTE

- Gravity crossflow is slow with low wing fuel quantity difference and can be significantly influenced by sideslipping the airplane.
- With crossfeed off and the valve partially open, some crossfeed may occur due to differences in primary ejector pump pressure.

Procedure completed

■ FWC (FAULT WARNING COMPUTER)*

Indicates miscompare between FWCs. (Displayed above and to the left of compass rose in both PFDs.)

1. Fault Warning Computers - RESET.
   a. SG REV Switch - SG1; PAUSE for tubes to reset. (Resets FWC 2).
   b. SG REV Switch - NORM; PAUSE for tubes to reset.
   c. FADEC switches - RESET.
   d. SG REV Switch - SG2; PAUSE for tubes to reset. (Resets FWC 1).
   e. SG REV Switch - NORM; PAUSE for tubes to reset.
   f. FADEC switches - RESET.

NOTE

When SG1 and SG2 are selected, FADEC FAULT LB, RB, or LA, RA amber CAS messages will illuminate. Both engine FADECs will revert to FADEC ADC REV mode when all four FADECs are faulted. The FADECs can be reset in the SG NORM position by selecting the FADEC switches to RESET.

Procedure completed

(Continued Next Page)

* Denotes Primus 2000 message

■ FWC (FAULT WARNING COMPUTER)* (Continued)

● FWC MESSAGE DOES NOT CLEAR

1. CAS Field - NOTE MESSAGES (this is FWC 1).
2. SG REV Switch - SG2.
3. CAS Field - NOTE MESSAGES (this is FWC 2).
4. CAS Field - DETERMINE VALIDITY of differing messages.
5. SG REV Switch - NORM or SG2 as required to display valid messages.
6. FADEC Switches - RESET (if SG REV is in NORM).

NOTE

If the SG REV switch is left in SG2, the FADEC FAULT LB, RB messages will remain illuminated. FADECs will operate normally on the “A” channel.

7. CAS Messages - TAKE APPROPRIATE ACTION.

Procedure completed

■ FWC 1-2 FAIL (FAULT WARNING COMPUTER 1-2 FAILURE)

● IF FWC 1 FAILED (INDICATED BY RED X IN CAS DISPLAY)

1. SG REV Switch - SG2. Confirm FWC 1 FAIL message and FADEC FAULT messages appear.

● IF FWC 2 FAILED (INDICATED BY FWC 2 FAIL CAS MESSAGE)

1. SG REV Switch - DO NOT SELECT SG2 REVERSION.

NOTE

Selecting SG2 will result in loss of all EICAS messages.

Procedure completed

■ GEN OFF L-R (GENERATOR OFF L-R)

● IF NOT DUE TO OVERCURRENT (DC OVERCURRENT AMBER CAS NOT DISPLAYED)

1. GEN Switch (affected generator) - CHECK GEN; RESET AS REQUIRED.
2. Generator - VERIFY GEN ON LINE.

Procedure completed

● IF UNABLE TO RESET

1. DC Power XTIE Switch - CLSD.
2. Electrical Load - MONITOR; REDUCE as required.

NOTE

- The XTIE switch will illuminate OPEN when the generator fails or is selected OFF indicating the need for pilot action to select CLSD.
- If the generator has been automatically shut off due to overcurrent, system logic will not allow the XTIE switch to be selected CLSD. Refer to Amber Abnormal Procedures- DC OVERCURRENT L-R-APU.

3. APU Generator - AS REQUIRED (within APU limitations).

NOTE

Refer to Normal Procedures, APU GROUND OR IN-FLIGHT START

Procedure completed

* Denotes Primus 2000 message

■ GS (GLIDESLOPE MISCOMPARE)*

Indicates FWC detects glideslope miscompare. Active only when both NAV receivers are tuned to the same ILS frequency. (Displayed on the right center of the attitude sphere on both PFDs.)

1. Glideslope Data - CROSSCHECK; DISREGARD GLIDESLOPE DATA if unable to confirm valid source.

Procedure completed

■ GROUND IDLE L-R

1. FADEC Switch (affected engine) - RESET.

Procedure completed

● **IF MESSAGE DOES NOT CLEAR**

1. FADEC Switch (affected engine) - SELECT OPPOSITE FADEC.

Procedure completed

● **IF MESSAGE STILL DOES NOT CLEAR**

1. GND IDLE Switch - HIGH.

Procedure completed

■ HDG (HEADING)*

Indicates heading miscompare. (Displayed above and to the right of the HSI on both PFDs.)

● **IF AHRS INSTALLED**

1. LH and RH AHRS Switches - CHECK IN SLV.

Procedure completed

● **IF IRS INSTALLED**

1. LH or RH IRS (if in attitude mode) - VERIFY HEADING.

Procedure completed

● **IF STILL MISCOMPARED**

1. PFD Heading Displays - DETERMINE WHICH AHRS OR IRS IS CORRECT.
2. AHRS or IRS REV Switch (faulty side) - SELECT AHRS OR IRS REV.

NOTE

On the ground, proximity to buildings or high energy buried cables may cause AHRS compass slaving unit errors. The slaving units are in each wing tip.

3. PFD Heading Displays - CONFIRM HDG 1 or 2 or DG 1 or 2 (AHRS), or MAG 1 or 2 or TRU 1 or 2 (IRS) are displayed in both PFDs and both MFDs.

Procedure completed

■ HDG1/HDG2 (HEADING 1/HEADING 2)*

Indicates both pilot and copilot displayed heading sources are from the same AHRS/IRS or both pilot and copilot displayed heading sources are cross-side AHRS/IRS. (Displayed above the HSI compass rose on both PFDs and both MFDs).

* Denotes Primus 2000 message

■ HP DUCT O'PRESS L-R (HIGH PRESSURE DUCT OVERPRESSURE L-R)

1. Throttle (affected engine) - REDUCE if practical.

NOTE

The CAS message will cycle on and off and the HP firewall shutoff valve will automatically cycle closed and open until the throttle is reduced.

Procedure completed

■ HP PCOOLR O'HT L-R (HIGH PRESSURE PRECOOLER OVERHEAT L-R)

1. Throttle (affected engine) - REDUCE if practical.

Procedure completed

■ HYD O'TEMP A-B (HYDRAULIC OVERTEMPERATURE A-B)

Indicates an overtemperature condition (>93°C) exists in the affected hydraulic system.

1. Hydraulic Temperature and Pressure (affected system) - MONITOR.

NOTE

If temperature continues to increase, the HYD O'TEMP A-B red CAS message will illuminate.

● **IF AFFECTED SYSTEM HYDRAULIC PRESSURE IS NORMAL (3000 PSI)**

Procedure completed

● **IF AFFECTED SYSTEM HYDRAULIC PRESSURE IS ABOVE 3200 PSI**

1. HYDRAULIC PUMP "A" or HYDRAULIC PUMP "B" Switch (as applicable) - UNLOAD.
2. Refer to Amber Abnormal Procedures, HYD PUMP FAIL A or HYD PUMP FAIL B, as applicable.

Procedure completed

■ HYD PTU FAIL (HYDRAULIC POWER TRANSFER UNIT FAILURE)

Indicates the hydraulic PTU output ("A" system) pressure is low while "B" system pressure is normal. If both systems' pressures are normal, this warning is false and no action is required.

● **IF "A" HYDRAULIC SYSTEM PRESSURE IS LOW**

1. Refer to Amber Abnormal Procedures, HYD PUMP FAIL A.

NOTE

The PTU is not active if both "A" and "B" hydraulic systems are at normal system pressure.

Procedure completed

■ HYD PUMP FAIL A (HYDRAULIC PUMP FAILURE OR FLUID LOSS, A SYSTEM)

1. Hydraulic Pressure and Fluid Quantity - CHECK.

● **IF HYDRAULIC PRESSURE AND QUANTITY ARE NORMAL (PUMP NOT FAILED)**

1. Land as soon as practical. Use NORMAL Procedures.

Procedure completed

● **IF PRESSURE CYCLING ("A" PUMP FAILED AND PTU OPERATING)**

1. Land as soon as practical. Use NORMAL Procedures.
2. "A" aux hydraulic pump ON for landing.

Procedure completed

● **IF QUANTITY NORMAL AND HYD PTU FAIL CAS MESSAGE IS ILLUMINATED**

1. "A" AUX HYDRAULIC PUMP - ON.

NOTE

- Do not unload the "A" system pump if the PTU or the "A" aux hydraulic pump is operating. "A" system hydraulic fluid overtemperature may result.
- The HYD PTU FAIL CAS message, if illuminated, will extinguish when the "A" aux hydraulic pump is operating.

2. Land as soon as practical.
3. Flaps - 15° MAXIMUM.

Procedure completed

● **IF PRESSURE (DUE TO FAILED AUX PUMP) AND/OR QUANTITY ARE LOW (FLUID LOSS)**

NOTE

This condition will be accompanied by a HYD PTU FAIL CAS message.

1. HYDRAULIC PUMP "A" Switch - UNLOAD.

NOTE

Unloading the hydraulic pump will inhibit the HYD PUMP FAIL message.

2. HYDR B/PTU CONT Circuit Breaker - PULL.
3. Land as soon as practical. Flaps 15° MAXIMUM.

WARNING

- **DO NOT EXTEND FLAPS BEYOND 15° WITH EITHER HYDRAULIC SYSTEM DEPRESSURIZED. IF A SPEED BRAKE OR SPOILER CHECK VALVE FAILS TO SEAT, UNCOMMANDED ROLL MAY RESULT. RETRACT FLAPS TO 15° IF EXTENDED.**
- **DO NOT USE SPEED BRAKES IN FLIGHT UNLESS "A" HYDRAULIC SYSTEM PRESSURE IS ZERO. OUTBOARD SPEED BRAKE PANELS MAY NOT RETRACT.**

(Continued Next Page)

■ HYD PUMP FAIL A (HYDRAULIC PUMP FAILURE OR FLUID LOSS, A SYSTEM) (Continued)

NOTE

- In the case of either hydraulic system not being pressurized, the affected system flight control PCUs are not powered. PCU monitor protection is not available.
- If "A" hydraulic system is inoperative, the following subsystems will be inoperative: outboard roll spoilers, normal wheel brakes, antiskid, LH thrust reverser, outboard speed brake panels and normal gear extension/retraction. Nose wheel steering will have accumulator pressure only.

BEFORE LANDING

1. Landing Data - CONFIRM.
   a. Airspeed - V_{REF}.

V_{REF} (KIAS)

FLAPS/SLATS	WEIGHT - POUNDS							
	23,000	25,000	27,000	28,000	29,000	30,000	31,000	31,800
15°/Extended	113	119	124	127	129	132	135	137

   b. Multiply Normal **FLAPS 15°** Landing Distance by 1.6.

CAUTION

AVOID LANDING WITH TAILWIND OR DOWNHILL RUNWAY GRADIENT.

2. Crew Briefing - COMPLETE.
3. Avionics and Flight Instruments - CHECK/SET.
4. Minimums - SET (RA/BARO).
5. FUEL CROSSFEED - AS REQUIRED, then OFF.
6. ENG SYNC - OFF.
7. Exterior Lights - AS REQUIRED.
8. Flaps - 15° MAXIMUM.

WARNING

DO NOT EXTEND FLAPS BEYOND 15° WITH EITHER HYDRAULIC SYSTEM DEPRESSURIZED. IF A SPEED BRAKE OR SPOILER CHECK VALVE FAILS TO SEAT, UNCOMMANDED ROLL MAY RESULT. RETRACT FLAPS TO 15° IF EXTENDED.

(Continued Next Page)

■ HYD PUMP FAIL A (HYDRAULIC PUMP FAILURE OR FLUID LOSS, A SYSTEM) (Continued)

9. Passengers - BRIEF.
10. Seats/Seat Belts/Shoulder Harnesses/Aft Divider Sliding Doors - CHECK/ SECURE/LATCHED OPEN (if belted toilet seat occupied).
11. Passenger Advisory Lights - PASS SAFETY.
12. IGNITION - NORM.
13. Pressurization - ZERO DIFFERENTIAL at touchdown.
14. Landing Gear - BLOW DOWN.
    a. Landing Gear Blowdown Handle - PULL (< 210 KIAS).
    b. Landing Gear - CHECK DOWN and LOCKED (3 green lights).
    c. Gear Handle - DOWN.

NOTE

Landing gear will not retract after blowdown.

15. Speed Brakes - RETRACTED.
16. EICAS - CHECK.
17. AIRSPEED - V_{REF}.

LANDING

1. Throttles - IDLE.
2. Speed Brakes - EXTEND at touchdown.
3. Elevator Control - FORWARD PRESSURE at touchdown.
4. Emergency Brake Handle - PULL and HOLD UNTIL STOPPED after nose wheel ground contact.

CAUTION

- REPEATED APPLICATION AND RELEASE MAY CAUSE PREMATURE LOSS OF PNEUMATIC PRESSURE.
- WHEN CLEAR OF THE RUNWAY, STOP AND SHUT DOWN. DO NOT ATTEMPT TO TAXI IN CLOSE PROXIMITY TO BUILDINGS OR OTHER AIRCRAFT USING EMERGENCY BRAKES.

NOTE

- The antiskid brake system does not function during emergency braking.
- Emergency brake pressure is regulated for optimum braking on most dry surfaces.

5. Right Thrust Reverser - DEPLOY WITH IDLE THRUST after nose wheel ground contact.

Procedure completed

■ HYD PUMP FAIL B (HYDRAULIC PUMP FAILURE OR FLUID LOSS, B SYSTEM)

1. "B" Hydraulic Pressure and Fluid Quantity - CHECK.

● **IF HYDRAULIC PRESSURE AND QUANTITY ARE NORMAL (PUMP NOT FAILED)**

1. Land as soon as practical.

Procedure completed

● **IF HYDRAULIC PRESSURE AND/OR QUANTITY ARE LOW (PUMP FAILED OR UNLOADED AND/OR FLUID LOSS)**

1. HYDRAULIC PUMP “B” Switch - UNLOAD.

NOTE

Unloading the hydraulic pump will inhibit the HYD PUMP FAIL message.

2. Rudder Standby System Pressure - CHECK.

□ **IF RUDDER STANDBY SYSTEM PRESSURE IS LOW**

1. RUDDER STBY Circuit Breaker - PULL (avoid running dry pump).
2. Land as soon as practical. Flaps 15° MAXIMUM.

Procedure completed

□ **IF RUDDER STANDBY SYSTEM PRESSURE IS NORMAL (MORE THAN 2200 PSI)**

1. Land as soon as practical. Flaps 15° MAXIMUM.

Procedure completed

WARNING

- **DO NOT EXTEND FLAPS BEYOND 15° WITH EITHER HYDRAULIC SYSTEM DEPRESSURIZED. IF A SPEED BRAKE OR SPOILER CHECK VALVE FAILS TO SEAT, UNCOMMANDED ROLL MAY RESULT. RETRACT FLAPS TO 15° IF EXTENDED.**
- **DO NOT USE SPEED BRAKES IN FLIGHT UNLESS “B” HYDRAULIC SYSTEM PRESSURE IS ZERO. INBOARD AND MIDDLE SPEED BRAKE PANELS MAY NOT RETRACT.**

NOTE

- In the case of either hydraulic system not being pressurized and the rudder standby system inoperative, the affected system flight control PCUs are not powered. PCU monitor protection is not available. Rudder PCU monitor protection is available if the RSS is operative.
- If “B” hydraulic system is inoperative, the following subsystems will be inoperative: PTU, inboard roll spoilers, inboard and middle speed brake panels, and RH thrust reverser.

(Continued Next Page)

■ HYD PUMP FAIL B (HYDRAULIC PUMP FAILURE OR FLUID LOSS, B SYSTEM) (Continued)

BEFORE LANDING

1. Landing Data - CONFIRM.
   a. Airspeed - V_{REF}.

V_{REF} (KIAS)

FLAPS/SLATS	WEIGHT - POUNDS							
	23,000	25,000	27,000	28,000	29,000	30,000	31,000	31,800
15°/Extended	113	119	124	127	129	132	135	137

   b. Multiply Normal **FLAPS 15°** Landing Distance by 1.3.

CAUTION

AVOID LANDING WITH TAILWIND OR DOWNHILL RUNWAY GRADIENT.

2. Crew Briefing - COMPLETE.
3. Avionics and Flight Instruments - CHECK/SET.
4. Minimums - SET (RA/BARO).
5. FUEL CROSSFEED - AS REQUIRED, then OFF.
6. ENG SYNC - OFF.
7. Exterior Lights - AS REQUIRED.
8. Flaps - 15° MAXIMUM.

WARNING

DO NOT EXTEND FLAPS BEYOND 15° WITH EITHER HYDRAULIC SYSTEM DEPRESSURIZED. IF A SPEED BRAKE OR SPOILER CHECK VALVE FAILS TO SEAT, UNCOMMANDED ROLL MAY RESULT. RETRACT FLAPS TO 15° IF EXTENDED.

9. Passengers - BRIEF.
10. Seats/Seat Belts/Shoulder Harnesses/Aft Divider Sliding Doors - CHECK/SECURE/LATCHED OPEN (if belted toilet seat occupied).
11. Passenger Advisory Lights - PASS SAFETY.
12. IGNITION - NORM.
13. Pressurization - ZERO DIFFERENTIAL at touchdown.
14. Landing Gear - DOWN and LOCKED (3 green lights).
15. Speed Brakes - RETRACTED.
16. EICAS - CHECK.
17. Airspeed - V_{REF}.

LANDING

1. Throttles - IDLE.
2. Speed Brakes - EXTEND at touchdown.
3. Elevator Control - FORWARD PRESSURE at touchdown.
4. Brakes - APPLY after nose wheel ground contact.
5. Left Thrust Reverser - DEPLOY with IDLE THRUST after nose wheel ground contact.

Procedure completed

HYD PUMP UNLOAD A-B (HYDRAULIC PUMP UNLOAD A-B)

Indicates the respective hydraulic pump has been unloaded either by selecting the corresponding hydraulic “A” or “B” switch to UNLOAD or automatically, due to high hydraulic fluid temperature of faulty valve.

1. Respective hydraulic pump switch - CHECK.

● **IF SWITCH IS IN NORM AND RESPECTIVE SYSTEM HYDRAULIC PRESSURE IS LOW AND NO HYD O'TEMP MESSAGE**

1. Respective (HYDR A CONT or HYDR B/PTU CONT) Circuit Breaker - PULL.

□ **IF PRESSURE RECOVERS**

1. Land as soon as practical.

Procedure completed

□ **IF PRESSURE REMAINS LOW**

1. Refer to Amber Abnormal Procedures, HYD PUMP FAIL A or HYD PUMP FAIL B (except unload switch is inoperative).

Procedure completed

● **IF SWITCH IS IN UNLOAD DUE TO HYDRAULIC OVERTEMPERATURE**

1. Refer to Amber Abnormal Procedures, HYD PUMP FAIL A OR HYD PUMP FAIL B.

Procedure completed

■ HYD VOLUME LOW A-B (HYDRAULIC VOLUME LOW A-B)

1. Hydraulic Pressure and Fluid Quantity - CHECK.

● **IF HYDRAULIC FLUID QUANTITY IS LOW (<16%) AND PRESSURE IS NORMAL OR LOW (PROBABLE LEAK)**

1. HYDRAULIC PUMP “A” or “B” Switch (as applicable) - UNLOAD.
2. Refer to Amber Abnormal Procedures, HYD PUMP FAIL A or HYD PUMP FAIL B.

Procedure completed

■ IAC 1-2 O’TEMP (INTEGRATED AVIONICS COMPUTER 1-2 OVERTEMPERATURE)

1. SG REV Switch - OPPOSITE SG.

NOTE

- FADEC FAULT L and R, A or B, and BUS CTRL 1 or 2 (relative to the failed IAC) amber CAS messages will also illuminate. No further action is required for these messages.
- Pulling the IAC circuit breaker will remove power from the respective FMS. If using FMS NAV, select opposite FMS on the affected side.

2. Affected IAC Circuit Breaker - PULL.
3. Land as soon as practical.

Procedure completed

■ IAC TEST INOP 1-2 (INTEGRATED AVIONICS COMPUTER BUILT-IN TEST INOPERATIVE 1-2)

This message is inhibited in flight and must be corrected prior to takeoff.

Indicates that the respective IAC built in test did not accomplish all power-up tests due to invalid weight-on-wheels signal. This message does not necessarily imply invalid weight-on-wheels logic to other airplane systems.

■ IAS (INDICATED AIRSPEED MISCOMPARE)*

Indicates FWC detects airspeed miscompare. (Displayed within the airspeed scale on both PFDs.)

1. Pilot/Copilot Airspeed - COMPARE with standby instruments.
2. ADC REV Switch (faulty side) - SELECT ADC REV.
3. Confirm ADC1 or ADC2 is displayed in both PFDs.

Procedure completed

* Denotes Primums 2000 Messages

■ LATERAL MODE OFF

Indicates the flight guidance computer has dropped the lateral mode. Clears after five seconds. Normally due to pilot action.

1. Flight Guidance Computer - VERIFY SELECTED MODES.

Procedure completed

■ LOC (LOCALIZER MISCOMPARE)*

Indicates FWC detected localizer miscompare. Active only if both NAVs are tuned to the same ILS frequency. (Displayed below and right of attitude sphere on both PFDs.)

1. NAV Sources - ATTEMPT TO DETERMINE which NAV source is correct and select that source on both sides.

● **IF UNABLE TO DETERMINE**

   1. Execute missed approach (unless runway is in sight).

   Procedure completed

* Denotes Primus 2000 message

■ MACH TRIM OFF

1. Flight Guidance Computer - SELECT OPPOSITE FGC.

- **IF MESSAGE REMAINS**

  1. Mach Speed - 0.82 MAXIMUM.

NOTE

- Mach trim will be inactive if primary trim fails or as a result of FGC failures.
- Overspeed warning will sound until Mach is at or below 0.82.

Procedure completed

■ MAG 1/MAG 2 (MAGNETIC 1 / MAGNETIC 2)*

Indicates both pilot and copilot displayed heading sources are from the same IRS or both pilot and copilot displayed heading sources are cross-side IRS. (Displayed above the HSI compass rose on both PFDs and MFDs. Applicable with IRSs in the MAGNETIC mode.)

■ MAX SPD (MAXIMUM SPEED)*

Indicates FGC overspeed protection active. (Displayed to the right of the airspeed scale in both PFDs.)

1. Reduce Speed.

Procedure completed

■ MIN (MINIMUM)*

Indicates radio altitude or barometric altitude less than or equal to decision height or minimum descent altitude. (Displayed within the ADI sphere on both PFDs.)

NOTE

AURAL ALERT “Minimums” - “Minimums” will be activated.

■ MSG (MESSAGE)*

Indicates message available in FMS. (Displayed to the left of the HSI in both PFDs.)

■ NOSE DOOR OPEN L-R

Indicates Nose Avionics Compartment Door not fully closed.

1. Reduce speed as required.
2. Land as soon as practical.

Procedure completed

* Denotes Primus 2000 Messages

■ NOSE WHL STR INOP (NOSE WHEEL STEERING INOPERATIVE)

1. Directional Control - MAINTAIN (rudder and differential brakes).

NOTE

This message is operative on ground only.

Procedure completed

■ OIL LEVEL LOW L-R

1. Oil Quantity - CHECK (EICAS, ENG).
2. Oil Pressure/Temperature - MONITOR.
3. Plan for possibility of shutting engine down. Refer to Abnormal Procedures, ENGINE FAILURE/PRECAUTIONARY SHUTDOWN.

Procedure completed

■ P/S-RAT HEAT OFF (PITOT-STATIC/RAM AIR TEMPERATURE HEAT OFF)

Indicates PITOT-STATIC heat switches are off in flight.

1. PITOT/STATIC Switches - LH/RH (ON).

Procedure completed

■ PARK BRK/LOW PRESS (PARKING BRAKE/LOW PRESSURE)

1. Parking Brake - CHECK, SET if required (“A” AUX PUMP ON).

NOTE

In flight this message should be accompanied by the PARK BRAKE ON amber CAS message.

Procedure completed

■ PARK BRAKE ON

Indicates parking brake handle is pulled up in flight.

1. Parking Brake Handle - DOWN.

Procedure completed

■ PITCH FEEL FAIL

1. Autopilot - OFF.
2. Airspeed - 250 KIAS/0.80 MACH MAXIMUM.
3. Altitude - 41,000 FEET MAXIMUM.

NOTE

Avoid making abrupt elevator inputs when airspeed is greater than 150 KIAS. Proper elevator feel scheduling cannot be assured. Pitch control forces may be lighter or heavier than normal.

4. Land as soon as possible. Plan stabilized approach. Refer to Normal Procedures, APPROACH AND LANDING.

Procedure completed

■ PITCH/ROLL DISC (PITCH/ROLL DISCONNECTED)

NOTE

- Indicates that the pitch-roll disconnect handle has been pulled up or stowed incorrectly. If a single axis has been reconnected, the message will remain displayed.
- Autopilot will disengage and will not reengage.

● **IF NOT INTENTIONAL**

1. Pitch/Roll Disconnect Handle - PITCH/ROLL RECONNECT, THEN PUSH DOWN AND ROTATE TO NORM.

CAUTION

DO NOT ATTEMPT TO PUSH THE HANDLE DOWN IN ANY POSITION OTHER THAN PITCH/ROLL RECONNECT. IT WILL NOT STOW PROPERLY.

2. Aileron/Elevator Controls - CHECK BOTH SIDES CONNECTED.

Procedure completed

■ PITOT HTR FAIL L-R, SB (PITOT HEATER FAILURE L-R, STANDBY)

1. Airspeed/Altitude (affected system) - COMPARE WITH UNAFFECTED SYSTEMS.
2. If normal, continue to monitor.

Procedure completed

● **IF DEGRADED**

1. ADC REV Switch (faulty side) - SELECT ADC REV.
2. Leave icing conditions as soon as practical.

Procedure completed

■ PRI STAB TRIM FAIL (PRIMARY STABILIZER TRIM FAILURE)

1. SECONDARY TRIM Switch - ON (lift guard).
2. Horizontal Stabilizer - TRIM.
3. Airspeed - 0.82 MACH MAXIMUM (new airspeed redline displayed).
4. Altitude - 41,000 FEET MAXIMUM.

NOTE

Mach trim and autopilot will be inoperative.

Procedure completed

● **IF UNABLE TO TRIM**

1. Refer to Abnormal Procedures, JAMMED STABILIZER TRIM SYSTEM.

Procedure completed

■ RA (RADIO ALTIMETER MISCOMPARE)*

Indicates FWC detects radio altimeter miscompare if dual radio altimeters installed. (Displayed in the ADI sphere in both PFDs.)

1. DH/MDA - USE BARO MINIMUMS (if applicable).

Procedure completed

■ RAT HEAT FAIL L-R (RAM AIR TEMPERATURE HEAT FAILURE L-R)

NOTE

- If in icing conditions, improper RAT information may be supplied to the FADECs. FADECs will compensate automatically; however, a FADEC FAULT message may result. Refer to Amber Abnormal Procedures, FADEC FAULT L A-B, R A-B.
- SAT displayed on the affected side may be inaccurate.

1. Leave icing conditions as soon as practical.

Procedure completed

■ RAT PROBE FAIL L-R (RAM AIR TEMPERATURE PROBE FAILURE L AND R)

NOTE

- Both engines will be in ADC Reversionary Mode.
- RAT PROBE FAIL amber CAS message indicates failure of both RAT probes. Single probe failure will be indicated by a cyan message.
- SAT and RAT will not be displayed in the cockpit.

1. Refer to Amber Abnormal Procedures, FADEC REV ADC- L-R.

Procedure completed

* Denotes Primus 2000 Messages

■ RETRIM L-R WING DOWN

Indicates that the autopilot is detecting a lateral/directional mistrim.

1. Rudder Trim - CHECK/SET.

NOTE

Rudder trim has a large influence on lateral trim. Check directional trim before retrimming aileron.

2. Aileron Trim - TRIM WING DOWN in direction indicated, if still required.
3. Fuel Quantity - CHECK/BALANCED.

Procedure completed

■ RETRIM NOSE UP-DOWN

Indicates that the autopilot is detecting a longitudinal mistrim.

1. AP/TRIM/NWS Disengage Button - PRESS (expect out-of-trim pitch forces).
2. Stabilizer Trim - RETRIM.

Procedure completed

■ RUD STBY SYS FAIL (RUDDER STANDBY SYSTEM FAILURE)

● **IF RUDDER STANDBY PRESSURE <2200 OR >3200 PSI (FLIGHT CONTROLS NOT REVERSIONARY)**

1. RUDDER STBY Circuit Breaker - PULL.
2. Land as soon as practical.

Procedure completed

● **IF PRESSURE IS NORMAL**

1. EICAS Message - RESET.
   a. SG REV Switch - SG1 (allow tubes to reset; resets FWC 2).
   b. SG REV Switch - NORM (allow tubes to reset).
   c. FADEC Switches - RESET.
   d. SG REV Switch - SG2 (allow tubes to reset; resets FWC 1).
   e. SG REV Switch - NORM.
   f. FADEC Switches - RESET.

NOTE

The RUD STBY SYS FAIL message will appear and latch on when triggered by excessive pump run time or by applying power to the EICAS with the RUDDER STBY circuit breaker pulled.

Procedure completed

● **IF MESSAGE REPEATS**

1. RUDDER STBY Circuit Breaker - PULL.
2. Land as soon as practical.

Procedure completed

■ RUD LIMIT FAIL A-B (RUDDER LIMIT FAIL A-B)

1. Rudder Limit - CHECK (EICAS, CTRL POS).
2. Land as soon as practical. Consider crosswind.

NOTE

- Single engine controllability may be limited at low airspeed.
- Indicates failure of a single rudder limiter. This failure may restrict rudder travel to less than normal as airspeed is reduced and may reduce nose wheel steering through the rudder pedals after landing.
- Normal lower rudder travel limit varies from $\pm 30°$ (100%) at 140 KIAS to $\pm 4°$ (14%) at 330 KIAS and above.
- The green area on the rudder position display (as indicated on the CAS CTRL POS page) indicates available travel, the area will vary with airspeed.
- If available rudder travel limit (as indicated on the CAS CTRL POS page) is less than 70%, limit crosswind to 10 knots.
- At 140 KIAS and slower, RUDDER LIMIT FAIL EICAS message will extinguish. DO NOT ASSUME FAILURE HAS CLEARED. Available rudder travel limits must be verified on the CAS CTRL POS page.

Procedure completed

■ RETRIM L-R WING DOWN

Indicates that the autopilot is detecting a lateral/directional mistrim.

1. Rudder Trim - CHECK/SET.

NOTE

Rudder trim has a large influence on lateral trim. Check directional trim before retrimming aileron.

2. Aileron Trim - TRIM WING DOWN in direction indicated, if still required.
3. Fuel Quantity - CHECK/BALANCED.

Procedure completed

■ RETRIM NOSE UP-DOWN

Indicates that the autopilot is detecting a longitudinal mistrim.

1. AP/TRIM/NWS Disengage Button - PRESS (expect out-of-trim pitch forces).
2. Stabilizer Trim - RETRIM.

Procedure completed

■ RUD STBY SYS FAIL (RUDDER STANDBY SYSTEM FAILURE)

● **IF RUDDER STANDBY PRESSURE <2200 OR >3200 PSI (FLIGHT CONTROLS NOT REVERSIONARY)**

1. RUDDER STBY Circuit Breaker - PULL.
2. Land as soon as practical.

Procedure completed

● **IF PRESSURE IS NORMAL**

1. EICAS Message - RESET.
   a. SG REV Switch - SG1 (allow tubes to reset; resets FWC 2).
   b. SG REV Switch - NORM (allow tubes to reset).
   c. FADEC Switches - RESET.
   d. SG REV Switch - SG2 (allow tubes to reset; resets FWC 1).
   e. SG REV Switch - NORM.
   f. FADEC Switches - RESET.

NOTE

The RUD STBY SYS FAIL message will appear and latch on when triggered by excessive pump run time or by applying power to the EICAS with the RUDDER STBY circuit breaker pulled.

Procedure completed

● **IF MESSAGE REPEATS**

1. RUDDER STBY Circuit Breaker - PULL.
2. Land as soon as practical.

Procedure completed

■ RUDDER LIMIT FAIL

1. Rudder Limit - CHECK (EICAS, CTRL POS).
2. Land as soon as practical. Consider crosswind.

NOTE

- Single engine controllability may be limited at low airspeed.
- Indicates failure of a single rudder limiter. This failure may restrict rudder travel to less than normal as airspeed is reduced and may reduce nose wheel steering through the rudder pedals after landing.
- Normal lower rudder travel limit varies from $\pm 30°$ (100%) at 140 KIAS to $\pm 4°$ (14%) at 330 KIAS and above.
- The green area on the rudder position display (as indicated on the CAS CTRL POS page) indicates available travel, the area will vary with airspeed.
- If available rudder travel limit (as indicated on the CAS CTRL POS page) is less than 70%, limit crosswind to 10 knots.
- At 140 KIAS and slower, RUDDER LIMIT FAIL EICAS message will extinguish. DO NOT ASSUME FAILURE HAS CLEARED. Available rudder travel limits must be verified on the CAS CTRL POS page.

Procedure completed

■ SEC STAB TRIM FAIL (SECONDARY STABILIZER TRIM FAILURE)

1. Refer to Abnormal Procedures, JAMMED STABILIZER TRIM SYSTEM.

■ SG 1/SG 2 (SYMBOL GENERATOR 1/SYMBOL GENERATOR 2)*

Indicates symbol generator reversionary mode selected. (Displayed in ADI sphere on both PFDs and top of both MFDs.)

■ SG 1-2 FAIL (SYMBOL GENERATOR 1-2 FAILURE)

1. SG REV Switch - SELECT OPPOSITE SG.

NOTE

Loss of either SG is indicated by loss of mutiple displayed units (DU 1-3 if SG1, DU 4 and 5 if SG2).

Procedure completed

■ SLAT A/I COLD L-R (SLAT ANTI-ICE COLD L-R)

1. Throttle (affected side) - INCREASE.

● **IF MESSAGE REMAINS AND WING A/I COLD MESSAGE NOT ILLUMINATED**

1. SLAT ANTI-ICE Switch - OFF (to prevent asymmetric icing unless it can be visually verified that the slat is anti-icing).
2. Leave icing environment as soon as practical.

NOTE

This message will be CYAN if the WING BLD LEAK CAS message is on. Refer to Amber Abnormal Procedures, WING BLD LEAK.

Procedure completed

□ **IF ICE IS NOT A FACTOR FOR LANDING**

Procedure completed

□ **IF LANDING WITH RESIDUAL ICE ON THE SLAT**

1. Refer to Abnormal Procedures, LANDING WITH RESIDUAL ICE.

Procedure completed

● **IF MESSAGE REMAINS AND WING A/I COLD MESSAGE IS ALSO ILLUMINATED**

1. Refer to Amber Abnormal Procedures, WING A/I COLD L-R.

Procedure completed

* Denotes Primus 2000 message

■ SLAT A/I HOT L-R (SLAT ANTI-ICE HOT L-R)

NOTE

- Slat anti-ice will automatically shut off with HOT message and turn on when message clears. Heat damage is not likely.
- Anti-ice HOT monitors are enabled when the anti-ice system is on or off. If the HOT message is on when the anti-ice system is selected off, the problem can be assumed to be a faulty temperature sensor, provided it can be verified that the anti-ice system is off (ITT, N_1, etc.).

● **IF MESSAGE CYCLES**

1. Anti-ice System - MONITOR.
2. Slats - VISUALLY MONITOR for anti-icing.

Procedure completed

● **IF MESSAGE IS STEADY**

1. SLAT ANTI-ICE Switch - OFF, THEN ON when message clears.
2. Slats - VISUALLY MONITOR for anti-icing.
3. Leave icing conditions as soon as practical.

Procedure completed

■ SLATS ASYMMETRY

NOTE

- Slat asymmetry will result if both slats are neither fully retracted nor fully extended. Full asymmetry will not create a hazardous roll condition, provided the airplane is not slowed below stick shaker speed.
- If it cannot be verified that both slats extend, assume slats retracted for landing.

1. Flap/Slat Selector - UP (unless needed for approach).

● **IF STILL ASYMMETRIC**

1. AP/TRIM/NWS Disengage Button - PRESS (if autopilot is engaged).
2. Control Wheel - APPLY OPPOSITE INPUT as required.
3. Airspeed - 250 KIAS MAXIMUM.
4. Rudder and Aileron Trim - AS REQUIRED.
5. Land as soon as practical. Refer to Abnormal Procedures, LANDING WITH FLAPS OR SLATS INOPERATIVE.

Procedure completed

■ SLATS FAIL

● SLATS DO NOT EXTEND

1. Refer to Abnormal Procedures, LANDING WITH FLAPS OR SLATS INOPERATIVE.

Procedure completed

● SLATS REMAIN EXTENDED

1. A-B Control - CHECK.
2. Slat CBs (Pilot CB Panel) - CHECK.

Procedure completed

☐ IF SLATS STILL EXTENDED

1. Airspeed - 250 KIAS (maximum).
2. Land as soon as practical - NORMAL Landing Procedures.

Procedure completed

■ SPEED BRAKES

1. Speed Brake Lever - STOW.

NOTE

- Speed brakes extended on final approach can result in high sink rate upon throttle reduction.
- Indicates speed brakes are extended below 500 feet AGL and flaps are extended to any position.

Procedure completed

■ STAB A/I COLD L-R (STABILIZER ANTI-ICE COLD L-R)

1. Anti-ice Switches - CHECK.
2. Throttles - INCREASE.

NOTE

This message will also illuminate if the affected STABILIZER anti-ice switch is OFF and either engine anti-ice switch or the opposite anti-ice switch is ON.

● IF MESSAGE REMAINS

1. Leave icing environment as soon as possible.

Procedure completed

● IF IT IS LIKELY THAT ICE IN ANY AMOUNT HAS FORMED ON THE STABILIZER

1. Refer to Abnormal Procedures, LANDING WITH RESIDUAL ICE.

Procedure completed

■ STAB A/I HOT L-R (STABILIZER ANTI-ICE HOT L-R)

NOTE

The STAB A/I HOT monitor is enabled whether or not the anti-ice is on. If stabilizer anti-ice can be verified to be OFF (switches, N_2, ITT), this message may be a monitor failure.

● **IF MESSAGE CYCLES**

1. Anti-ice System - MONITOR.

NOTE

Stabilizer anti-ice will automatically shut off with hot message and turn on after message clears. Heat damage is not likely.

Procedure completed

● **IF MESSAGE IS STEADY**

1. STABILIZER ANTI-ICE Switch (affected side) - CYCLE OFF 1 MINUTE THEN ON IF NEEDED.
2. Leave icing conditions as soon as practical.

Procedure completed

● **ON GROUND**

1. Throttle (affected side) - REDUCE.

Procedure completed

■ STAB TRIM MISCMP (STABILIZER TRIM MISCOMPARE)

Indicates disagreement between stabilizer trim position displayed on EICAS and that sensed by the autopilot. This message is disabled in flight.

1. Correct prior to flight.

Procedure completed

■ STALL WARN L-R

1. Opposite Side Low Speed Awareness Data - MONITOR AT LOW AIRSPEED.

● **IF BOTH**

1. Airspeed - MAINTAIN ≥ 50 KIAS ABOVE STALL SPEED (except for landing).
2. Bank Angle - 30° MAXIMUM.

WARNING

- **STALL WARNING STICK SHAKER WILL BE INOPERATIVE.**
- **AUTOMATIC SLAT EXTENSION FUNCTION WILL BE INOPERATIVE.**
- **MINIMUM SPEED AND RESPECTIVE LOW SPEED AWARENESS SYSTEM WILL BE INOPERATIVE.**

Procedure completed

■ START VLV OPEN L-R (START VALVE OPEN L-R)

Indicates the start valve is open after the start sequence is completed.

● **IN FLIGHT**

1. Engine START DISENGAGE Button - PRESS.
2. START Circuit Breaker (affected side) - PULL.

Procedure completed

☐ **IF MESSAGE REMAINS**

1. Land as soon as possible.

☐ **AFTER LANDING, IF STILL OPEN PRIOR TO SHUTDOWN**

CAUTION

DO NOT SHUT THE ENGINE DOWN WITH THE START VALVE OPEN AND BLEED AIR ON. AIR TURBINE STARTER DRIVE SHAFT DAMAGE MAY RESULT.

1. Both ENG BLD AIR and APU BLEED AIR Switches - OFF (prior to shutdown).

Procedure completed

● **ON GROUND AFTER START**

1. Engine START DISENGAGE Button - PRESS.

☐ **IF MESSAGE REMAINS**

1. Both ENG BLD AIR and APU BLEED AIR Switches - OFF (prior to shutdown)

Procedure completed

■ STATIC HT FAIL L-R (STATIC HEATER FAILURE L-R)

1. Airspeed/Altitude (affected system) - COMPARE WITH UNAFFECTED SYSTEMS.
2. Leave icing environment as soon as practical.
3. Maintain zero sideslip - OBSERVE SLIP and LATERAL ACCELERATION INDICATORS.

Procedure completed

■ TAILCONE BLD LEAK (TAILCONE BLEED LEAK)

NOTE

- Indicates possible bleed air leak in the tailcone near the PACs.
- May occur during long ground operations in hot ambient conditions with engine or APU bleed on.

1. L and R ENG BLD AIR and APU BLEED AIR Switches - OFF one at a time, CHECK for message to clear.

Procedure completed

■ TAILCONE DOOR OPEN

Indicates tailcone door is not closed.

1. Land as soon as practical.

Procedure completed

■ TCAS FAIL*

Indicates TCAS failure has occurred. This message will appear in both PFDs and in both MFDs if traffic is selected on the MFD.

■ TOILET DOOR OPEN

1. Land as soon as practical.

Procedure completed

■ TRIM SW FAIL L-R

Indicates monitor has detected failure of one half of the respective primary pitch trim switch. This message will also illuminate if one half of the switch is depressed for more than 25 seconds. The respective trim switch will remain inactive.

1. Pitch Trim - USE OPPOSITE SWITCH.

Procedure completed

* Denotes Primus 2000 Messages

■ TR AUTOSTOW L-R (THRUST REVERSER AUTOSTOW L-R) TR NOT DEPLOYED

WARNING

THROTTLE MUST BE MOVED TO IDLE STOP TO RESET FADEC LOGIC AND REGAIN CONTROL OF THRUST. FADECS WILL REDUCE ENGINE TO IDLE IN EVENT OF INADVERTENT THRUST REVERSER DEPLOYMENT BUT WILL NOT MOVE THE THROTTLE TO THE IDLE POSITION.

NOTE

Thrust reverser partial or full deployment and autostow has occurred and the respective throttle is not fully against the idle stop. The autostow message will not illuminate if the throttle is at idle when the autostow occurs.

1. Throttle (affected engine) - IDLE, THEN NORMAL OPERATION.
2. Stow Switch (affected engine) - EMER.
3. Land as soon as practical.

Procedure completed

■ TRU 1/TRU 2 (TRUE 1/TRUE 2)*

Indicates the respective IRS if installed, has been selected to the True Heading mode. (Displayed above the HSI compass rose on the respective PFD and MFD.) Also, if pilot and copilot displayed heading sources are from the same IRS or both pilot and copilot displayed heading sources are cross-side IRS. (Displayed above the HSI compass rose on both PFDs and MFDs.)

■ VERTICAL MODE OFF

Indicates the flight guidance computer has disengaged the vertical modes, most likely due to pilot action.

1. Flight Guidance Computer - VERIFY SELECTED MODES.

Procedure completed

■ VSPD (V SPEED)*

Indicates takeoff speeds are not set on ground. (Displayed below airspeed scale in both PFDs.)

1. Enter appropriate takeoff speeds.

Procedure completed

* Denotes Primus 2000 Messages

■ WING A/I COLD L-R (WING ANTI-ICE COLD L-R)

1. Anti-ice Switches - CHECK.
2. Throttle (affected engine) - INCREASE.

Procedure completed

● IF PAC HP VLV OPN MESSAGE IS DISPLAYED

1. PAC BLEED SELECT Switch - LP.

Procedure completed

● IF MESSAGE REMAINS

1. ANTI-ICE WING XOVER Switch - WING XOVER (will require increased engine thrust on the opposite engine).
2. Leave icing conditions as soon as practical.

□ IF ICE ON WING OR SLAT IS NOT A FACTOR FOR LANDING

1. Refer to NORMAL Landing Procedures.

Procedure completed

□ IF LANDING WITH RESIDUAL ICE ON THE WING OR SLAT

1. Refer to Abnormal Procedures, LANDING WITH RESIDUAL ICE.

NOTE

- This message will be CYAN if the WING BLD LEAK message is on. Refer to Amber Abnormal Procedures, WING BLD LEAK.
- This message will illuminate if the respective engine ant-ice switch is OFF and the WING XOVER is OFF and the opposite engine anti-ice or either stabilizer anti-ice switch is on.

Procedure completed

■ WING A/I HOT L-R (WING ANTI-ICE HOT L-R)

● IF MESSAGE CYCLES

1. Anti-ice System - MONITOR.

NOTE

Wing anti-ice (and slat, if it was turned on) will automatically be shut off with WING A/I HOT message displayed and then turn on when the message clears. Heat damage is not likely.

2. Wing and Slats - VISUALLY MONITOR for anti-icing.
3. Leave icing conditions as soon as practical.

Procedure completed

(Continued Next Page)

■ WING A/I HOT L-R (WING ANTI-ICE HOT L-R) (Continued)

● IF MESSAGE IS STEADY

1. Throttle (affected engine) - REDUCE.
2. Leave icing conditions as soon as practical.

NOTE

- If the message remains with the throttle at IDLE, it may then be considered to be a nuisance message.
- The WING A/I HOT monitor is enabled whether or not the anti-ice is on. If wing and slat anti-ice can be verified to be off (switches, N_2, ITT), this message may be a monitor failure.

Procedure completed

● ON GROUND

1. Throttle (affected engine) - REDUCE.

Procedure completed

■ WING BLD LEAK L-R (WING BLEED LEAK L-R)

1. Throttle (affected engine) - REDUCE.

NOTE

Indicates a bleed leak in the over-wing fairing.

2. ANTI-ICE WING XOVER Switch - WING XOVER (will require increased opposite engine thrust).
3. Leave icing conditions as soon as practical.

NOTE

- The WING BLD LEAK monitor is enabled whether or not the anti-ice is on. If wing and slat anti-ice can be verified to be off (switches, N_2, ITT), this message may be a monitor failure.
- The associated wing anti-ice valve closes automatically when the wing BLD LEAK L-R message is displayed. The valve will stay closed after the sensor cools and the message has cleared.
- WING or SLAT COLD message is cyan if the WING BLD LEAK monitor is active.

Procedure completed

■ WING CUFF COLD L-R

1. Leave icing conditions as soon as practical.

Procedure completed

■ WING CUFF HOT L-R

● IF MESSAGE CYCLES

1. Anti-ice System - MONITOR.

NOTE

The wing cuff will cycle off and on if the cuff overheats.

Procedure completed

● IF MESSAGE STAYS ON STEADY

1. Affected Side ENG/WING Anti-ice Circuit Breaker - PULL.
2. Affected Side ENGINE Anti-ice Switch - OFF.

NOTE

Power will be removed from the wing cuff. The affected engine anti-ice valve and the wing anti-ice valves will remain open. Automatic wing overtemp protection will not be available when the circuit breaker is out.

3. Leave icing conditions as soon as practical.

Procedure completed

■ WING TANK O'FULL L-R (WING TANK OVERFULL L-R)

1. CTR WING XFER Switch (affected side) - OFF, THEN ON as required to maintain fuel balance.

NOTE

Indicates possible failure of the single point automatic shutoff (on ground) or center tank to wing transfer shutoff.

Procedure completed

■ WSHLD HEAT INOP L-R (WINDSHIELD HEAT INOPERATIVE L-R)

1. Leave icing conditions as soon as practical.

NOTE

- Defog capability will be reduced on affected windshield sections.
- Message may cycle if windshield temperature controller has failed.

Procedure completed

■ WSHLD O'TEMP L-R (WINDSHIELD OVERTEMPERATURE L-R)

- **IF MESSAGE CYCLES**

1. Windshield - MONITOR.

NOTE

The temperature controller has failed. The windshield is cycling on the overheat limit. This will also result in WSHLD HEAT INOP while the windshield is cycled off. Refer to Amber Abnormal Procedures, WSHLD HEAT INOP L-R.

Procedure completed

- **IF MESSAGE STEADY**

1. Windshield Heat Switch (affected side) - OFF for one minute, then ON (if required).

Procedure completed

■ YD FAIL LOWER A-B (YAW DAMPER FAILURE LOWER A AND B)

1. Upper Rudder Yaw Damper - CHECK ON.
2. Altitude - 41,000 FEET MAXIMUM, DESCEND AS REQUIRED.
3. Airspeed - 0.75 MACH MINIMUM until below 31,000 FEET.
4. Land as soon as practical (flaps 15° maximum).

NOTE

Do not exceed flaps 15° for approach and landing.

Procedure completed

■ YD FAIL UPPER A-B (YAW DAMPER FAILURE UPPER A-B)

● **ON GROUND**

Indicates the selected upper yaw damper channel has failed or both channels have failed.

● **IN FLIGHT**

Indicates the affected upper yaw damper channel has failed.

□ **IF SELECTED CHANNEL**

1. UPPER YAW DAMP Switch - PRESS (select opposite channel).

Procedure completed

□ **IF BOTH A AND B FAIL**

1. Altitude - 45,000 Feet (maximum descent if required).
2. Land as soon as practical. Use NORMAL Landing Procedures.

Procedure completed

■ YD NOT CENTERED (YAW DAMPER NOT CENTERED)

1. Flight Guidance Computer - SELECT OPPOSITE FGC.

NOTE

- This can occur if the yaw damper is powered up with the rudder pedals not centered.
- Indicates the yaw damper actuator did not center on powerup. This is a ground only message and will initiate NO TAKEOFF warning.

Procedure completed

■ YD OFF LOWER (YAW DAMPER OFF LOWER)

1. YD Button - PRESS (ON).

Procedure completed

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CYAN CAS MESSAGE DEFINITIONS AND PROCEDURES

This section presents cyan CAS messages in alphabetical order with the titles spelled out in parenthesis. In most cases, these messages provide information pertaining to future action which may be required and no specific procedure is applicable.

AC BEARING L-R (ALTERNATOR BEARING FAILURE L-R)

Indicates impending alternator bearing failure within approximately 20 hours of operation. Maintenance is required.

AHRS 1-2 AUX POWER (ATTITUDE, HEADING REFERENCE SYSTEM 1-2 AUXILIARY POWER)

Indicates that primary AHRS electrical power has failed and AHRS is powered from the emergency bus.

AIRCRAFT MAINTENANCE

This is a ground only message that indicates Aircraft Maintenance Test (AMT) data is available from the TEMPERATURE MONITORS (RTDs). Maintenance is required.

1. Maintenance is required within 10 hours of indication of the message.

Procedure completed

AILERON RATIO LOW

Indicates that the lateral flight control system is operating in the default mode of low ratio due to single hydraulic systems only operation.

APU GEN OFF (APU GENERATOR OFF)

In flight indicates that APU is running AND that the APU GEN is selected ON and both left and right hand generators are ON or the left hand generator is OFF and the right hand generator is ON.

1. Generator Switches - CHECK/AS REQUIRED.

Procedure completed

AURAL WARN FAIL 1-2

Indicates that the respective aural warning computer has failed. Aural warnings will not be audible through either the respective headset or overhead speaker. Aural warnings will continue to work normally through the opposite side headset and speaker. If both aural warning computers fail, then the message will change to the amber AURAL WARNING FAIL message.

BATT 1-2 OFF

Indicates the respective battery has been selected OFF.

CROSSTIE CLOSED

Indicates the crosstie relay has been selected closed by any of the following: A) the DC Power Bus 1 or Bus 2 switch annunciator following generator failure in flight, B) manually closed by the flight crew or C) ground operation during initial power-up.

CVR FAIL (COCKPIT VOICE RECORDER FAILURE)

Indicates loss of DC power to the Cockpit Voice Recorder or an internal fault, or downloading data. Refer to the approved Minimum Equipment List.

DC BEARING L-R APU (GENERATOR BEARING FAILURE L-R)

Indicates impending generator bearing failure within approximately 20 hours of operation. Maintenance is required.

NOTE

This message may appear as a momentary message then extinguish. The 4 hour time limit still starts from the first time that the message was posted.

ENG A/I COLD L-R (ENGINE ANTI-ICE COLD L-R)

Indicates that the engine anti-ice is on and inlet lip temperature is cold due to a pylon bleed leak. Refer to Emergency Procedures, PYLON BLEED LEAK.

ENG SHUTDOWN L-R (ENGINE SHUTDOWN L-R)

Indicates that the affected engine has been shut down by the engine throttle. Clears after engine start.

CYAN CAS MESSAGE DEFINITIONS AND PROCEDURES

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Indicates that primary AHRS electrical power has failed and AHRS is powered from the emergency bus.

APU GEN OFF (APU GENERATOR OFF)

ON GROUND: Indicates APU generator is OFF (or failed) and APU is running.

IN FLIGHT: Indicates APU generator is OFF (or failed) and APU is running and both main generators are on.

1. Generator Switches - CHECK/AS REQUIRED.

Procedure completed

BATT 1-2 OFF

Indicates the respective battery has been selected OFF.

CROSSTIE CLOSED

Indicates the crosstie relay has been selected closed by any of the following: A) the DC Power Bus 1 or Bus 2 switch annunciator following generator failure in flight, B) manually closed by the flight crew or C) ground operation during initial power-up.

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ON GROUND: Indicates APU generator is OFF (or failed) and APU is running.

IN FLIGHT: Indicates APU generator is OFF (or failed) and APU is running and both main generators are on.

1. Generator Switches - CHECK/AS REQUIRED.

Procedure completed

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This message may appear as a momentary message then extinguish. The 4 hour time limit still starts from the first time that the message was posted.

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Indicates that the engine anti-ice is on and inlet lip temperature is cold due to a pylon bleed leak. Refer to Emergency Procedures, PYLON BLEED LEAK.

ENG SHUTDOWN L-R (ENGINE SHUTDOWN L-R)

Indicates that the affected engine has been shut down by the engine throttle. Clears after engine start.

FDR FAIL (FLIGHT DATA RECORDER FAILURE)

Indicates loss of DC power to the Flight Data Recorder or internal fault. Refer to the approved Minimum Equipment List.

FGC A-B FAIL (FLIGHT GUIDANCE COMPUTER FAIL A OR B)

NOTE

- Indicates failure of the respective flight guidance computer. Depending on the cause, the computer may reset in about 30 seconds.
- If the FGC has failed twice in two minutes, it will not reset.

IF FGC DOES RESET

Land as soon as practical.

FGC-ADC MISCMP (FLIGHT GUIDANCE COMPUTER AIR DATA COMPUTER MISCOMPARE)

Indicates that Air Data Computer 1 and 2 data to the Flight Guidance Computers does not agree. One or more Flight Director/Autopilot modes may disconnect or not engage.

1. Primary Flight Displays - CHECK AIR DATA DISPLAYS.
2. ADC REV Switch (faulty side) - SELECT ADC REV.

FGC-ATT MISCMP (FLIGHT GUIDANCE COMPUTER ATTITUDE MISCOMPARE)

Indicates that the Flight Guidance Computer has prohibited autopilot engagement due to AHRS attitude miscompare. This CAS message will clear after 5 seconds.

FIRE BOTTL LOW APU OR L-R (FIRE BOTTLE PRESSURE LOW APU OR L-R ENGINE)

Indicates that the APU or left or right engine fire extinguisher bottle pressure is low, or the bottle has been discharged. Dispatch is prohibited with either engine fire bottle low. APU operation is prohibited if the APU fire bottle is low.

FLIGHT IDLE L-R

Indicates that the ground idle switch is in the HIGH position on the ground.

FUEL GRV XFLW XSIT (FUEL GRAVITY CROSSFLOW IN TRANSIT)

Indicates a failure of the gravity crossflow valve to fully open or to fully close.

GUST LOCK ON (Airplanes serial 750-0002 through 750-0063)

Indicates that the flight control gust lock is engaged. This will trigger the NO TAKEOFF warning system. Refer to Cyan CAS Abnormal Procedures, NO TAKEOFF or Emergency Procedures, NO TAKEOFF.

MEMORY FULL

Indicates that the Engine Exceedance Parameters memory is full and must be downloaded to clear the message.

NO TAKEOFF

Indicates that the airplane is not in safe takeoff configuration on the ground. This message will change to RED with MASTER WARNING and aural warning if the throttles are advanced for takeoff. Refer to Emergency Procedures, NO TAKEOFF.

NOTE

No Takeoff Cyan CAS message indicates engines running and one or more of the following:

- Flaps < 5°.
- Flaps > 15°.
- Either slat not extended.
- Slat asymmetry.
- Parking brake on.
- Either start valve open.
- Speed brakes extended.
- Stabilizer, aileron, rudder trim not within takeoff limits.
- Yaw damper not centered.
- Gust lock on (if installed).
- Fuel quantity low.
- Engine synchronizer on.
- Pitch/Roll disconnect handle not stowed correctly.

Message will be displayed in Cyan below 60° TLA and will change to red with MASTER WARNING and Aural Warning if either TLA is above 60°. MASTER WARNING and Aural Warning will clear at 80 KIAS if takeoff is continued.

FDR FAIL (FLIGHT DATA RECORDER FAILURE)

Indicates loss of DC power to the Flight Data Recorder or internal fault. Refer to the approved Minimum Equipment List.

FGC A-B FAIL (FLIGHT GUIDANCE COMPUTER FAIL A OR B)

NOTE

- Indicates failure of the respective flight guidance computer. Depending on the cause, the computer may reset in about 30 seconds.
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Land as soon as practical.

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Indicates that the Engine Exceedance Parameters memory is full and must be downloaded to clear the message.

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- Either slat not extended.
- Slat asymmetry.
- Parking brake on.
- Either start valve open.
- Speed brakes extended.
- Stabilizer, aileron, rudder trim not within takeoff limits.
- Yaw damper not centered.
- Gust lock on (if installed).
- Fuel quantity low.
- Engine synchronizer on.
- Aileron Latch handle not stowed.
- Pitch/Roll disconnect handle not stowed correctly.

Message will be displayed in Cyan below 60° TLA and will change to red with MASTER WARNING and Aural Warning if either TLA is above 60°. MASTER WARNING and Aural Warning will clear at 80 KIAS if takeoff is continued.

OIL FILTER BYPASS L-R

Indicates impending or actual engine oil filter bypass.

NOTE

20 hours of operation are allowed provided the Amber CHIP DETECT L-R CAS message is not displayed.

IN FLIGHT

1. Engine Oil Pressure/Temperature - MONITOR.

P/S-RAT HEAT OFF (PITOT/STATIC RAM AIR TEMPERATURE HEAT OFF)

Indicates that either pitot/static RAT heat switch is selected to OFF on the ground. This message will change to amber with MASTER CAUTION if the throttles are advanced for takeoff or when airborne. Refer to Amber Abnormal Procedures, P/S RAT HEAT OFF.

PARK BRAKE ON

Indicates that the parking brake handle has been pulled up and sufficient pressure is being maintained. This message is amber if the handle is pulled up in flight.

CAUTION

HYDRAULIC PRESSURE MUST BE APPLIED TO SET THE BRAKES.

RAT PROBE FAIL L-R (RAM AIR TEMPERATURE PROBE FAILURE L OR R)

Indicates either, but not both, RAT probe inoperative. Dispatch is prohibited except in accordance with the approved Minimum Equipment List. Autopilot vertical modes on the affected side will drop and FADEC FAULT L-R Amber CAS message will illuminate.

REMOTE CB TRIPPED (REMOTE CIRCUIT BREAKER TRIPPED)

Indicates tripped status of one or more of the following aft J-Box circuit breakers:

- AHRS AUX PWR
- APU Feed
- AVN Emergency Feed
- Battery 1
- Battery 2
- Cabin ECU
- Cockpit ECU
- EICAS Feed
- Elec Emergency Feed
- LH Start Logic (starter assisted)
- LH Landing Light
- LH Wing Root Heater
- Seat Belt/Chime
- RH Landing Light
- RH Start Logic (starter assisted)
- RH Wing Root Heater
- Secondary Trim 1
- Secondary Trim 2
- Standby Battery Pack
- ELT

NOTE

The AHRS AUX PWR AFT J-BOX circuit breaker provides power to AHRS 1, or IRS 1 if the optional IRSs are installed.

Dispatch is prohibited except in accordance with an approved Minimum Equipment List.

SLAT A/I COLD L-R (SLAT ANTI-ICE COLD L-R)

Indicates that the respective slat anti-ice is cold due to wing supply bleed leak. Refer to Amber Abnormal Procedures, WING BLD LEAK L-R.

TONE GEN 1-2 FAIL (TONE GENERATOR 1-2 FAILURE)

Indicates that the respective IAC warning tone generator has failed. The opposite tone generator will continue to supply all warning tones. If both tone generators fail, no tones will be available (caution/warning tones, altitude alert, AP disconnect and minimums tone).

WING A/I COLD L-R (WING ANTI-ICE COLD L-R)

Indicates that the respective inboard wing anti-ice is cold due to wing supply bleed leak. Refer to Amber Abnormal Procedures, WING BLD LEAK L-R.

YD FAIL LOWER A-B (YAW DAMPER FAILURE LOWER A-B)

Indicates failure of the respective lower yaw damper. Dispatch is prohibited except in accordance with an approved Minimum Equipment List.

1. Ensure FGC has switched to operative channel.

YD FAIL UPPER A-B (YAW DAMPER FAILURE UPPER A-B)

On the ground indicates that the off side (not selected) yaw damper channel has failed. Amber CAS message would be displayed in flight. Dispatch is prohibited except in accordance with an approved Minimum Equipment List.

WHITE CAS ABNORMAL PROCEDURES
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WHITE CAS MESSAGE DEFINITIONS AND PROCEDURES

This section presents white CAS messages in alphabetical order with the titles spelled out in parenthesis. In most cases these messages provide information pertaining to system status or future action which may be required and no specific procedure is applicable.

ACFT MAINTENANCE (AIRCRAFT MAINTENANCE)

This is a ground only ADVISORY message that indicates Aircraft Maintenance Test (AMT) data is available. The systems that activate this message are: FADEC, APU, PCU-MONITOR, ACTIVE MOUNT (if installed), GLARESHIELD FAN, NOSE COMPARTMENT FAN, TAILCONE FAN and CABIN DOOR FAULT.

AHRS 1-2 BASIC (ATTITUDE HEADING REFERENCE SYSTEM)

Indicates true airspeed input has been lost from air data computer, therefore, affected AHRS attitude and heading may precess slightly.

A/I ON ENG-STAB-SLAT-ALL

This message indicates the respective engine, stabilizer, slat, or anti-ice system has been selected on. If all systems are on the message will be ALL.

APU ON (AUXILIARY POWER UNIT ON)

This is a status message indicating that the APU is on.

AVN MAINTENANCE (AVIONICS MAINTENANCE)

Ground only message that indicates Integrated Avionics Maintenance Test (IMT) data is available for the Primus 2000 system.

CHECKLIST MISMATCH

The configuration monitor in the IAC detects that the two IAC's have different checklist procedures. Use hard copy checklist.

FGC A-B MASTER (FLIGHT GUIDANCE COMPUTER A-B MASTER)

This message indicates whether A or B Flight Guidance Computer is in control, and is displayed for 5 seconds after an automatic or pilot initiated transfer.

FUEL BOOST ON L-R

The affected fuel boost pump has been activated manually or automatically (APU on, fuel crossfeed, engine start), in normal operation.

FUEL FW VLV CLSD L-R (FUEL FIRE WALL VALVE CLOSED L-R)

Indicates that the affected fuel firewall shutoff valve is in the closed position, thus preventing fuel from reaching the engine.

FUEL GRV XFLW OPEN (FUEL GRAVITY CROSSFLOW OPEN)

Indicates that the fuel gravity crossflow valve is in the open position.

FUEL XFEED OPEN (FUEL CROSSFEED OPEN)

Indicates that the fuel crossfeed valve is in the open position.

NOTE

This message may also be displayed in Amber. Refer to Amber Abnormal Procedures.

HYD AUX PUMP ON (HYDRAULIC AUXILIARY PUMP ON)

The electric auxiliary hydraulic pump is on as sensed by voltage supplied to the pump.

HYD FW SHUTOFF A-B (HYDRAULIC FIREWALL SHUTOFF A-B)

Indicates that the hydraulic system firewall shutoff valve(s) is closed.

IMT - AFCS ON (INTEGRATED MAINTENANCE TEST - AUTOMATIC FLIGHT CONTROL SYSTEM ON)

This ground only message indicates inability to enter IMT because the automatic flight control system is engaged.

IMT - IAS HIGH (INTEGRATED MAINTENANCE TEST - INDICATED AIRSPEED HIGH)

This ground only message indicates inability to enter IMT because airspeed is > 50 KIAS. Thus, IMT may interpret the aircraft as being in the air.

WHITE CAS MESSAGE DEFINITIONS AND PROCEDURES

This section presents white CAS messages in alphabetical order with the titles spelled out in parenthesis. In most cases these messages provide information pertaining to system status or future action which may be required and no specific procedure is applicable.

ACFT MAINTENANCE (AIRCRAFT MAINTENANCE)

This is a ground only ADVISORY message that indicates Aircraft Maintenance Test (AMT) data is available. The systems that activate this message are: FADEC, PCU-MONITOR, BLEED AIR RESISTANCE TEMPERATURE DEVICES (RTDs), ACTIVE MOUNT (if installed), GLARESHIELD FAN, NOSE COMPARTMENT FAN, TAILCONE FAN and CABIN DOOR FAULT.

1. Maintenance is required within 10 hours of indication of the message.

Procedure completed

AHRS 1-2 BASIC (ATTITUDE HEADING REFERENCE SYSTEM)

Indicates true airspeed input has been lost from air data computer, therefore, affected AHRS attitude and heading may precess slightly.

A/I ON ENG-STAB-SLAT-ALL

This message indicates the respective engine, stabilizer, slat, or anti-ice system has been selected on. If all systems are on the message will be ALL.

APU ON (AUXILIARY POWER UNIT ON)

This is a status message indicating that the APU is on.

AVN MAINTENANCE (AVIONICS MAINTENANCE)

Ground only message that indicates Integrated Avionics Maintenance Test (IMT) data is available for the Primus 2000 system.

CHECKLIST MISMATCH

The configuration monitor in the IAC detects that the two IAC's have different checklist procedures. Use hard copy checklist.

FGC A-B MASTER (FLIGHT GUIDANCE COMPUTER A-B MASTER)

This message indicates whether A or B Flight Guidance Computer is in control, and is displayed for 5 seconds after an automatic or pilot initiated transfer.

FUEL BOOST ON L-R

The affected fuel boost pump has been activated manually or automatically (APU on, fuel crossfeed, engine start), in normal operation.

FUEL FW VLV CLSD L-R (FUEL FIRE WALL VALVE CLOSED L-R)

Indicates that the affected fuel firewall shutoff valve is in the closed position, thus preventing fuel from reaching the engine.

FUEL GRV XFLW OPEN (FUEL GRAVITY CROSSFLOW OPEN)

Indicates that the fuel gravity crossflow valve is in the open position.

FUEL XFEED OPEN (FUEL CROSSFEED OPEN)

Indicates that the fuel crossfeed valve is in the open position.

NOTE

This message may also be displayed in Amber. Refer to Amber Abnormal Procedures.

HYD AUX PUMP ON (HYDRAULIC AUXILIARY PUMP ON)

The electric auxiliary hydraulic pump is on as sensed by voltage supplied to the pump.

HYD FW SHUTOFF A-B (HYDRAULIC FIREWALL SHUTOFF A-B)

Indicates that the hydraulic system firewall shutoff valve(s) is closed.

IMT - AFCS ON (INTEGRATED MAINTENANCE TEST - AUTOMATIC FLIGHT CONTROL SYSTEM ON)

This ground only message indicates inability to enter IMT because the automatic flight control system is engaged.

IMT - IAS HIGH (INTEGRATED MAINTENANCE TEST - INDICATED AIRSPEED HIGH)

This ground only message indicates inability to enter IMT because airspeed is > 50 KIAS. Thus, IMT may interpret the aircraft as being in the air.

IMT - NO EFIS (INTEGRATED MAINTENANCE TEST - NO ELECTRONIC FLIGHT INSTRUMENT SYSTEMS)

This ground only message indicates inability to enter IMT because the electronic flight instruments are not operational, therefore one would be unable to access IMT through either MFD.

IMT - NO WOW (INTEGRATED MAINTENANCE TEST - NO WEIGHT ON WHEELS)

Inability to enter IMT because the aircraft must be on the ground.

KEY NOT ACTIVE

When not labeled with ENG/MSGS, depressing the left most bezel button on the EICAS produces this message to indicate its inactive status.

PAC HI CKPT-CBN (PRESSURIZED AIR CONDITIONING HIGH COCKPIT - CABIN)

Indicates respective PAC is in high flow mode. Refer to applicable limitations.

PAC HP VLV OPN L-R (PRESSURIZED AIR CONDITIONING HIGH PRESSURE VALVE OPEN L-R)

Indicates PACs are using high pressure bleed air. Refer to applicable limitations.

SATCOM CALL 1-2

Indicates SELCAL alert on the optional satellite communication system.

SELCAL VHF 1-2 / HF 1-2

Indicates SELCAL alert on the optional VHF or HF SELCAL system.

SPEED BRAKES

Two of the six speed brakes are position monitored. This message indicates at least one of the monitored panels is not stowed, and may be illuminated in conjunction with an amber speed brake EICAS symbology indicating an asymmetric condition exists.

EMERGENCY PROCEDURES
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EMERGENCY PROCEDURES (Continued)

FLIGHT GUIDANCE

MISCELLANEOUS

*Denotes Primus 2000 message

EMERGENCY PROCEDURES

■ ENGINE FAILURE, FIRE, OR MASTER WARNING DURING TAKEOFF (ENG FIRE LIGHT, ENGINE FIRE L-R CAS MESSAGE AND/OR ENGINE FAIL L-R CAS MESSAGE OR MASTER WARNING)

- **SPEED BELOW V_1 - TAKEOFF REJECTED.**

1. Takeoff - ABORT if below V_1.

- Maintain Directional Control.
- Brakes - MAXIMUM PILOT EFFORT.
- Throttles - IDLE.
- Speed Brakes - EXTEND.
- Control Column - FORWARD PRESSURE.
- Thrust Reverser(s) - DEPLOY (nose wheel on ground). Use as required (if no fire).

☐ **IF ENGINE FIRE INDICATIONS PRESENT (FIRE LIGHT AND/OR CAS MESSAGE)**

1. Illuminated ENG FIRE Switch - CONFIRM, then LIFT COVER and PUSH.
2. Either Illuminated BOTTLE ARMED Light - PUSH (BOTTLE ARMED light off).
3. Throttle - CONFIRM ENGINE, then CUTOFF (if required).
4. APU MASTER Switch - OFF (if required).
5. ENGINE FIRE Light on 30 Sec., BOTTLE ARMED Light - PUSH (if required).
6. Parking Brake - SET.
7. BATT Switches - OFF (if required).
8. Throttle - Operating Engine, CUTOFF.
9. EXIT AIRCRAFT (if required).

Procedure completed

☐ **IF NO ENGINE FIRE (ENGINE FAIL L-R CAS MESSAGE)**

Procedure completed

- **SPEED ABOVE V_1** -TAKEOFF CONTINUED

1. Climb to a safe altitude.

NOTE

- Maintain directional control.
- Accelerate to V_R, ROTATE.
- Gear - UP (after positive rate-of-climb).

2. Airspeed - V_2 MINIMUM (one engine) or as required (two engines) until clear of obstacles at or above 1500 feet AGL.

CAUTION

IF AIRPLANE CONTROL OR OBSTACLES ARE NOT A FACTOR, THE PILOT MAY BEGIN ENGINE FIRE PROCEDURES (IF ENG FIRE LIGHT ON) DURING CLIMB TO SAFE ALTITUDE. OTHERWISE, BOTH ENGINES SHOULD BE LEFT IN THE TAKEOFF DETENT UNTIL LEVEL OFF.

(Continued Next Page)

■ ENGINE FAILURE, FIRE, OR MASTER WARNING DURING TAKEOFF (ENG FIRE LIGHT, ENGINE FIRE L-R CAS MESSAGE AND/OR ENGINE FAIL L-R CAS MESSAGE OR MASTER WARNING) (Continued)

3. Flaps - RETRACT at V_2 +15 KIAS, Minimum.
4. Accelerate to V_{ENR} (190 KIAS).

□ **IF ENGINE FIRE INDICATIONS PRESENT AND AT OR ABOVE 400 FEET AGL**

1. Throttle (affected engine) - CONFIRM, then IDLE.

○ **IF ENG FIRE LIGHT REMAINS ON (15 SECONDS) - PROBABLE FIRE**

1. Illuminated ENG FIRE Switch - CONFIRM, then LIFT COVER and PUSH.
2. Either Illuminated BOTTLE ARMED Light - PUSH (BOTTLE ARMED light off).

WARNING

IF FIRE LIGHT REMAINS ON AFTER 30 SECONDS, PUSH REMAINING ILLUMINATED BOTTLE ARMED LIGHT.

3. Land as soon as possible.
4. Throttle (affected engine) - CONFIRM, then CUTOFF.
5. Refer to Abnormal Procedures, SINGLE ENGINE APPROACH AND LANDING.

Procedure completed

○ **IF ENG FIRE LIGHT OUT WITH THROTTLE IDLE - PROBABLE BLEED AIR LEAK**

1. Affected ENG BLD AIR Switch - OFF.
2. Land as soon as practical.

NOTE

Consider reduced power on affected engine as required to keep the fire light out.

Procedure completed

□ **IF NO ENGINE FIRE (ENGINE FAIL L-R CAS MESSAGE) AND OBSTACLES CLEARED (1500 FEET AGL OR HIGHER)**

1. Accomplish Abnormal Procedures, PRECAUTIONARY SHUTDOWN AND/OR INFLIGHT RESTART.

Procedure completed

■ ENGINE FIRE (ENG FIRE LIGHT AND ENGINE FIRE L-R CAS MESSAGE)

1. Throttle (affected engine) - CONFIRM, then IDLE.

● **IF ENG FIRE LIGHT REMAINS ON (15 SECONDS) PROBABLE FIRE**

1. ENG FIRE Switch - CONFIRM, then LIFT COVER and PUSH.
2. Either Illuminated BOTTLE ARMED Light - PUSH (bottle armed light goes off).

(Continued Next Page)

■ ENGINE FIRE (ENG FIRE LIGHT AND ENGINE FIRE L-R CAS MESSAGE) (Continued)

NOTE

The affected ENGINE FAILED red CAS message will be displayed when the engine is shut down using the ENG FIRE switch with the throttle at or forward of the idle detent. It will be replaced by the ENG SHUTDOWN cyan message when the throttle is placed to cutoff.

☐ **IF ENG FIRE LIGHT ON AFTER 30 SECONDS**

1. Remaining Bottle Armed Light - PUSH.
2. Land as soon as possible. Refer to Abnormal Procedures, ENGINE FAILURE/PRECAUTIONARY SHUTDOWN.

Procedure completed

☐ **IF FIRE EXTINGUISHED**

1. Accomplish Abnormal Procedure: ENGINE FAILURE/PRECAUTIONARY SHUTDOWN.

Procedure completed

● **IF LIGHT GOES OUT WITH THROTTLE AT IDLE AND NO OTHER ENGINE FIRE INDICATIONS ARE PRESENT (PROBABLE BLEED LEAK)**

1. Affected Engine Bleed Switch - OFF.

NOTE

May require reduced power on affected side to keep light out.

2. Land as soon as practical.

Procedure completed

■ ENGINE FAILURE DURING FINAL APPROACH (ENGINE FAIL L-R CAS MESSAGE)

1. Flaps - APPROACH.
2. Airspeed - V_{REF}(15) +10 KIAS MINIMUM, until landing is assured.
3. Autopilot - AS DESIRED.
4. Speed Brakes - RETRACT.
5. AUX Pump - ON (if "A" Hydraulic System pressure is below 1500 PSI).
6. Plan to USE the EMERGENCY BRAKES (if needed).

WARNING

DO NOT EXTEND FLAPS BEYOND 15° WITH EITHER HYDRAULIC SYSTEM DEPRESSURIZED. IF A SPEED BRAKE OR SPOILER CHECK VALVE FAILS TO REMAIN FULLY CLOSED, UNCOMMANDED ROLL MAY RESULT. RETRACT FLAPS TO 15° OR LESS, IF EXTENDED.

7. Multiply normal Flaps 15° Landing Distance by 1.6.

Procedure completed

■ ENGINE VIBRATION (ENG VIBRATION L-R RED CAS MESSAGE)

1. Vibration - CONFIRM (sound and feel indications).

● **IF VIBRATION EXISTS**

1. Throttle (affected engine) - RETARD to reduce vibration.
2. Land as soon as practical.

Procedure completed

● **IF VIBRATION CONTINUES OR OTHER EVIDENCE OF ENGINE MALFUNCTION EXISTS**

1. Consider shutting down the engine to prevent greater damage and subsequent engine failure. Refer to Abnormal Procedures, ENGINE FAILURE/ PRECAUTIONARY SHUTDOWN.

CAUTION

IF THE VIBRATION CONTINUES IN A RUNNING ENGINE, THE ENGINE WILL LIKELY FAIL.

NOTE

ENG VIBRATION L-R amber CAS message indicates a lower level of vibration. Refer to Abnormal Procedures, ENG VIBRATION L-R amber CAS message.

2. Land as soon as possible.

Procedure completed

■ APU FIRE (APU FIRE LIGHT AND APU FIRE CAS MESSAGE)

1. APU Fire Switch - LIFT COVER and PUSH.

NOTE

This step will discharge the fire extinguisher. APU shutdown will occur automatically within 15 seconds after the APU FIRE light illuminates but the fire extinguisher will not discharge without pilot action.

2. APU MASTER Switch - OFF.
3. Land as soon as possible.

NOTE

APU FIRE CAS message and Master Warning operate only if EICAS is operating.

Procedure completed

■ DUAL ENGINE FLAMEOUT - LOW ALTITUDE (ENGINE FAILED L-R CAS MESSAGE)

1. Fuel - CHECK (Tanks/Quantity; Crossfeed/As Required; Transfer/As Required; Boost Pumps/ON).
2. Throttles - CUTOFF.
3. “A” AUX HYDRAULIC PUMP - ON.

● **IF APU IS ON AND AIR AVAILABLE**

4. APU Generator - ON.
5. Either ENGINE START button - PRESS (below 25% N_2).
6. Throttle - IDLE $\geq$10% N_2.

● **IF APU AIR NOT AVAILABLE**

4. HYDRAULIC PUMP “A” and “B” Switches - UNLOAD.
5. Load Shed Switch - O'RIDE.
6. Airspeed - $\geq$ 240 KIAS.
7. Throttles - BOTH IDLE (if N_2 $\geq$10%).

NOTE

- Throttles must be placed to cutoff to reset FADEC start logic.
- Engine acceleration during windmilling air starts will be considerably slower than during starter assisted starts, particularly at the low airspeed end of the start envelope. If N_2 is accelerating and ITT is within limits, allow the start to continue. ITT fluctuations from 500°C to 700°C during start are normal.
- It is unlikely that an engine start, using APU air, can be accomplished from below 1000 feet AGL, or using windmill start from below 3000 feet AGL, following a low altitude dual engine flameout.

□ **IF ENGINE(S) STARTS**

1. Opposite Engine - START (if required).
   a. PAC ISOL VALVE - OPEN (if crossbleed start).
   b. ENGINE START Button - PRESS.
   c. Throttle - IDLE $\geq$10% N_2.
2. HYDRAULIC PUMP “A” and “B” Switches - NORMAL (if required).
3. Land as soon as possible. Refer to Normal Procedures or Abnormal Procedures, SINGLE-ENGINE APPROACH AND LANDING, as applicable.

Procedure completed

□ **IF ENGINES DO NOT START**

1. Landing Gear - AS REQUIRED, use BLOWDOWN.

CAUTION

DO NOT EXTEND THE LANDING GEAR HYDRAULICALLY IF THE “A” SYSTEM IS POWERED ONLY BY THE AUXILIARY HYDRAULIC PUMP. GEAR EXTENSION WILL BE SLOW AND WILL RESULT IN LOW PRESSURE TO THE FLIGHT CONTROL PCUs FOR UP TO 30 SECONDS.

   a. Landing Gear Blowdown Handle - PULL (below 210 KIAS).
   b. Landing Gear - CHECK DOWN and LOCKED (3 green lights).
   c. Gear Handle - DOWN.

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■ DUAL ENGINE FLAMEOUT - LOW ALTITUDE (ENGINE FAILED L-R CAS MESSAGE) (Continued)

2. Flaps - 15° MAXIMUM.

WARNING

DO NOT EXTEND FLAPS BEYOND 15° WITH EITHER HYDRAULIC SYSTEM DEPRESSURIZED. IF A SPEED BRAKE OR SPOILER CHECK VALVE FAILS TO REMAIN FULLY CLOSED, UNCOMMANDED ROLL MAY RESULT. RETRACT FLAPS TO 15° OR LESS, IF EXTENDED.

3. Airspeed - V_{REF}.

NOTE

The airspeeds in the following table are the minimum recommended until landing flare to ensure sufficient energy to arrest descent rate and are based on V_{REF} (1.3 V_S) for the appropriate configuration, plus 20 knots (slats extended), V_{REF} (1.3 V_S) for the appropriate configuration, plus 30 knots (slats retracted).

V_{REF} (KIAS)

FLAPS/SLATS	WEIGHT - POUNDS								LANDING DISTANCE FACTORS
	23,000	25,000	27,000	29,000	31,000	33,000	34,000	35,700	
0°/Retracted	134	140	146	151	157	164	168	172	4.1 (3.0)*
0°/Extended	124	130	136	141	147	154	158	162	3.5 (2.5)**
5°/Retracted	130	136	142	147	153	160	162	166	3.9 (2.7)*
5°/Extended	120	126	132	137	143	150	152	156	3.2 (2.9)***
15°/Retracted	123	129	134	139	145	153	155	158	2.9 (2.8)***
15°/Extended	113	119	124	129	135	143	145	148	2.2 (2.0)***

Multiply the Normal **FLAPS FULL** Landing Distance by the appropriate landing distance factor in the above table. The factors in parenthesis () can be used if the following conditions apply:

***** Altitude under 5,000 feet, weight less than 29,000 pounds, no tailwinds.
****** Altitude under 5,000 feet, weight less than 29,000 pounds.
******* Altitude under 5,000 feet

CAUTION

- AVOID LANDING WITH TAILWIND OR DOWNHILL RUNWAY GRADIENT.
- LANDING DISTANCE FACTORS OF 3.0 OR GREATER MAY REQUIRE THE USE OF A RUNWAY WITH AN ARRESTING BARRIER.

Procedure completed

■ DUAL ENGINE FLAMEOUT IN CRUISE (ENGINE FAILED L-R CAS MESSAGE)

1. Crew Oxygen Masks - DON (if required).
2. PASS OXY - ON (if required).
3. Airspeed - 0.80 M/250 KIAS minimum if possible.

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■ DUAL ENGINE FLAMEOUT IN CRUISE (ENGINE FAILED L-R CAS MESSAGE) (Continued)

NOTE

At 250 KIAS or above, with the hydraulic pump switches in NORM, the engines will windmill at sufficient RPM to provide normal hydraulic pressure for several minutes.

4. Fuel - CHECK (Tanks/Quantity; Crossfeed/As Required; Transfer/As Required; Boost Pumps/ON).
5. ATC - ADVISE/Transponder - EMERGENCY CODE.
6. Descend as required to FL350 or below.
7. Load Shed Switch - O'RIDE.
8. Interior Master Switch - OFF.

WARNING

ENGINE START WITHOUT LOAD SHED OVERRIDE WILL NOT BE POSSIBLE DUE TO LACK OF FUEL BOOST.

NOTE

- With the electrical Load Shed Switch in NORM, electrical load will automatically reduce to emergency one minute after failure of the second generator.
- With the Load Shed Switch in EMER (or NORM, following automatic load shed) electrical power is supplied to the following equipment only. In this condition, properly charged batteries will supply power for approximately 30 minutes. Time can be increased by minimizing use of the Auxiliary Hydraulic Pump.

Both Rudder Limiters	"A" AUX Hydraulic Pump
Pilot and Copilot Audio Panels	Upper Rudder Actuator
Audio Warnings ***	Pitch Feel
VHF Comm 1	Rudder Trim
VHF Nav 1	Aileron Trim
RMU 1	Secondary Stabilizer Trim
Standby Nav/Comm (Honeywell radios only)	APU
	Engine Start Logic
Standby HSI	Both Engine A and B FADECs (ADC REV mode)
Standby Attitude *	
Standby Pitot/Static Heat	Engine Fire Detect and Extinguishers
Auxiliary Panel Lights	Firewall Shutoff - Fuel and Hydraulic
IRS 1	Standby Engine Instruments *
Emergency Lighting **	Landing Gear Control and Indication Lights (except retract)
MADC 1	
LH Windshield Heat	HF Radio 1 (if installed, 750-0023 and on only)

* Powered by standby battery
** Also powered by emergency light battery pack
*** Secondary pitch trim clacker and pilot's overspeed warning only

- While operating on the emergency electrical bus, transponder and external lighting are not operative. Advise Air Traffic Control.
- At 250 KIAS or above, with the hydraulic pump switches normal, the engines will windmill for several minutes at sufficient RPM to provide normal flight control hydraulic pressure.

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■ DUAL ENGINE FLAMEOUT IN CRUISE (ENGINE FAILED L-R CAS MESSAGE) (Continued)

● **BELOW FL350, ATTEMPT WINDMILL START (AIRSPEED ≥ 250 KIAS, N_2 ≥ 10%)**

1. "A" AUX HYDRAULIC PUMP - ON.
2. HYDRAULIC PUMP "A" and "B" Switches - UNLOAD.

NOTE

- Unloading the hydraulic pumps will improve windmilling start characteristics.

- If the hydraulic system(s) are unloaded at high altitude, the pump(s) may not prime when the switch(es) are returned to normal, resulting in failure to restore hydraulic pressure. The A system can be restored by selecting the "A" AUX pump on, which will prime the A system engine driven pump and restore A system pressure. The B system pump may not recover until altitude is reduced.

3. Airspeed - ≥ 250 KIAS.
4. Throttles - CUTOFF.
5. IGNITION - NORM or ON.

NOTE

- Throttles must be placed to cutoff to reset FADEC start logic.

- Engine acceleration during windmilling air starts will be considerably slower than during starter assisted starts, particularly at the low airspeed end of the start envelope. If N_2 is accelerating and ITT is within limits, allow the start to continue. ITT fluctuations from 500°C to 700°C during start are normal.

(Continued Next Page)

■ DUAL ENGINE FLAMEOUT IN CRUISE (ENGINE FAILED L-R CAS MESSAGE) (Continued)

6. Throttles - IDLE ($N_2 \geq$ 10% RPM).

☐ IF ENGINES DO NOT RESTART (APU AVAILABLE AND BELOW FL310)

1. Throttles - CUTOFF.
2. APU - START ($\leq$ FL310).
   a. APU MASTER Switch - ON.
   b. APU START/STOP Switch - START.

NOTE

- Refer to Normal Procedures, APU START Checklist/Start Envelope. One APU start attempt is approved within 30 minutes of dual generator failure (engine flameout) provided that the Load Shed is in EMER within 5 minutes after loss of the second generator.
- Throttles must be placed in cutoff to reset the FADEC start logic.

   c. APU Generator - ON.
   d. APU Bleed Air Valve - OPEN.
3. Load Shed Switch - NORM.
4. Throttles - CUTOFF.
5. Either ENGINE START Button - PRESS ($\leq$ 25,000 FEET).
6. Throttle - IDLE AT $\geq$10% N_2.
7. Opposite Engine - START.

☐ IF ENGINES DO NOT START

1. Throttles - CUTOFF.
2. Engine START DISENGAGE Button - PRESS, if starter engaged.
3. Refer to Emergency Procedures, MAXIMUM GLIDE/EMERGENCY LANDING.

Procedure completed

☐ IF ENGINES START

1. HYDRAULIC PUMP “A” Switch - NORM.
2. HYDRAULIC PUMP “B” Switch - NORM (if right engine running).
3. “A” AUX HYDRAULIC PUMP - OFF (if left engine running).
4. Load Shed Switch - NORM.
5. Land as soon as possible.

Procedure completed

☐ IF ONLY ONE ENGINE STARTS

1. Land as soon as possible. Refer to Abnormal Procedures, SINGLE-ENGINE APPROACH AND LANDING.

Procedure completed

■ MAXIMUM GLIDE/EMERGENCY LANDING

● **IF NO GENERATOR ON LINE AND LANDING IS NOT IMMINENT** (airborne time >10 minutes from engines flameout)

1. "A" AUX HYDRAULIC PUMP - OFF.
2. Aileron Latch Handle - PULL.
3. Load Shed Switch - EMER.
4. Airspeed - 250 KIAS if possible or best glide (170 KIAS).

NOTE

At 250 KIAS, the engines will windmill for several minutes at sufficient RPM to provide normal flight control hydraulic pressure.

Procedure completed

● **IF NO GENERATOR ON LINE AND LANDING IS IMMINENT**

1. Aileron Latch Handle - PUSH DOWN (If Pulled and A Aux Hyd Pump is On).

NOTE

If excessive time was used prior to selecting the DC Power Bus 1 and Bus 2 switches to EMER or by use of AUX hydraulic pump or APU start in descent, further use of the AUX hydraulic pump may deplete the right battery resulting in loss of the right EMER bus.

2. "A" AUX HYDRAULIC PUMP - ON (if battery charge believed sufficient).
3. Speed Brakes - RETRACTED.

(Continued Next Page)

■ MAXIMUM GLIDE/EMERGENCY LANDING (Continued)

4. Airspeed - AS REQUIRED.
5. Transponder - EMERGENCY CODE.
6. ATC - ADVISE.
7. Crew Briefing - COMPLETE. Refer to Emergency Procedures, EMERGENCY EVACUATION and/or DITCHING, as applicable.
8. Passengers - BRIEF. Refer to Emergency Procedures, EMERGENCY EVACUATION and/or DITCHING, as applicable.
9. Seats/Seat Belts/Shoulder Harnesses/Aft Divider Sliding Doors - CHECK/SECURE/LATCHED OPEN (if belted toilet seat is occupied).

BEFORE LANDING

1. Landing Data - CONFIRM.
2. Avionics Power Switch - OFF.
3. Load Shed Switch - O'RIDE.
4. Exterior Lights - AS REQUIRED.
5. Flaps - 15° MAXIMUM (if battery charge is sufficient).

WARNING

DO NOT EXTEND FLAPS BEYOND 15° WITH EITHER HYDRAULIC SYSTEM DEPRESSURIZED. IF A SPEED BRAKE OR SPOILER CHECK VALVE FAILS TO SEAT, UNCOMMANDED ROLL MAY RESULT. RETRACT FLAPS TO 15° OR LESS, IF EXTENDED.

6. Landing Gear - AS REQUIRED, use BLOWDOWN.

CAUTION

DO NOT EXTEND THE LANDING GEAR HYDRAULICALLY IF THE “A” SYSTEM IS POWERED ONLY BY THE AUXILIARY HYDRAULIC PUMP. GEAR EXTENSION WILL BE SLOW AND WILL RESULT IN LOW PRESSURE TO THE FLIGHT CONTROL PCUs FOR UP TO 30 SECONDS.

   a. Landing Gear Blowdown Handle - PULL (below 210 KIAS).
   b. Landing Gear - CHECK DOWN and LOCKED (3 green lights).
   c. Gear Handle - DOWN.

NOTE

The gear will not retract after blowdown.

7. Airspeed - AS REQUIRED.

(Continued Next Page)

■ MAXIMUM GLIDE/EMERGENCY LANDING (Continued)

a. The airspeeds in the following table are the minimum recommended until landing flare to ensure sufficient energy to arrest descent rate.

V_{REF} (KIAS)

FLAPS/SLATS	WEIGHT							
	23,000	25,000	27,000	29,000	31,000	33,000	34,000	35,700
15°/Extended	113	119	124	129	135	143	145	148
15°/Retracted	123	129	134	139	145	153	155	158
0°/Extended	124	130	136	141	147	154	158	162

b. Multiply normal **FLAPS 15°** landing distance by 1.3 (slats extended) or by 2.3 (slats retracted).

c. For 0° flap/slats extended multiply **FLAPS FULL** landing distance by 3.5 (use a factor of 2.5 if altitude is below 5,000 feet and weight is less than 29,000 pounds).

CAUTION

- AVOID LANDING WITH TAILWIND OR DOWNHILL RUNWAY GRADIENT.
- LANDING DISTANCE FACTORS OF 3.0 OR GREATER MAY REQUIRE THE USE OF A RUNWAY WITH AN ARRESTING BARRIER.

Procedure completed

■ TR AUTOSTOW L-R - THRUST REVERSERS NOT DEPLOYED (TR AUTOSTOW L-R RED CAS MESSAGE)

WARNING

THE FADECS REDUCE THE ENGINE THRUST TO IDLE VIA SOFTWARE COMMAND. THIS RESULTS IN THROTTLE REMAINING IN THE LAST POSITION AT WHICH IT WAS SET. THE THROTTLE MUST BE MOVED TO IDLE TO RESET THE FADEC LOGIC TO GAIN CONTROL OF THRUST AND CLEAR THE MESSAGE.

1. Stow Switches (both) - EMER.
2. Throttles (both) - IDLE then NORMAL OPERATION.
3. Land as soon as practical.

Procedure completed

■ THRUST REVERSER INADVERTENT IN-FLIGHT DEPLOYMENT (UNLOCK AND DEPLOY LIGHTS ON)

1. STOW Switch (affected thrust reverser) - EMER.
2. Throttle (affected engine) - CONFIRM, then IDLE.
3. Control Wheel/Autopilot - GRIP/DISENGAGE.
4. Airspeed - REDUCE to 170 KIAS MAXIMUM.
5. Throttle (unaffected engine) - AS REQUIRED.

- **IF REVERSER STOWS**

1. Thrust Reverser Lights - UNLOCK and DEPLOY lights extinguished; ARM light illuminated.

(Continued Next Page)

■ THRUST REVERSER INADVERTENT IN-FLIGHT DEPLOYMENT (UNLOCK AND DEPLOY LIGHTS ON) (Continued)

2. Throttle (affected engine) - ADVANCE SLOWLY, then normal operation.

NOTE

- The affected engine thrust will be regained after the throttle is brought to idle and then advanced.
- The affected TR AUTOSTOW message will clear when the throttle is brought to idle.

3. Land as soon as practical - Refer to Normal Procedures, BEFORE LANDING.

Procedure completed

● **IF REVERSER DOES NOT STOW**

WARNING

- **DO NOT ADVANCE THROTTLE ON THE AFFECTED ENGINE. REVERSE THRUST WILL INCREASE AFTER THE THROTTLE HAS BEEN BROUGHT TO IDLE AND THEN ADVANCED.**
- **DO NOT ENGAGE AUTOPILOT.**

NOTE

- The airplane will roll in the direction of the deployed reverser.
- Buffeting is cyclic in nature and is considered normal for this condition.
- Airplane is controllable through normal use of the flight controls.

☐ **IF DEPLOYMENT OCCURS DURING LANDING APPROACH**

1. Throttle (operating engine) - AS REQUIRED.
2. Throttle (affected engine) - CONFIRM, IDLE/then CUTOFF.
3. Airspeed - INCREASE to V_{REF} +25 KIAS (if possible without developing high sink rate).
4. Flaps - 15°.
5. Sink Rate - CONTROL WITH THRUST.
6. “A” AUX PUMP - ON (if LH engine shutdown).
7. DO NOT ATTEMPT GO-AROUND.

LANDING

1. Throttle - IDLE.
2. Speed Brakes - EXTEND at touchdown.
3. Elevator Control - FORWARD PRESSURE at touchdown.
4. Brakes - APPLY after nose wheel ground contact.
5. Thrust Reverser (operating engine) - DEPLOY after nose wheel ground contact.

Procedure completed

(Continued Next Page)

■ THRUST REVERSER INADVERTENT IN-FLIGHT DEPLOYMENT (UNLOCK AND DEPLOY LIGHTS ON) (Continued)

☐ IF DEPLOYMENT OCCURS PRIOR TO LANDING APPROACH

1. Thrust Reverser Circuit Breakers (LH Panel) - IN.

NOTE

The thrust reverser circuit breakers control normal operation on their respective side and emergency stow operation of the opposite side.

2. Throttle (affected engine) - CONFIRM IDLE/THEN CUTOFF.
3. “A” AUX HYDRAULIC PUMP - ON (if LH engine shutdown).
4. Electrical Load - REDUCE as required.
5. FUEL CROSSFEED - AS REQUIRED.
6. TCAS - TA only.
7. Airspeed - 170 KIAS MAXIMUM.
8. Land as soon as possible.

APPROACH

1. Altitude - MINIMUM 1000 FEET AGL until landing is assured.

WARNING

- **DO NOT DESCEND BELOW 1000 FEET AGL UNTIL LANDING IS ASSURED. A GO-AROUND AT AN ALTITUDE BELOW 1000 FEET AGL MAY NOT BE POSSIBLE FROM THE PRESCRIBED LANDING CONFIGURATION. DESCENT BELOW 1000 FEET AGL REQUIRES THAT THE LANDING BE COMPLETED.**
- **IT IS UNLIKELY THAT A POSITIVE CLIMB GRADIENT CAN BE MAINTAINED WITH A DEPLOYED THRUST REVERSER ABOVE 4000 FEET MSL.**

BEFORE LANDING

1. Landing Data - CONFIRM, refer to Section IV, Performance, of the FAA Approved Flight Manual.
   a. Airspeed - V_{REF} (FLAPS 15°) + 25 to 150 feet AGL.
      - Slow to V_{REF} (FLAPS 15°) by 50 feet AGL.
   b. Use the Normal **FLAPS 15°** Landing Distance.

CAUTION

AVOID LANDING WITH TAILWIND OR DOWNHILL RUNWAY GRADIENT.

2. Crew Briefing - COMPLETE.

(Continued Next Page)

■ THRUST REVERSER INADVERTENT IN-FLIGHT DEPLOYMENT (UNLOCK AND DEPLOY LIGHTS ON) (Continued)

3. Avionics and Flight Instruments - CHECK/SET.
4. Minimums - SET (RA/BARO).
5. FUEL CROSSFEED - AS REQUIRED, OFF prior to landing.
6. Exterior Lights - AS REQUIRED.
7. Flaps - 15° MAXIMUM.
8. Passengers - BRIEF.
9. Seats/Seat Belts/Shoulder Harnesses/Aft Divider Sliding Doors - CHECK/ SECURE/LATCHED OPEN (if belted toilet seat is occupied).
10. Passenger Advisory Lights - PASS SAFETY.
11. IGNITION - NORM.
12. Pressurization - ZERO DIFFERENTIAL at touchdown.
13. Landing Gear - DOWN and LOCKED (3 green lights).
14. EICAS - CHECK.
15. Speed Brakes - RETRACTED.
16. Airspeed - V_{REF}(Flaps 15°) at 50 feet AGL.

LANDING

1. Throttle - IDLE.
2. Speed Brakes - EXTEND at touchdown.
3. Elevator Control - FORWARD PRESSURE at touchdown.
4. Brakes - APPLY after nose wheel ground contact.
5. Thrust Reverser (operating engine) - DEPLOY after nose wheel ground contact.

NOTE

Reverse thrust may need to be reduced during crosswind landings or on wet or icy runways.

Procedure completed

☐ GO-AROUND FROM THE FLAPS 15° LANDING CONFIGURATION (ABOVE 1000 FEET AGL)

WARNING

IT IS UNLIKELY THAT A POSITIVE CLIMB GRADIENT CAN BE MAINTAINED WITH A DEPLOYED THRUST REVERSER ABOVE 4000 FEET MSL.

1. Throttle (operating engine) - SET to TAKEOFF.
2. Airplane Pitch Attitude - POSITIVE ROTATION to +7.5°.
3. Flaps - 15°.
4. Climb Speed - V_{APP}.
5. Landing Gear - UP (when positive rate of climb is established).

■ OIL PRESSURE LOW L OR R (OIL PRESS LOW L-R CAS MESSAGE)

1. EICAS - CHECK ENGINE OIL PRESSURE.

● **IF OIL PRESSURE IS LESS THAN 50 PSI BUT NOT BELOW 34 PSI**

1. Throttle (affected engine) - REDUCE to LESS THAN 88% N_2.
   a. Oil Temperature and Quantity - MONITOR.
2. Land as soon as practical. Refer to Normal Procedures, APPROACH AND LANDING.

Procedure completed

● **IF OIL PRESSURE IS BELOW 34 PSI**

1. Engine - SHUT DOWN. Refer to Abnormal Procedures, ENGINE FAILURE/ PRECAUTIONARY SHUTDOWN.
2. Land as soon as practical. Refer to Abnormal Procedures, SINGLE-ENGINE APPROACH AND LANDING.

Procedure completed

● **IF PRESSURE IS AT OR ABOVE 50 PSI AND NO OTHER EVIDENCE OF A PROBLEM EXISTS**

1. Oil Temperature and Quantity - MONITOR.
2. Land as soon as practical. Refer to Normal Procedures, APPROACH AND LANDING.

NOTE

Oil pressure in the transient (amber) range from 34 to 49 PSI is normal during ground idle and in flight for short periods at idle following reduction from high thrust.

Procedure completed

■ COCKPIT/CABIN SMOKE OR FIRE

1. Oxygen Masks - DON and EMER (crew and passengers).
2. Smoke Goggles - DON (as required).

NOTE

Headsets and hats must be removed before donning oxygen mask.

3. Microphone Switches - MIC OXY MASK.
4. Control Wheel INPH/MIC Switches - INPH (as required).
5. Determine source.

● **ENVIRONMENTAL**

1. PAC ISOL VALVE - CLSD.

☐ **KNOWN PAC**

1. Affected PAC Switch - OFF.
2. Altitude - FL 410 MAXIMUM.
3. Land as soon as practical.

Procedure completed

☐ **UNKNOWN PAC**

1. PAC SWITCHES: CKPT PAC Switch - OFF; CAB PAC Switch - ON (allow time to purge).
2. Altitude - FL 410 MAXIMUM.
3. Land as soon as practical.

Procedure completed

(Continued Next Page)

■ COCKPIT/CABIN SMOKE OR FIRE (Continued)

☐ IF SMOKE/ODOR DOES NOT CLEAR

1. PAC Switches: CKPT PAC Switch - ON; CAB PAC Switch - OFF.
2. Altitude - FL410 MAXIMUM.
3. Land as soon as practical.

Procedure completed

● ELECTRICAL

☐ SOURCE KNOWN

1. Isolate Faulty Circuit(s) - PULL CIRCUIT BREAKER(S).

Procedure completed

☐ SOURCE UNKNOWN

1. AUX Panel Lights - FULL BRIGHT (night).
2. Generator Switches - OFF.
3. Load Shed Switch - EMER.

NOTE

- The pressurization system will automatically revert to Manual Mode when the main DC electrical system is disabled by turning off the generators and selecting the Load Shed Switch to EMER.
- With the Load Shed Switch in EMER (or NORM, following automatic load shed) electrical power is supplied to the following equipment only. In this condition, properly charged batteries will supply power for approximately 30 minutes. Time can be increased by minimizing use of the Auxiliary Hydraulic Pump.

Both Rudder Limiters	"A" AUX Hydraulic Pump
Pilot and Copilot Audio Panels	Upper Rudder Actuator
Audio Warnings ***	Pitch Feel
VHF Comm 1	Rudder Trim
VHF Nav 1	Aileron Trim
RMU 1	Secondary Stabilizer Trim
Standby Nav/Comm (Honeywell radios only)	APU
	Engine Start Logic
Standby HSI	Both Engine A and B FADECs (ADC REV mode)
Standby Attitude *	
Standby Pitot/Static Heat	Engine Fire Detect and Extinguishers
Auxiliary Panel Lights	Firewall Shutoff - Fuel and Hydraulic
AHRS 1 or IRS 1	Standby Engine Instruments *
Emergency Lighting **	Landing Gear Control and Indication Lights (except retract)
MADC 1	
LH Windshield Heat	HF Radio 1 (750-0023 and on, if installed)

* Powered by Standby Battery
** Also powered by emergency light battery pack
*** Secondary pitch trim clacker and pilot's overspeed warning only

- While in this condition, transponder and external lighting are not operative. Advise Air Traffic Control.

(Continued Next Page)

■ COCKPIT/CABIN SMOKE OR FIRE (Continued)

4. Cockpit Divider Door - OPEN.
5. Airspeed and Altitude - USE STANDBY INDICATOR (observe placard V_{MO} schedule, FL410 maximum).

NOTE

The standby airspeed placard limits are approximately 0.82 Mach above FL240. Linear airspeed interpolation between altitudes is permitted.

6. Pressurization - CONTROL MANUALLY (use Cabin Altitude UP/DN switch as required).
7. Land as soon as possible. Refer to Emergency Procedures, BEFORE LANDING (IF SMOKE SOURCE WAS NOT ISOLATED).

Procedure completed

● COCKPIT FIRE

1. Fire Extinguisher - UNSTOW and REMOVE SAFETY PIN (under copilot's seat).
2. Fire - LOCATE and EXTINGUISH.
3. Land as soon as possible. Refer to Emergency Procedures, BEFORE LANDING (SOURCE ISOLATED).

● CABIN FIRE

1. Oxygen Mask - PLUG INTO PORTABLE O_2 BOTTLE (forward cabin cabinet), DON and EMER.
2. Smoke Goggles -DON (as required).
3. Fire Extinguisher - UNSTOW AND REMOVE SAFETY PIN (forward cabin cabinet).
4. PASS OXY - ON (assure passengers are receiving oxygen).
5. Passenger Safety Lights - PASS SAFETY.
6. Land as soon as possible. Refer to Emergency Procedures, BEFORE LANDING (SOURCE ISOLATED).

WARNING

WHETHER OR NOT SMOKE HAS DISSIPATED, IF IT CANNOT BE VISIBLY CONFIRMED THAT ANY FIRE HAS BEEN EXTINGUISHED FOLLOWING FIRE SUPPRESSION AND/OR SMOKE EVACUATION, LAND IMMEDIATELY AT THE NEAREST SUITABLE AIRPORT.

Procedure completed

(Continued Next Page)

■ COCKPIT/CABIN SMOKE OR FIRE (Continued)

□ IF SMOKE NEEDS TO BE CLEARED

○ IF NORMAL DC ELECTRICAL POWER AVAILABLE

1. CABIN DUMP Switch - DUMP (cabin altitude will not exceed approximately 15,000 feet).

NOTE

If the airplane is above 31,000 feet MSL and the autopilot is engaged, it will automatically enter Emergency Descent Mode (EDM) if cabin altitude exceeds approximately 14,500 feet.

2. Autopilot - AS REQUIRED.
3. Emergency Descent - AS REQUIRED.
4. Land as soon as possible. Refer to Emergency Procedures, BEFORE LANDING (SOURCE ISOLATED).

Procedure completed

○ IF LOAD SHED SWITCH SELECTED TO EMER

1. Cabin Altitude UP/DN Switch - UP (as required).

NOTE

The CABIN DUMP switch is disabled if the main DC electrical system has been disabled by turning off the generators and selecting the load shed switch to EMER or allowing automatic load shed to occur.

2. Emergency Descent - AS REQUIRED.
3. Land as soon as possible.
4. Refer to Emergency Procedures, BEFORE LANDING (SOURCE ISOLATED).

Procedure completed

● BEFORE LANDING (IF SMOKE SOURCE WAS ISOLATED)

1. Generators - ON.
2. Load Shed Switch - NORM.
3. Refer to Normal Procedures, BEFORE LANDING.

Procedure completed

● BEFORE LANDING (IF SMOKE SOURCE WAS NOT ISOLATED)

1. ATC - ADVISE (transponder and external lights will be inoperative).
2. Landing Gear - CHECK DOWN AND LOCKED (three green lights).
3. Landing Data - CONFIRM.
   a. Airspeed - V_{REF}.

V_{REF} (KIAS)

FLAPS/SLATS	WEIGHT - POUNDS							
	23,000	25,000	27,000	29,000	31,000	33,000	34,000	35,700
0°/Retracted	134	140	146	151	157	164	168	172

(Continued Next Page)

■ COCKPIT/CABIN SMOKE OR FIRE (Continued)

b. Multiply normal **FLAPS FULL** landing distance by the appropriate landing distance factor in the following table.

LANDING DISTANCE FACTOR

ALTITUDE FEET	WEIGHT - POUNDS							
	23,000	25,000	27,000	29,000	31,000	33,000	34,000	35,700
0	2.06	2.08	2.32	2.63	3.53	3.60	4.03	4.03
5,000	2.08	2.27	2.70	3.61	3.73	4.07	4.25	4.26
10,000	2.42	2.82	3.75	3.99	4.36	4.45	4.45	4.62
14,000	2.69	3.55	4.08	4.30	4.39	4.45	4.45	4.62

WARNING

- **STICK SHAKER AND AUTO SLAT WILL BE INOPERATIVE. DO NOT SLOW BELOW V_{REF}.**
- **ANTISKID BRAKES WILL BE INOPERATIVE; HOWEVER, NORMAL POWER BRAKES WILL FUNCTION. USE CAUTION NOT TO SKID TIRES.**

CAUTION

- AVOID LANDING WITH TAILWIND OR DOWNHILL RUNWAY GRADIENT.
- FACTORS OF 3.0 OR GREATER MAY REQUIRE THE USE OF AN AIRPORT THAT HAS A RUNWAY WITH AN ARRESTING BARRIER.

4. Speed Brakes - RETRACT.
5. Airspeed - V_{REF}.

Procedure completed.

■ BAGGAGE SMOKE (BAGGAGE SMOKE CAS MESSAGE)

1. Baggage Compartment Isolation Valve (ISO VLV) Switch - LIFT RED COVER and CLOSE (switch up).

NOTE

The baggage compartment isolation valve will not reopen until zero cabin differential pressure is achieved at low cabin altitude.

2. Land as soon as possible.

Procedure completed.

■ DUAL GENERATOR FAILURE (GEN OFF L-R RED CAS MESSAGE)

1. Load Shed Switch - O'RIDE.
2. Interior Master Switch - OFF.
3. Generator Switches - BOTH RESET/OFF.
4. Generator Voltages - CHECK READINGS (EICAS).

NOTE

If generator voltage is significantly below or above 28 volts, the GCU will not allow that generator to remain on line.

5. Generator Switches - GEN.
6. Fuel Crossfeed - OFF.

● **IF ONLY ONE GENERATOR COMES ON-LINE**

1. Land As Soon As Practical, Refer to Normal Procedures - BEFORE LANDING.

● **IF NEITHER GENERATOR IS ON-LINE**

1. Load Shed Switch - EMER.
2. Descend to FL310 or below.
3. APU - START.

● **IF APU CAN BE STARTED (AT OR BELOW FL310)**

1. APU - START.
   a. APU MASTER Switch - ON.
   b. APU START/STOP Switch - START.

NOTE

Refer to Normal Procedures, APU START Checklist/Start Envelope. One APU start attempt is approved within 60 minutes of dual generator failure.

2. APU Generator - ON.
3. Load Shed Switch - NORM.
4. Land As Soon As Practical, Refer to Normal Procedures - BEFORE LANDING.

● **IF APU CANNOT BE STARTED AND NO GENERATORS ARE ON-LINE (MAIN DC AND APU)**

1. Standby Instruments - MONITOR.
2. Airspeed - 0.82 MACH OR BELOW.
3. Autopilot - DISENGAGE.
4. AUX Panel Lights - FULL BRIGHT (Night).
5. Secondary Trim Switch - ON, TRIM AS REQUIRED.

(Continued Next Page)

■ DUAL GENERATOR FAILURE (GEN OFF L-R RED CAS MESSAGE)

(Continued)

NOTE

- Fuel crossfeed, gravity crossflow and center wing transfer valve will remain in their selected mode. If a mode change is necessary, select it prior to selecting the Load Shed Switch to EMER.
- With the Load Shed Switch in EMER (or NORM, following automatic load shed) electrical power is supplied to the following equipment only. In this condition, properly charged batteries will supply power for approximately 30 minutes. Time can be increased by minimizing use of the Auxiliary Hydraulic Pump.

Both Rudder Limiters	"A" AUX Hydraulic Pump
Pilot and Copilot Audio Panels	Upper Rudder Actuator
Audio Warnings *******	Pitch Feel
VHF Comm 1	Rudder Trim
VHF Nav 1	Aileron Trim
RMU 1	Secondary Stabilizer Trim
Standby Nav/Comm (Honeywell radios only)	APU
	Engine Start Logic
Standby HSI	Both Engine A and B FADECs (ADC REV mode)
Standby Attitude *****	
Standby Pitot/Static Heat	Engine Fire Detect and Extinguishers
Auxiliary Panel Lights	Firewall Shutoff - Fuel and Hydraulic
AHRS 1 or IRS 1	Standby Engine Instruments *****
Emergency Lighting ******	Landing Gear Control and Indication Lights (except retract)
MADC 1	
LH Windshield Heat	HF Radio 1 (if installed, 750-0023 and on only)

***** Powered by Standby Battery
****** Also powered by emergency light battery pack
******* Secondary pitch trim clacker and pilot's overspeed warning only

- While in this condition, transponder and external lighting are not operative. Advise Air Traffic Control.

6. Airspeed and Altitude - USE STANDBY INDICATOR (observe placard V_{MO} schedule, FL410 maximum).

NOTE

The Standby Airspeed Placard Limits are approximately 0.82 Mach above FL240. Linear airspeed interpolation between altitudes is permitted. If EMER bus is selected above .82 mach, overspeed warning will sound until the airplane is slowed below .82 mach.

7. Pressurization - MANUAL mode; ADJUST as required.
8. Land as soon as possible.

BEFORE LANDING

1. Landing Data - CONFIRM.

NOTE

If within 5 minutes of landing and less than 45 minutes from generator failure and the left battery has not been used excessively, sufficient battery charge should be available to extend the flaps.

(Continued Next Page)

■ DUAL GENERATOR FAILURE (GEN OFF L-R RED CAS MESSAGE)

(Continued)

a. Airspeed - V_{REF}.

V_{REF} (KIAS)

FLAPS/SLATS	WEIGHT								LANDING DISTANCE FACTORS
	23,000	25,000	27,000	28,000	29,000	30,000	31,000	31,800	
0°/Retracted	134	140	146	149	151	154	157	160	3.9 (3.0)*
0°/Extended	124	130	136	139	141	144	147	150	3.1 (2.7)**
5°/Retracted	130	136	142	144	147	150	153	155	3.5 (2.2)*
5°/Extended	120	126	132	134	137	140	143	145	2.8 (2.3)**
15°/Retracted	123	129	134	137	139	142	145	147	2.5

b. Multiply Normal **FLAPS FULL** Landing Distance by the appropriate landing distance factor in the above table. The factors in parenthesis () can be used if the following conditions apply:

* Altitude under 5,000 feet, weight less than 29,000 pounds.
** Altitude under 5,000 feet.

CAUTION

- AVOID LANDING WITH TAILWIND OR DOWNHILL RUNWAY GRADIENT.
- LANDING DISTANCE FACTORS OF 3.0 OR GREATER MAY REQUIRE THE USE OF A RUNWAY WITH AN ARRESTING BARRIER.

2. Crew Briefing - COMPLETED.
3. Avionics and Flight Instruments - CHECK.
4. Passengers - BRIEF.
5. Seats/Seat Belts/Shoulder Harnesses/Aft Divider Sliding Doors - CHECK/SECURE/LATCHED OPEN (if belted toilet seat occupied).
6. Emergency Lights - ON.
7. Pressurization - ZERO DIFFERENTIAL PRESSURE at touchdown.
8. Landing Gear - CHECK DOWN and LOCKED (3 green lights).
9. Airspeed - V_{REF} (Refer to table for flaps/slats retracted.).

CAUTION

IF THE LOAD SHED SWITCH IS SELECTED TO EMER, USE BRAKES WITH CAUTION OR PLAN TO USE EMERGENCY BRAKING. NORMAL BRAKES ARE OPERATIVE BUT ANTISKID PROTECTION IS NOT AVAILABLE. EMERGENCY BRAKES ARE REGULATED TO AVOID SKID. DO NOT USE BOTH SIMULTANEOUSLY.

● LANDING ASSURED

1. Load Shed Switch - O'RIDE.
2. Avionics Switch - OFF; ON as required for communications, then OFF.

NOTE

- Load shed switch in O'RIDE will allow DC power to operate flaps, anti-skid, landing light (only if required) and thrust reversers.
- Avionics power should be OFF to reduce electrical load and minimize distraction due to display tubes powering up.

(Continued Next Page)

■ DUAL GENERATOR FAILURE (GEN OFF L-R RED CAS MESSAGE)
(Continued)

3. Flaps - FULL (if time permits).
4. Airspeed - V_{REF} (as required).

LANDING

1. Throttles - IDLE.
2. Speed Brakes - EXTEND at touchdown.
3. Elevator Control - FORWARD PRESSURE at touchdown.
4. Brakes - APPLY after nose wheel ground contact.
5. Thrust Reversers - DEPLOY after nose wheel ground contact.

Procedure completed

■ BATTERY 1 OR 2 OVERTEMPERATURE (BATT 1-2 O'TEMP CAS MESSAGE)

1. Affected Battery Switch - OFF.
2. Battery Temperature - MONITOR.

NOTE

The BATTERY O'TEMP message will first occur at +63°C. If the battery temperature continues to rise, the MASTER WARNING and aural warning will repeat at +71°C.

● **IF BATTERY TEMPERATURE CONTINUES TO RISE**

1. Land as soon as possible.

Procedure completed

■ LOSS OF CABIN PRESSURE (CABIN ALTITUDE RED CAS MESSAGE)

1. Oxygen Masks - DON AND 100%.
2. Microphone Switches - MIC OXY MASK.
3. Emergency Descent - AS REQUIRED.
4. Control Wheel INPH/MIC Switches - INPH (as required).
5. PASS OXY Switch - ON (assure passengers are receiving oxygen).
6. Transponder - EMERGENCY CODE.

NOTE

CABIN ALTITUDE red CAS message indicates cabin altitude above 10,000 feet. For amber message (cabin altitude above 8500 feet), refer to Amber Abnormal Procedures, CABIN ALTITUDE.

Procedure completed

■ EMERGENCY DESCENT

1. Throttles - IDLE.
2. Speed Brakes - EXTEND.
3. Initial Pitch Attitude - 15° DOWN.

CAUTION

IF STRUCTURAL DAMAGE IS SUSPECTED, LIMIT AIRSPEED TO A REASONABLE VALUE AND LIMIT MANEUVERING LOADS UNTIL DAMAGE ASSESSMENT CAN BE MADE.

4. Airspeed - M_{MO}/V_{MO}.
5. Transponder - EMERGENCY CODE.
6. Autopilot - DISENGAGE (as required).

NOTE

- If the airplane is above 31,000 feet MSL and the autopilot is engaged, it will automatically enter Emergency Descent Mode (EDM) when cabin altitude exceeds approximately 14,500 feet. The autopilot will inititate a pitch-down left-turn (90°) maneuver. The flight crew must retard throttles to idle and extend the speed brakes. The autopilot will control the descent near the M_{MO}/V_{MO} limit and level off at 15,000 feet MSL. The flight crew must then retract the speed brakes and apply thrust to resume normal flight. If the airplane slows to stick shaker the autopilot will disconnect.
- The autopilot Emergency Descent Mode (EDM) is annunciated by EDM message in the PFD and EMERGENCY DESCENT CAS message. This mode can only be cancelled by disengaging the autopilot.
- The autopilot EDM cannot achieve maximum rate-of-descent. It is recommended that the autopilot be disengaged and the airplane hand flown if maximum rate-of-descent is required.

7. ATC - ADVISE and OBTAIN LOCAL ALTIMETER SETTING.
8. Altitude - 15,000 FEET MSL or MINIMUM SAFE ALTITUDE.

WARNING

IT IS THE PILOT'S RESPONSIBILITY TO DETERMINE MINIMUM SAFE ALTITUDE AND TO ENSURE THAT THE AUTOPILOT DOES NOT TURN THE AIRPLANE INTO TRAFFIC OR UNSAFE WEATHER.

9. Passengers - BRIEF.
10. Land as soon as possible.

Procedure completed

■ DUAL HYDRAULIC PUMP FAILURE (HYD PUMP FAIL A-B CAS MESSAGE)

1. “A” AUX HYDRAULIC PUMP Switch - ON.
2. Refer to Emergency Procedure, LANDING IF “A” SYSTEM PRESSURE IS RESTORED BY THE AUXILIARY PUMP.

● **IF “A” SYSTEM PRESSURE IS NOT RESTORED BY THE AUXILIARY PUMP**

1. AILERON LATCH Handle - PULL.
2. Autopilot - OFF.
3. Airspeed - REDUCE (maximum 250 KIAS/0.80 MACH).
4. Altitude - FL410 MAXIMUM.
5. HYDRAULIC PUMP “A” and “B” Switches - BOTH UNLOAD.
6. “A” AUX HYDRAULIC PUMP Switch - OFF.
7. Rudder Standby Hydraulic Pressure - CHECK.

NOTE

With normal rudder standby system pressure (>2200 psi), rudder control will function normally.

8. Land as soon as practical. Refer to Emergency Procedure, LANDING WITH FLIGHT CONTROLS MANUAL REVERSION.

Procedure completed

■ LANDING WITH FLIGHT CONTROLS MANUAL REVERSION

● **‘A’ AND ‘B’ HYDRAULIC SYSTEMS PRESSURE LOST**

1. AILERON LATCH Handle - PULL (ailerons are manual reversion).
2. LH/RH Elevator FLT CONTROL SHUTOFF Switches (two aft switches) - PUSH.
3. Airspeed - 250 KIAS/0.80 MACH MAXIMUM.
4. Altitude - 41,000 FEET MAXIMUM, DESCEND AS REQUIRED.
5. Rudder Standby Hydraulic Pressure - CHECK.

WARNING

- **DO NOT EXTEND FLAPS BEYOND 15° WITH EITHER HYDRAULIC SYSTEM DEPRESSURIZED. IF A SPEED BRAKE OR SPOILER CHECK VALVE FAILS TO SEAT, UNCOMMANDED ROLL MAY RESULT. RETRACT FLAPS TO 15° OR LESS, IF EXTENDED.**
- **IF SLATS ARE RETRACTED, DO NOT SLOW BELOW V_{REF}. AUTO SLAT WILL BE INOPERATIVE.**

NOTE

- Plan to use emergency gear extension and emergency brakes. Thrust reversers, speed brakes, and normal wheel brakes will be inoperative. Nose wheel steering is available only from the accumulator.
- Control response will be slow and forces high. Plan to use the longest available runway which minimizes crosswind. Maximum crosswind component is 10 knots.

(Continued Next Page)

■ LANDING WITH FLIGHT CONTROLS MANUAL REVERSION (Continued)

NOTE (Continued)

- Lateral/Directional control: if the rudder standby system is operational, rudder response and control forces will be normal. If the rudder standby system is not operational, rudder response will be slow and forces high. Aileron response will be slow and forces high. The aileron latch must be pulled. Spoilers will be inoperative.
- Pitch/Airspeed control: stabilizer trim will be normal and should be used to maintain trimmed position. Elevator response will be slow with reduced authority and forces high. Avoid large changes in pitch using elevator to prevent pilot induced oscillations. Elevator Flight Control Shutoff switches must be OFF. Judicious use of rudder control will significantly enhance lateral control.
- In IMC conditions, the flight director should be used for reference only. The flight director gains are not tailored to hydraulics-off control response. Attempting to precisely follow flight director commands can result in pilot induced oscillations.
- Pilot workload can be reduced, through crew coordination, if one pilot operates flight controls and one operates throttles for glidepath control.
- Plan for a stabilized final approach. The airplane should be within 10 to 15 knots above the appropriate V_{REF} and established on glidepath between 3 to 5 NM from the runway on final approach.
- The following systems are inoperative: all roll spoilers, all flight control PCUs except lower rudder, speed brakes, wing leading edge slats including auto slats, both thrust reversers, normal brakes and antiskid. If the speed brakes and/or slats were extended at the time of hydraulic failure, they will remain extended.
- Upper rudder available with flaps 5°.
- Lower rudder is powered by the rudder standby hydraulic system.
- Nose wheel steering has accumulator pressure only.
- Only emergency brakes will be available.

(Continued Next Page)

■ LANDING WITH FLIGHT CONTROLS MANUAL REVERSION (Continued)

BEFORE LANDING (MULTIENGINE OR SINGLE ENGINE DUAL HYDRAULIC FAIL)

1. Landing Data - CONFIRM.
   a. Airspeed - V_{REF}.

V_{REF} (KIAS)

FLAPS/SLATS	WEIGHT - POUNDS							
	23,000	25,000	27,000	29,000	31,000	33,000	34,000	35,700
15°/Extended	113	119	124	129	135	143	145	148
15°/Retracted	123	129	134	139	145	153	155	158

   b. Multiply normal **FLAPS 15°** landing distance by 1.6 (slats extended) or 2.8* (slats retracted).
   *Use a factor of 1.7 if altitude is below 5,000 feet and weight is less than 29,000 pounds.

CAUTION

AVOID LANDING WITH TAILWIND OR DOWNHILL RUNWAY GRADIENT.

2. Crew Briefing - COMPLETE.
3. Avionics and Flight Instruments - CHECK/SET.
4. Minimums - SET (RA/BARO).
5. FUEL CROSSFEED - AS REQUIRED, then OFF.
6. ENGINE SYNC - OFF.
7. External Lights - AS REQUIRED.
8. Flaps - 15° MAXIMUM.
9. Passengers - BRIEF.
10. Seats/Seat Belts/Shoulder Harnesses/Aft Divider Sliding Doors - CHECK/ SECURE/LATCHED OPEN (if belted toilet seat is occupied).
11. Passenger Advisory Lights - PASS SAFETY.
12. IGNITION - NORM.
13. Pressurization - ZERO DIFFERENTIAL at touchdown.
14. Landing Gear - BLOW DOWN.
    a. Landing Gear Blowdown Handle - PULL (below 210 KIAS).
    b. Landing Gear - CHECK DOWN and LOCKED (3 green lights).
    c. Gear Handle - DOWN.
15. EICAS - CHECK.
16. Airspeed - V_{REF} (as required).

LANDING

1. Throttles - IDLE (smoothly in flare).
2. Flare - NORMAL ATTITUDE using elevator.
3. Elevator Control - FORWARD PRESSURE at touchdown.

(Continued Next Page)

■ LANDING WITH FLIGHT CONTROLS MANUAL REVERSION (Continued)

4. Emergency Brakes - PULL and HOLD until stopped (after nose wheel ground contact).

CAUTION

- MINIMIZE USE OF NOSE WHEEL STEERING. NOSE WHEEL STEERING WILL BECOME INOPERATIVE WHEN THE ACCUMULATOR IS DISCHARGED.
- THE ANTISKID BRAKE SYSTEM DOES NOT FUNCTION DURING EMERGENCY BRAKING.
- REPEATED APPLICATION AND RELEASE OF EMERGENCY BRAKES MAY CAUSE PREMATURE LOSS OF PNEUMATIC PRESSURE. WHEN CLEAR OF THE RUNWAY, STOP AND SHUT DOWN. DO NOT ATTEMPT TO TAXI IN CLOSE PROXIMITY TO BUILDINGS OR OTHER AIRCRAFT USING EMERGENCY BRAKES OR NOSE WHEEL STEERING.

NOTE

Emergency brake pressure is regulated for optimum braking on most dry surfaces.

Procedure completed

■ LANDING IF “A” SYSTEM PRESSURE IS RESTORED BY THE AUXILIARY PUMP

1. Land as soon as practical.

WARNING

- **DO NOT EXTEND FLAPS BEYOND 15° WITH EITHER HYDRAULIC SYSTEM DEPRESSURIZED. IF A SPEED BRAKE OR SPOILER CHECK VALVE FAILS TO SEAT, UNCOMMANDED ROLL MAY RESULT. RETRACT FLAPS TO 15° OR LESS, IF EXTENDED.**
- **DO NOT USE SPEED BRAKES IN FLIGHT UNLESS “B” SYSTEM PRESSURE IS ZERO. INBOARD AND MIDDLE SPEED BRAKE PANELS MAY NOT RETRACT.**

NOTE

If “B” hydraulic system is inoperative, the following subsystems will be inoperative: PTU, inboard roll spoilers, inboard and middle speed brake panels and RH thrust reverser.

(Continued Next Page)

■ LANDING IF "A" SYSTEM PRESSURE IS RESTORED BY THE AUXILIARY PUMP (Continued)

BEFORE LANDING

1. Landing Data - CONFIRM.
   a. Airspeed - V_{REF}.

V_{REF} (KIAS)

FLAPS/SLATS	WEIGHT							
	23,000	25,000	27,000	29,000	31,000	33,000	34,000	35,700
15°/Extended	113	119	124	129	135	143	145	148

   b. Multiply normal **FLAPS 15°** landing distance by 1.3.

CAUTION

AVOID LANDING WITH TAILWIND OR DOWNHILL RUNWAY GRADIENT.

2. Crew Briefing - COMPLETE.
3. Avionics and Flight Instruments - CHECK/SET.
4. Minimums - SET (RA/BARO).
5. FUEL CROSSFEED - OFF.
6. ENGINE SYNC - OFF.
7. Exterior Lights - AS REQUIRED.
8. Flaps - 15° MAXIMUM.
9. Passengers - BRIEF.
10. Seats/Seat Belts/Shoulder Harnesses/Aft Divider Sliding Doors - CHECK/SECURE/LATCHED OPEN (if belted toilet seat is occupied).
11. Passenger Advisory Lights - PASS SAFETY.
12. IGNITION - NORM.
13. Pressurization - ZERO DIFFERENTIAL at touchdown.
14. Landing Gear - BLOW DOWN.

CAUTION

DO NOT EXTEND THE LANDING GEAR HYDRAULICALLY IF THE "A" SYSTEM IS POWERED ONLY BY THE "A" AUX HYDRAULIC PUMP. GEAR EXTENSION WILL BE SLOW AND WILL RESULT IN LOW PRESSURE TO THE FLIGHT CONTROL PCUs FOR UP TO 30 SECONDS.

   a. Landing Gear Blowdown Handle - PULL (below 210 KIAS).
   b. Landing Gear - CHECK DOWN and LOCKED (3 green lights).
   c. Gear Handle - DOWN.

NOTE

The gear will not retract after blowdown.

15. Speed Brakes - RETRACTED.
16. EICAS - CHECK.
17. Airspeed - V_{REF}.

(Continued Next Page)

■ LANDING IF “A” SYSTEM PRESSURE IS RESTORED BY THE AUXILIARY PUMP (Continued)

LANDING

NOTE

- Only the left thrust reverser will deploy. Use caution during single-engine reversing.
- Minimize simultaneous use of nose wheel steering, slats, thrust reversers, brakes, and flight controls.

1. Throttles - IDLE.
2. Speed Brakes - EXTEND at touchdown.
3. Elevator Control - FORWARD PRESSURE at touchdown.
4. Brakes - APPLY after nose wheel ground contact.
5. Left Thrust Reverser - DEPLOY after nose wheel ground contact.

Procedure completed

■ JAMMED ROLL OR PITCH CONTROL SYSTEM

1. Control Wheel - RELAX PRESSURE.
2. Pitch/Roll Disconnect Handle - PULL UNTIL LATCHED.
3. Operative Flight Control Wheel - IDENTIFY, RECOVER AIRCRAFT ATTITUDE.
4. Trim - AS REQUIRED.

NOTE

- If aileron is jammed, aileron trim may be ineffective. Rudder trim may improve controllability.
- Relaxing control pressure prior to pulling the disconnect will minimize abrupt control input when the controls disconnect.
- Pilot’s control column controls ailerons and LH elevator. Copilot’s control column controls roll spoilers and RH elevator.
- PITCH/ROLL DISC amber CAS message will illuminate.
- The autopilot, if engaged, will automatically disengage (when the Pitch/Roll disengage handle is pulled) and will not reengage.
- Do not push the disconnect handle down unless rotated to the PITCH/ROLL RECONNECT (9 o’clock) position.

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■ JAMMED ROLL OR PITCH CONTROL SYSTEM (Continued)

● IF PITCH CONTROL JAMMED

1. Pitch/Roll Disconnect Handle - TURN CLOCKWISE to ROLL RECONNECT.
2. Land as soon as possible, use normal procedures.

WARNING

DO NOT USE THRUST REVERSERS.

NOTE

- Minimize large elevator inputs. There will be some minor roll coupling with elevator input.
- Autopilot will not re-engage.
- PITCH/ROLL DISC CAS message will remain on.

Procedure completed

● IF ROLL CONTROL JAMMED

1. Pitch/Roll Disconnect Handle - TURN COUNTER CLOCKWISE TO PITCH RECONNECT.
2. Fuel - BALANCE PRIOR TO LANDING.
3. Land as soon as possible, use Normal procedures.

NOTE

- If the jammed control is not centered, the remaining control authority will be limited in one direction. Use rudder control to assist in producing roll response.
- Fuel must be balanced prior to landing.
- Maximum crosswind is 10 knots.
- Roll spoilers have a dead band around neutral. Make small smooth inputs and return to neutral. Rudder control may also be used to assist in producing roll response.
- Autopilot will not reengage.
- PITCH/ROLL DISC CAS message will remain on.

Procedure completed

■ DUAL RUDDER LIMITER FAILURE, EXCESS TRAVEL (RUDDER LIMIT FAIL CAS MESSAGE)

1. Rudder Pedals - DO NOT APPLY LARGE OR ABRUPT RUDDER INPUT.

WARNING

IF BOTH RUDDER LIMITERS HAVE FAILED, RUDDER AUTHORITY MAY BE MORE THAN SCHEDULED AND MAY BE ENOUGH TO RESULT IN STRUCTURAL DAMAGE IF LARGE PEDAL INPUT IS APPLIED.

2. EICAS - CHECK RUDDER TRAVEL LIMIT (CTRL POS page).

NOTE

The green area on the rudder control position page indicates safe area of rudder deflection for the current airspeed. The red area indicates available but prohibited travel range.

3. Airspeed - REDUCE IF PRACTICAL.

NOTE

- As airspeed is reduced, rudder travel may be limited to less than scheduled. Refer to amber abnormal procedures, RUDDER LIMIT FAIL.
- Single engine controllability may be limited at low airspeed.
- Indicates failure of a single rudder limiter. This failure may restrict rudder travel to less than normal as airspeed is reduced and may reduce nose wheel steering through the rudder pedals after landing.
- Normal lower rudder travel limit varies from $\pm 30°$ (100%) at 140 KIAS to $\pm 4°$ (14%) at 330 KIAS and above.
- The green area on the rudder position display (as indicated on the CAS CTRL POS page) indicates available travel, the area will vary with airspeed.
- If available rudder travel limit (as indicated on the CAS CTRL POS page) is less than 70%, limit crosswind to 10 knots.

4. Land As Soon As Practical.

Procedure completed

■ AUTO SLATS FAIL (AUTO SLATS FAIL CAS MESSAGE)

1. Control Column - PUSH, PITCH DOWN TO HORIZON.
2. Throttles - SET TO CLIMB DETENT.
3. Airspeed - INCREASE.
4. Return to assigned altitude.

WARNING

INDICATES IMMINENT STALL AND AUTO SLATS FAILED TO EXTEND.

Procedure completed

■ HYDRAULIC OVERTEMPERATURE A-B (HYD O'TEMP A-B CAS MESSAGE)

1. Affected HYDRAULIC PUMP Switch - UNLOAD.

NOTE

Indicates that the affected hydraulic system fluid is hot.

● **IF "A" SYSTEM**

1. "A" System Pressure - CHECK (PTU will cycle "A" system pressure between 1500 and 2700 psi).

NOTE

After unloading, the indicated temperature will remain high and may increase due to the small volume of fluid in the unload circuit. However, the system will remain protected.

2. Land as soon as practical.
3. Flaps - 15° MAXIMUM.

□ **BEFORE LANDING**

1. "A" AUX HYDRAULIC PUMP - ON.
2. Refer to Normal Procedures, BEFORE LANDING.

Procedure completed

● **IF "B" SYSTEM**

1. Rudder Standby Pressure - CHECK.
2. Land as soon as practical. Refer to Amber Abnormal Procedures, HYD PUMP FAIL B; BEFORE LANDING.

NOTE

After unloading, the indicated temperature will remain high and may increase due to the small volume of fluid in the unload circuit. However, the system will remain protected.

Procedure completed

■ PRIMARY PITCH TRIM RUNAWAY

1. AP/TRIM/NWS Disengage Button - PRESS and HOLD.
2. Secondary Trim Switch - ON (lift guard cover).
3. AP/TRIM/NWS Disengage Switch - RELEASE.
4. Trim - AS REQUIRED.
5. Airspeed - 0.82 MACH MAXIMUM.
6. Altitude - FL410 MAXIMUM.

NOTE

- Flight Guidance Computer trim monitors will detect any stabilizer trim runaway and automatically transfer control to the opposite flight guidance computer.
- Mach trim and autopilot will be inoperative.

7. Land as soon as practical.

Procedure completed

■ SECONDARY PITCH TRIM RUNAWAY

1. Secondary Trim Switch - OFF (close guard cover).
2. Land as soon as practical.
3. Refer to Abnormal Procedures, JAMMED STABILIZER TRIM SYSTEM.

Procedure completed

■ UNCOMMANDED ROLL

- **IF ROLL DUE TO AUTOPILOT OR LATERAL CONTROL INPUT**

1. Control Wheel - APPLY OPPOSITE AILERON AND RUDDER AS REQUIRED.
2. AP/TRIM/NWS Disengage Button - PRESS.
3. Aileron and Rudder Trim - AS REQUIRED.
4. Airspeed - 250 KIAS MAXIMUM (Slow As Required).

WARNING

DO NOT PULL PITCH/ROLL DISCONNECT.

5. Land As Soon As Practical - Refer to Normal Procedures - APPROACH AND LANDING.

Procedure completed

(Continued Next Page)

■ UNCOMMANDED ROLL (Continued)

● IF UNCOMMANDED ROLL OCCURRED AFTER SPEED BRAKES WERE EXTENDED

1. Speed Brakes - RETRACT.

WARNING

DO NOT USE SPEED BRAKES FOR REMAINDER OF FLIGHT.

2. Altitude - MAXIMUM 41,000 FEET, DESCEND AS REQUIRED.
3. Land As Soon As Practical - Refer to Normal Procedures, APPROACH and LANDING.
4. Multiply Normal **FLAPS FULL** Landing Distance by 1.3.

Procedure completed

● IF UNCOMMANDED ROLL OCCURRED AS SPEED BRAKES WERE RETRACTED

1. Speed Brakes - EXTEND TO PREVIOUS POSITION.
2. Land As Soon As Practical. Refer to Abnormal Procedures, SPEED BRAKES FAIL TO RETRACT. DO NOT MOVE SPEED BRAKE LEVER FORWARD.

Procedure completed

● IF UNCOMMANDED ROLL OCCURRED DURING FLAP EXTENSION/RETRACTION

1. Flaps - RETURN TO PREVIOUS POSITION.
2. Land As Soon As Practical. Refer to Abnormal Procedures, LANDING WITH FLAPS OR SLATS INOPERATIVE.

Procedure completed

● IF STILL UNABLE TO REDUCE THE OUT-OF-TRIM FORCE AND AIRCRAFT CONTROL IS NOT IN QUESTION AND NONE OF THE ABOVE APPLY

1. Visually inspect the wing into which the aircraft tends to roll to determine if a roll spoiler is extended.

□ IF ROLL SPOILER IS EXTENDED

1. Left Seat Pilot - FLY AIRPLANE.
2. Pitch/Roll Disconnect Handle - PULL THEN PITCH RECONNECT.
3. Copilot's Control Wheel - APPLY AND HOLD OPPOSITE INPUT TO BALANCE SPOILERS.
4. Plan a Flaps 15° Landing.
5. Maximum Crosswind Limit 10 Knots.

(Continued Next Page)

■ UNCOMMANDED ROLL (Continued)

BEFORE LANDING

1. Landing Data - CONFIRM.
   a. Airspeed - V_{REF}.

V_{REF} (KIAS)

FLAPS/SLATS	WEIGHT							
	23,000	25,000	27,000	29,000	31,000	33,000	34,000	35,700
15°/Extended	123	129	134	139	145	153	155	158

   b. Multiply normal **FLAPS 15°** landing distance by 1.9.

CAUTION

AVOID LANDING WITH A TAILWIND OR DOWNHILL RUNWAY GRADIENT.

2. Crew Briefing - COMPLETE.
3. Avionics and Flight Instruments - CHECK/SET.
4. Minimums - SET (RA/BARO).
5. FUEL CROSSFEED - AS REQUIRED, then OFF.
6. ENG SYNC - OFF.
7. Flaps - APPROACH SCHEDULE.
8. Passengers - BRIEF.
9. Seats/Seat Belts/Shoulder Harnesses/Aft Divider Sliding Doors - CHECK/SECURE/LATCHED OPEN (if belted toilet seat is occupied).
10. Passenger Advisory Lights - PASS SAFETY.
11. IGNITION - NORM.
12. Pressurization - ZERO DIFFERENTIAL at touchdown.
13. Landing Gear - CHECK DOWN and LOCKED (3 green lights).
14. Flaps - 15°.
15. EICAS - CHECK.
16. Airspeed - V_{REF}.

Procedure completed

■ NOSEWHEEL STEERING MALFUNCTION

1. AP/TRIM/NWS Disconnect Button - PRESS/HOLD.
2. Directional Control - MAINTAIN (rudder/brake as required).

Procedure completed

■ LOSS OF INDICATED AIRSPEED/ALTITUDE (AIRSPEED/ALTITUDE RED “X”) AND/OR VERTICAL SPEED DATA (RED VS IN PFD)*

Indicates loss of calibrated airspeed and/or altitude data input.

● **IF PILOT’S SIDE**

1. Pilot’s ADC REV - PUSH
2. Confirm Amber ADC2 displayed on PFDs.

Procedure completed

(Continued Next Page)

* Denotes Primus 2000 Message

■ LOSS OF INDICATED AIRSPEED/ALTITUDE (AIRSPEED/ALTITUDE RED “X”) AND/OR VERTICAL SPEED DATA (RED VS IN PFD)*
(Continued)

- **IF COPILOT’S SIDE**

1. Copilot’s ADC REV - PUSH
2. Confirm Amber ADC1 displayed on PFDs.

Procedure completed

■ DUAL MICRO AIR DATA COMPUTER FAILURE INDICATED BY LOSS OF PILOT’S AND COPILOT’S AIRSPEED, ALTITUDE, AND VERTICAL SPEED

1. Airspeed and Altitude - USE STANDBY INDICATOR (observe placard V_{MO} schedule, FL410 maximum).

NOTE

- The standby airspeed placard limits are approximately 0.82 Mach above FL240. Linear airspeed interpolation between altitudes is permitted.
- Mach Trim will be inoperative. Refer to Amber Abnormal Procedures, MACH TRIM OFF.
- Both engines will be in ADC reversionary mode. Refer to Amber Abnormal Procedures, FADEC REV ADC-N_1 L-R.

2. Pressurization - MANUAL, ADJUST AS REQUIRED.

WARNING

- **RUDDER LIMITING WILL BE INOPERATIVE. CHECK EICAS. REFER TO EMERGENCY PROCEDURES, DUAL RUDDER LIMITER FAIL.**
- **MINIMUM SPEED SYSTEM WILL BE INOPERATIVE. MINIMUM AIRSPEED ABOVE FL350 IS 150 KIAS.**

NOTE

- Lower rudder yaw dampers will be inoperative.
- Both AHRS will revert to basic mode (AHRS equipped airplanes).
- Transponder altitude reporting and TCAS will be inoperative.
- Autopilot will operate only in basic attitude hold.
- Pitch feel will not vary with airspeed and may be heavy on landing.
- True airspeed and FMS wind data will be inoperative (AHRS equipped airplanes). IRS will use last known true airspeed.
- Overspeed warning and altitude alert will be inoperative.

■ LOSS OF CAS MESSAGE DISPLAY (RED “X” IN EICAS MESSAGE AREA)*

Indicates failure of FWC 1.

1. Refer to Amber Message Procedure FWC 1-2 FAIL.

■ LOSS OF PITCH/ROLL AND/OR HEADING DATA (ATT FAIL AND/OR HDG FAIL IN PFD)*

Indicates loss of pitch, roll, and/or heading information from the IRS. HDG message is amber.

● **IF PILOT’S SIDE**

1. Standby Attitude - MONITOR.
2. Pilot’s IRS REV - PUSH.
3. Confirm ATT2 displayed on PFDs, MAG2 or TRU2 (with IRS) displayed on MFDs and PFDs.

NOTE

Loss of IRS 1 data results in loss of heading data to the standby HSI.

Procedure completed

● **IF COPILOT’S SIDE**

1. Standby Attitude - MONITOR.
2. Copilot’s IRS REV - PUSH.
3. Confirm ATT1 displayed on PFDs, MAG1 or TRU1 (with IRS) displayed on MFDs and PFDs.

Procedure completed

■ LOSS OF NAVIGATION DATA (RED “X” OVER GLIDESLOPE AND/OR LATERAL DEVIATION SCALES)*

Indicates loss of data from selected NAV source.

1. Opposite NAV Source - SELECT.
2. Confirm Amber LOC1/LOC2 or VOR1/VOR2 or FMS1/FMS2 Mode annunciation in PFD (and MFDs for FMS).

Procedure completed

* Denotes Primus 2000 Message

■ NO TAKEOFF CAS MESSAGE

1. Takeoff - ABORT, IF BELOW V_1.
2. Correct prior to flight.

NOTE

Select on either MFD, MAIN 2/2 page, push bezel button 5 (under the "NO T/O" text). This enables the NO TAKEOFF TEXT window, which gives the description of the trigger(s) for the NO TAKEOFF warning event. Correct the respective item(s) and then continue the flight. The trigger items will remain in memory, even after having been corrected, until the Avionics power is shut down at the end of the flight.

Procedure completed

■ STABILIZER BLEED LEAK L OR R (STAB BLD LEAK L-R CAS MESSAGE)

1. Affected STABILIZER ANTI-ICE Switch - OFF.
2. Leave icing environment as soon as practical.
3. Refer to Abnormal Procedures, LANDING WITH RESIDUAL ICE, if applicable.

● **IF MESSAGE DOES NOT CLEAR**

1. Opposite STABILIZER ANTI-ICE Switch - OFF.

□ **IF MESSAGE CLEARS WITH OPPOSITE OFF**

1. Affected STABILIZER ANTI-ICE Switch - ON.

NOTE

The stabilizer bleed leak monitor system is enabled whether or not anti-ice is on. If the message is displayed with all anti-ice OFF, and it can be verified that anti-ice is off (N_2 and ITT changes), the message may be due to a failed sensor.

2. Refer to Abnormal Procedures, LANDING WITH RESIDUAL ICE, if applicable.

Procedure completed

■ HYDRAULIC WHEEL BRAKE FAILURE

1. Brake Pedals - RELEASE BRAKE PEDAL PRESSURE.
2. EMERGENCY BRAKE Handle - PULL and HOLD until stopped.
3. Directional Control - MAINTAIN with nose wheel steering.

CAUTION

- REPEATED APPLICATION AND RELEASE MAY CAUSE PREMATURE LOSS OF PNEUMATIC PRESSURE.
- WHEN CLEAR OF THE RUNWAY, STOP AND SHUT DOWN. DO NOT ATTEMPT TO TAXI IN CLOSE PROXIMITY TO BUILDINGS OR OTHER AIRCRAFT USING EMERGENCY BRAKES.

NOTE

- The antiskid brake system does not function during emergency braking.
- Multiply normal (FLAPS FULL) Landing Distance by 1.25.
- Emergency brake pressure is regulated for optimum braking on most dry surfaces.

■ NO TAKEOFF CAS MESSAGE

1. Takeoff - ABORT, IF BELOW V_1.
2. Correct prior to flight.

NOTE

- If takeoff is continued, the Master Warning and double chime will stop at 80 KIAS. The CAS message will clear upon liftoff.
- NO TAKEOFF Red CAS message indicates engines running with TLA >60° on the ground and one or more of the following:
  - Flaps < 5°.
  - Flaps > 15°.
  - Either slat not extended.
  - Slat asymmetry.
  - Parking brake on.
  - Either start valve open.
  - Speed brakes extended.
  - Stabilizer, aileron, rudder trim not in takeoff limits.
  - Yaw damper not centered.
  - Gust lock on (if installed).
  - Fuel quantity low.
  - ENG SYNC on.
  - AILERON LATCH handle not stowed.
  - Pitch/Roll disconnect handle not stowed.

Procedure completed

■ STABILIZER BLEED LEAK L OR R (STAB BLD LEAK L-R CAS MESSAGE)

1. Affected STABILIZER ANTI-ICE Switch - OFF.
2. Leave icing environment as soon as practical.
3. Refer to Abnormal Procedures, LANDING WITH RESIDUAL ICE, if applicable.

● **IF MESSAGE DOES NOT CLEAR**

1. Opposite STABILIZER ANTI-ICE Switch - OFF.

☐ **IF MESSAGE CLEARS WITH OPPOSITE OFF**

1. Affected STABILIZER ANTI-ICE Switch - ON.

NOTE

The stabilizer bleed leak monitor system is enabled whether or not anti-ice is on. If the message is displayed with all anti-ice OFF, and it can be verified that anti-ice is off (N_2 and ITT changes), the message may be due to a failed sensor.

2. Refer to Abnormal Procedures, LANDING WITH RESIDUAL ICE, if applicable.

Procedure completed

■ HYDRAULIC WHEEL BRAKE FAILURE

1. Brake Pedals - RELEASE BRAKE PEDAL PRESSURE.
2. EMERGENCY BRAKE Handle - PULL and HOLD until stopped.
3. Directional Control - MAINTAIN with nose wheel steering.

CAUTION

- REPEATED APPLICATION AND RELEASE MAY CAUSE PREMATURE LOSS OF PNEUMATIC PRESSURE.
- WHEN CLEAR OF THE RUNWAY, STOP AND SHUT DOWN. DO NOT ATTEMPT TO TAXI IN CLOSE PROXIMITY TO BUILDINGS OR OTHER AIRCRAFT USING EMERGENCY BRAKES.

NOTE

- The antiskid brake system does not function during emergency braking.
- Multiply normal (FLAPS FULL) Landing Distance by 1.25.
- Emergency brake pressure is regulated for optimum braking on most dry surfaces.

■ PYLON BLEED LEAK L OR R (PYLON BLD LEAK L-R CAS MESSAGE)

1. Affected ENG BLD AIR Switch - LP.

● **IF IN ICING CONDITIONS**

1. Wing XOVER Switch - WING XOVER.
2. Leave icing conditions as soon as possible.

NOTE

Affected engine inlet anti-ice will not be operative. Increased opposite engine thrust will be required to maintain adequate anti-ice protection to both the stabilizer and wings.

● **IF MESSAGE DOES NOT CLEAR** (approximately 30 seconds)

1. Affected ENG BLD AIR Switch - OFF.
2. PAC ISOL VALVE - OPEN.
3. CKPT and CAB PAC Selector Switches - ON (do not select HIGH above 25,000 feet).

NOTE

CKPT and CAB PAC Switches should not be in HIGH for altitudes above 25,000 feet when the PAC isolation valve is OPEN and either left or right engine bleed air is off.

□ **IF MESSAGE REMAINS ON**

1. Throttle (Affected Side) - IDLE.

○ **IF MESSAGE CLEARS** (probable HP or LP bleed valve failed open)

1. Land as soon as practical.

Procedure completed

○ **IF MESSAGE STILL ON** (probable temperature sensor failure)

1. ENG BLD AIR Switch - HP/LP.
2. Land as soon as practical.
3. Use throttle, as required.

Procedure completed

■ CHECK PRIMARY FLIGHT DISPLAYS (CHECK PFD CAS MESSAGE)

1. Standby Instruments - CHECK.
2. PFD(S) - COMPARE DISPLAYED INFORMATION (Attitude, Mach, Airspeed, Altitude, Baro Set).

● **IF PILOT'S DISPLAY INVALID**

1. SG REV Switch - SELECT SG2.

Procedure completed

● **IF COPILOT'S DISPLAY INVALID**

1. SG REV Switch - SELECT SG1.
2. FADEC Switches - LH RESET and RH RESET (to clear FADEC FAULT messages).

Procedure completed

■ EMERGENCY EVACUATION

1. Parking Brake - SET (if gear down).
2. Throttles - BOTH CUTOFF.
3. LH/RH ENG FIRE Switches - BOTH PRESS (if fire suspected).
4. BOTTLE 1 and BOTTLE 2 ARMED Switches - BOTH PRESS (if fire suspected).
5. EMERG LT Switch - ON (night).
6. BATT 1 and BATT 2 Switches - OFF.
7. Airplane and Immediate Area - CHECK FOR BEST ESCAPE ROUTE and DIRECT EVACUATION.

● **IF THRU CABIN DOOR**

1. Cabin Door - OPEN.
2. Move away from airplane.

Procedure completed

● **IF THRU ESCAPE HATCH**

1. Escape Hatch - REMOVE and THROW HATCH OUT OF AIRPLANE.
2. Move away from airplane.

Procedure completed

■ DITCHING

NOTE

The airplane is not certified for ditching under FAR 25.801. Ditching was not conducted during certification testing of the airplane. Should ditching be required, the following procedures are recommended:\

PRELIMINARY

1. Radio - MAYDAY.
2. Transponder - 7700.
3. ELT - EMER.
4. CKPT PAC, CAB PAC and ENG BLD AIR Switches - OFF (prevents water from entering through bleed valves).
5. Passenger Advisory Lights - PASS SAFETY.
   a. Check aft facing seats full aft and all seats upright and outboard.
6. Water Barrier - IN POSITION.

WARNING

THE WATER BARRIER MUST BE IN POSITION PRIOR TO DITCHING.

NOTE

The water barrier is stowed in the aft bulkhead behind closet door. Crew members should be familiar with its location and use. Passengers should be briefed.

7. Passenger Life Jackets - ON refer to Emergency Procedures, LIFE VEST DONNING PROCEDURES.

CAUTION

LIFE JACKETS MUST NOT BE INFLATED UNTIL OUTSIDE AIRPLANE.

(Continued Next Page)

■ DITCHING (Continued)

APPROACH

1. Gear - UP.
2. WARN AUDIO 1 and 2 (Copilot's CB Panel) - PULL.
3. Flaps - FULL.
4. Speed - V_{REF}.
5. Rate-of-Descent - 200 TO 300 FEET PER MINUTE.
6. Plan approach to parallel any uniform swell pattern and attempt to touch down along a wave crest or just behind it. If the surface wind is very strong or the water surface rough and irregular, ditch into the wind on the back side of a wave.

WATER CONTACT

1. Airplane Pitch Attitude - Slightly higher than normal landing attitude.
2. Reduce airspeed and rate-of-descent to a minimum but do not stall the airplane.
3. Throttles - CUTOFF just prior to water contact and contact water on a crest of a swell, parallel to the major swell.

AFTER WATER CONTACT

Under reasonable ditching conditions, the airplane should remain afloat an adequate time to launch and board life rafts in an orderly manner.

If possible, the main cabin door should remain closed and evacuation made through the emergency exit. However, the water barrier will allow use of the cabin door as an additional egress route. The water barrier must be in position for ditching and must be installed before the door is opened.

NOTE

The cabin door does not fully open with the water barrier installed.

■ MINIMUM SPEED (MINIMUM SPEED RED CAS MESSAGE ILLUMINATED AND AURAL WARNING)

1. Control Column - PUSH, PITCH DOWN TO HORIZON.
2. Throttles - SET TO CLIMB DETENT.
3. Airspeed - ABOVE LOW SPEED AWARENESS WHITE ARC.
4. Climb - TO ASSIGNED ALTITUDE.

WARNING

THE MINIMUM SPEED WARNING SYSTEM, IN ADDITION TO THE STICK SHAKER STALL WARNING, IS TO WARN OF EXCESSIVELY LOW AIRSPEED AT ALTITUDES AT OR ABOVE 35,000 FEET MSL. CONTINUING TO SLOW BELOW THIS WARNING MAY RESULT IN DUAL ENGINE FLAMEOUT.

NOTE

Activation of the minimum speed system below 35,000 feet MSL indicates a system failure and should not be responded to unless other indications of low airspeed are present.

■ LIFE VEST DONNING PROCEDURES

● ADULT DONNING

1. Grasp the poly bag and tear the pull tab free of the bag, opening the sewn end.
2. Remove the life preserver from the bag.
3. Follow the pictorial instructions in Figure 6-1.
4. The flotation chambers may also be inflated by forcing air into the chamber by mouth using the oral inflation tubes - either for "topping off" the chambers due to gradual air loss - or in the event of failure of the CO_2 gas cartridges.

Procedure completed

LIFE VEST DONNING PROCEDURES

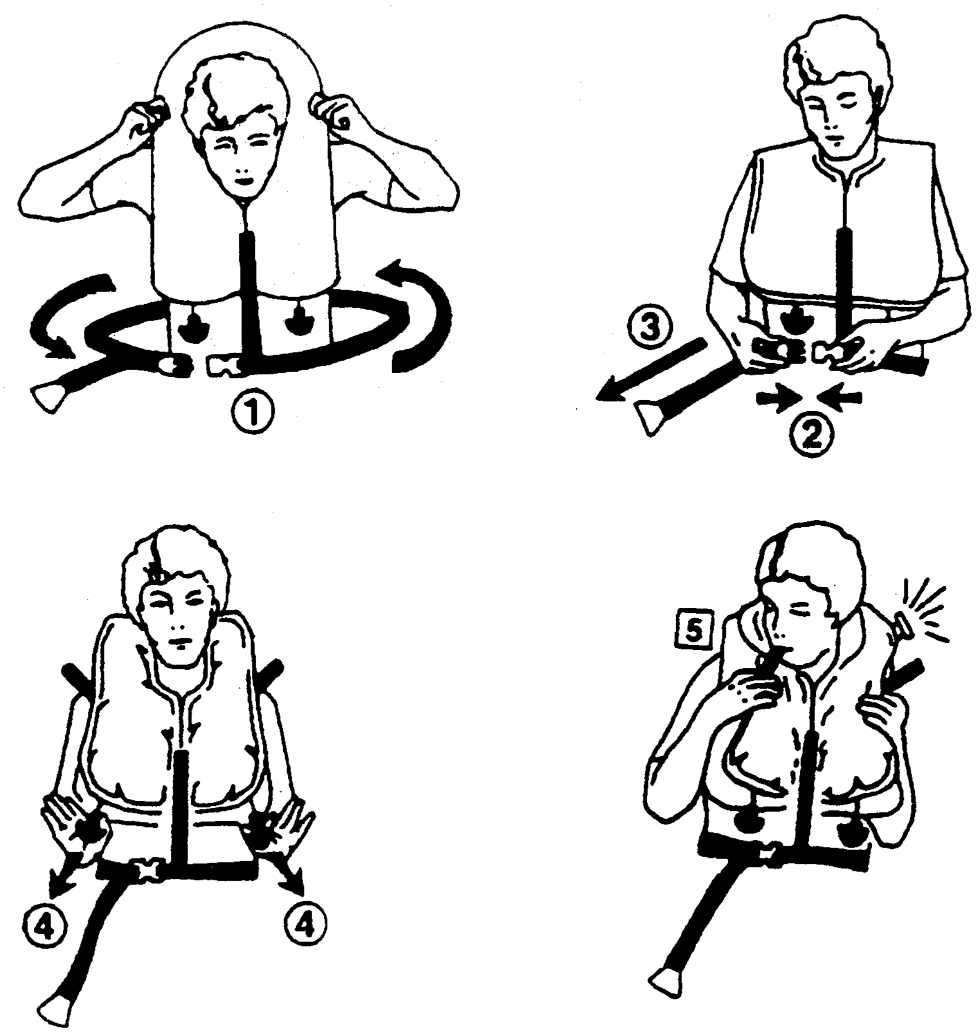

Figure 6-1

■ LIFE VEST DONNING PROCEDURES (continued)

● CHILD DONNING

1. Place life preserver over child's head and down around neck as in adult donning.
2. Run the waist strap around the back of the child's waist and back to the front as in adult donning.
3. Buckle the waist strap together to the center strap as in adult donning.
4. Adjust waist strap so it is tight about child's waist by pulling on the short, tabbed end of the waist strap.
5. For small children whose head may slip through the life preserver's neck opening, pass the excess length of waist strap between the child's legs from front to back. Tie this excess strap securely to the tight waist strap at the child's back. The excess strap should be against the crotch, but not tight.
6. Inflate life preserver as in adult operation. Small children may only require one cell of the life preserver to be inflated.
7. The flotation chambers may also be inflated by forcing air into the chamber by mouth using the oral inflation tubes - either for "topping off" the chambers due to gradual air loss - or in the event of failure of the CO_2 gas cartridges.

Procedure completed

EMERGENCY PROCEDURES
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EMERGENCY PROCEDURES (Continued)

FLIGHT GUIDANCE

MISCELLANEOUS

*Denotes Primus 2000 message

EMERGENCY PROCEDURES

■ ENGINE FAILURE, FIRE, OR MASTER WARNING DURING TAKEOFF (ENG FIRE LIGHT, ENGINE FIRE L-R CAS MESSAGE AND/OR ENGINE FAILED L-R CAS MESSAGE OR MASTER WARNING)

● **SPEED BELOW V_1 - TAKEOFF REJECTED.**

1. Takeoff - ABORT if below V_1.

- Maintain Directional Control.
- Brakes - MAXIMUM PILOT EFFORT.
- Throttles - IDLE.
- Speed Brakes - EXTEND.
- Control Column - FORWARD PRESSURE.
- Thrust Reverser(s) - DEPLOY (nose wheel on ground). Use as required (if no fire).

☐ **IF ENGINE FIRE INDICATIONS PRESENT (FIRE LIGHT AND/OR CAS MESSAGE)**

1. Illuminated ENG FIRE Switch - CONFIRM, then LIFT COVER and PUSH.
2. Either Illuminated BOTTLE ARMED Light - PUSH (BOTTLE ARMED light off).
3. Throttle - CONFIRM ENGINE, then CUTOFF (if required).
4. APU MASTER Switch - OFF (if required).
5. ENGINE FIRE Light on 30 Sec., BOTTLE ARMED Light - PUSH (if required).
6. Parking Brake - SET.
7. BATT Switches - OFF (if required).
8. Throttle - Operating Engine, CUTOFF.
9. EXIT AIRCRAFT (if required).

Procedure completed

☐ **IF NO ENGINE FIRE (ENGINE FAIL L-R CAS MESSAGE)**

Procedure completed

SPEED ABOVE V_1 -TAKEOFF CONTINUED

1. Climb to a safe altitude.

NOTE

- Maintain directional control.
- Accelerate to V_R, ROTATE.
- Gear - UP (after positive rate-of-climb).

2. Airspeed - V_2 MINIMUM (one engine) or as required (two engines) until clear of obstacles at or above 1500 feet AGL.

CAUTION

IF AIRPLANE CONTROL OR OBSTACLES ARE NOT A FACTOR, THE PILOT MAY BEGIN ENGINE FIRE PROCEDURES (IF ENG FIRE LIGHT ON) DURING CLIMB TO SAFE ALTITUDE. OTHERWISE, BOTH ENGINES SHOULD BE LEFT IN THE TAKEOFF DETENT UNTIL LEVEL OFF.

(Continued Next Page)

■ ENGINE FAILURE, FIRE, OR MASTER WARNING DURING TAKEOFF (ENG FIRE LIGHT, ENGINE FIRE L-R CAS MESSAGE AND/OR ENGINE FAIL L-R CAS MESSAGE OR MASTER WARNING)(Continued)

3. Flaps - RETRACT at V_2 +15 KIAS, Minimum.
4. Accelerate to V_{ENR} (190 KIAS).

□ **IF ENGINE FIRE INDICATIONS PRESENT AND AT OR ABOVE 400 FEET AGL**

1. Throttle (affected engine) - CONFIRM, then IDLE.

○ **IF ENG FIRE LIGHT REMAINS ON (15 SECONDS) - PROBABLE FIRE**

1. Illuminated ENG FIRE Switch - CONFIRM, then LIFT COVER and PUSH.
2. Either Illuminated BOTTLE ARMED Light - PUSH (BOTTLE ARMED light off).

WARNING

IF FIRE LIGHT REMAINS ON AFTER 30 SECONDS, PUSH REMAINING ILLUMINATED BOTTLE ARMED LIGHT.

3. Land as soon as possible.
4. Throttle (affected engine) - CONFIRM, then CUTOFF.
5. Refer to Abnormal Procedures, SINGLE ENGINE APPROACH AND LANDING.

Procedure completed

○ **IF ENG FIRE LIGHT OUT WITH THROTTLE IDLE - PROBABLE BLEED AIR LEAK**

1. Affected ENG BLD AIR Switch - OFF.
2. Land as soon as practical.

NOTE

Consider reduced power on affected engine as required to keep the fire light out.

Procedure completed

□ **IF NO ENGINE FIRE (ENGINE FAIL L-R CAS MESSAGE) AND OBSTACLES CLEARED (1500 FEET AGL OR HIGHER)**

1. Accomplish Abnormal Procedures, PRECAUTIONARY SHUTDOWN AND/OR INFLIGHT RESTART.

Procedure completed

■ ENGINE FIRE (ENG FIRE LIGHT AND ENGINE FIRE L-R CAS MESSAGE)

1. Throttle (affected engine) - CONFIRM, then IDLE.

● **IF ENG FIRE LIGHT REMAINS ON (15 SECONDS) PROBABLE FIRE**

1. ENG FIRE Switch - CONFIRM, then LIFT COVER and PUSH.
2. Either Illuminated BOTTLE ARMED Light - PUSH (bottle armed light goes off).

(Continued Next Page)

■ ENGINE FIRE (ENG FIRE LIGHT AND ENGINE FIRE L-R CAS MESSAGE) (Continued)

NOTE

The affected ENGINE FAILED red CAS message will be displayed when the engine is shut down using the ENG FIRE switch with the throttle at or forward of the idle detent. It will be replaced by the ENG SHUTDOWN cyan message when the throttle is placed to cutoff.

☐ **IF ENG FIRE LIGHT ON AFTER 30 SECONDS**

1. Remaining Bottle Armed Light - PUSH.
2. Land as soon as possible. Refer to Abnormal Procedures, ENGINE FAILURE/PRECAUTIONARY SHUTDOWN.

Procedure completed

☐ **IF FIRE EXTINGUISHED**

1. Accomplish Abnormal Procedure: ENGINE FAILURE/PRECAUTIONARY SHUTDOWN.

Procedure completed

● **IF LIGHT GOES OUT WITH THROTTLE AT IDLE AND NO OTHER ENGINE FIRE INDICATIONS ARE PRESENT (PROBABLE BLEED LEAK)**

1. Affected Engine Bleed Switch - OFF.

NOTE

May require reduced power on affected side to keep light out.

2. Land as soon as practical.

Procedure completed

■ ENGINE FAILURE DURING FINAL APPROACH (ENGINE FAILED L-R CAS MESSAGE)

1. Flaps - APPROACH.
2. Airspeed - V_{REF}(15) +10 KIAS MINIMUM, until landing is assured.
3. Autopilot - AS DESIRED.
4. Speed Brakes - RETRACT.
5. AUX Pump - ON (if "A" Hydraulic System pressure is below 1500 PSI).
6. Plan to USE the EMERGENCY BRAKES (if needed).

● **IF RIGHT ENGINE IS FAILED OR IF EITHER HYDRAULIC SYSTEM PRESSURE IS BELOW GREEN RANGE**

WARNING

DO NOT EXTEND FLAPS BEYOND 15° WITH EITHER HYDRAULIC SYSTEM DEPRESSURIZED. IF A SPEED BRAKE OR SPOILER CHECK VALVE FAILS TO REMAIN FULLY CLOSED, UNCOMMANDED ROLL MAY RESULT. RETRACT FLAPS TO 15° OR LESS, IF EXTENDED.

7. Multiply Normal Flaps 15° Landing Distance by 1.6.

Procedure completed

■ ENGINE VIBRATION (ENG VIBRATION L-R RED CAS MESSAGE)

1. Vibration - CONFIRM (sound and feel indications).

- **IF VIBRATION EXISTS**

  1. Throttle (affected engine) - RETARD to reduce vibration.
  2. Land as soon as practical.

  Procedure completed

- **IF VIBRATION CONTINUES OR OTHER EVIDENCE OF ENGINE MALFUNCTION EXISTS**

  1. Consider shutting down the engine to prevent greater damage and subsequent engine failure. Refer to Abnormal Procedures, ENGINE FAILURE/ PRECAUTIONARY SHUTDOWN.

  CAUTION

  IF THE VIBRATION CONTINUES IN A RUNNING ENGINE, THE ENGINE WILL LIKELY FAIL.

  NOTE

  ENG VIBRATION L-R amber CAS message indicates a lower level of vibration. Refer to Abnormal Procedures, ENG VIBRATION L-R amber CAS message.

  2. Land as soon as possible.

  Procedure completed

■ APU FIRE (APU FIRE LIGHT AND APU FIRE CAS MESSAGE)

1. APU Fire Switch - LIFT COVER and PUSH.

NOTE

This step will discharge the fire extinguisher. APU shutdown will occur automatically within 15 seconds after the APU FIRE light illuminates but the fire extinguisher will not discharge without pilot action.

2. APU MASTER Switch - OFF.
3. Land as soon as possible.

NOTE

APU FIRE CAS message and Master Warning operate only if EICAS is operating.

Procedure completed

■ DUAL ENGINE FLAMEOUT - LOW ALTITUDE (ENGINE FAILED L-R CAS MESSAGE)

1. Fuel - CHECK (Tanks/Quantity; Crossfeed/As Required; Transfer/As Required; Boost Pumps/ON).
2. Throttles - CUTOFF.
3. “A” AUX HYDRAULIC PUMP - ON.

● IF APU IS ON AND AIR AVAILABLE

4. APU Generator - ON.
5. Either ENGINE START button - PRESS (below 25% N_2).
6. Throttle - IDLE 10% N_2.

● IF APU AIR NOT AVAILABLE

4. HYDRAULIC PUMP “A” and “B” Switches - UNLOAD.
5. Airspeed - 240 KIAS.
6. Throttles - BOTH IDLE (if $N_2 \geq 10\%$).

NOTE

- Throttles must be placed to cutoff to reset FADEC start logic.
- Engine acceleration during windmilling air starts will be considerably slower than during starter assisted starts, particularly at the low airspeed end of the start envelope. If N_2 is accelerating and ITT is within limits, allow the start to continue. ITT fluctuations from 500°C to 700°C during start are normal.
- It is unlikely that an engine start, using APU air, can be accomplished from below 1000 feet AGL, or using windmill start from below 3000 feet AGL, following a low altitude dual engine flameout.

□ IF ENGINE(S) STARTS

1. Opposite Engine - START (if required).
   a. PAC ISOL VALVE - OPEN (if crossbleed start).
   b. ENGINE START Button - PRESS.
   c. Throttle - IDLE $\geq 10\%$ N_2.
2. HYDRAULIC PUMP “A” and “B” Switches - NORMAL (if required).
3. Land as soon as possible. Refer to Normal Procedures or Abnormal Procedures, SINGLE-ENGINE APPROACH AND LANDING, as applicable.

Procedure completed

□ IF ENGINES DO NOT START

1. Landing Gear - AS REQUIRED, use BLOWDOWN.

(Continued Next Page)

■ DUAL ENGINE FLAMEOUT - LOW ALTITUDE (ENGINE FAILED L-R CAS MESSAGE) (Continued)

CAUTION

DO NOT EXTEND THE LANDING GEAR HYDRAULICALLY IF THE "A" SYSTEM IS POWERED ONLY BY THE AUXILIARY HYDRAULIC PUMP. GEAR EXTENSION WILL BE SLOW AND WILL RESULT IN LOW PRESSURE TO THE FLIGHT CONTROL PCUs FOR UP TO 30 SECONDS.

a. Landing Gear Blowdown Handle - PULL (below 210 KIAS).
b. Landing Gear - CHECK DOWN and LOCKED (3 green lights).
c. Gear Handle - DOWN.

2. Flaps - 15° MAXIMUM.

WARNING

DO NOT EXTEND FLAPS BEYOND 15° WITH EITHER HYDRAULIC SYSTEM DEPRESSURIZED. IF A SPEED BRAKE OR SPOILER CHECK VALVE FAILS TO REMAIN FULLY CLOSED, UNCOMMANDED ROLL MAY RESULT. RETRACT FLAPS TO 15° OR LESS, IF EXTENDED.

3. Airspeed - V_{REF}.

NOTE

The airspeeds in the following table are the minimum recommended until landing flare to ensure sufficient energy to arrest descent rate and are based on V_{REF} (1.3 V_S) for the appropriate configuration (slats extended), and V_{REF} (1.3 V_S) for the appropriate configuration plus 10 knots (slats retracted).

V_{REF} (KIAS)

FLAPS/SLATS	WEIGHT - POUNDS								LANDING DISTANCE FACTORS
	23,000	25,000	27,000	29,000	31,000	33,000	34,000	35,700	
0°/Retracted	134	140	146	151	157	164	168	172	4.1 (3.0)*
0°/Extended	124	130	136	141	147	154	158	162	3.5 (2.5)**
5°/Retracted	130	136	142	147	153	160	162	166	3.9 (2.7)*
5°/Extended	120	126	132	137	143	150	152	156	3.2 (2.9)***
15°/Retracted	123	129	134	139	145	153	155	158	2.9 (2.8)***
15°/Extended	113	119	124	129	135	143	145	148	2.2 (2.0)***

Multiply the Normal **FLAPS FULL** Landing Distance by the appropriate landing distance factor in the above table. The factors in parenthesis () can be used if the following conditions apply:

***** Altitude under 5,000 feet, weight less than 29,000 pounds, no tailwinds.
****** Altitude under 5,000 feet, weight less than 29,000 pounds.
******* Altitude under 5,000 feet.

CAUTION

- AVOID LANDING WITH TAILWIND OR DOWNHILL RUNWAY GRADIENT.
- LANDING DISTANCE FACTORS OF 3.0 OR GREATER MAY REQUIRE THE USE OF A RUNWAY WITH AN ARRESTING BARRIER.

Procedure completed

■ DUAL ENGINE FLAMEOUT IN CRUISE (ENGINE FAILED L-R CAS MESSAGE)

1. Crew Oxygen Masks - DON (if required).
2. PASS OXY - ON (if required).

● **ABOVE FL350, DESCEND**

1. Airspeed - 0.80 M/250 KIAS minimum if possible.

NOTE

At 250 KIAS or above, with the hydraulic pump switches in NORM, the engines will windmill at sufficient RPM to provide normal hydraulic pressure for several minutes.

2. Fuel - CHECK (Tanks/Quantity; Crossfeed/As Required; Transfer/As Required; Boost Pumps/ON).
3. ATC - ADVISE/Transponder - EMERGENCY CODE.
4. Descend as required to FL350 or below.
5. DC Power BUS 1 and BUS 2 Switches - EMER (if required to conserve batteries).

NOTE

Advise ATC that transponder will become inoperative.

BELOW FL350, ATTEMPT WINDMILL START (AIRSPEED $\geq$ 250 KIAS, $N_2 \geq$ 10%)

1. DC Power BUS 1 and BUS 2 Switches - NORM.
2. “A” AUX HYDRAULIC PUMP - ON.
3. HYDRAULIC PUMP “A” and “B” Switches - UNLOAD.

NOTE

- Unloading the hydraulic pumps will improve windmilling start characteristics.
- If the hydraulic system(s) are unloaded at high altitude, the pump(s) may not prime when the switch(es) are returned to normal, resulting in failure to restore hydraulic pressure. The A system can be restored by selecting the “A” AUX pump on, which will prime the A system engine driven pump and restore A system pressure. The B system pump may not recover until altitude is reduced.

4. Airspeed - $\geq$ 250 KIAS.
5. Throttles - CUTOFF.
6. IGNITION - NORM or ON.

NOTE

- Throttles must be placed to cutoff to reset FADEC start logic.
- Engine acceleration during windmilling air starts will be considerably slower than during starter assisted starts, particularly at the low airspeed end of the start envelope. If N_2 is accelerating and ITT is within limits, allow the start to continue. ITT fluctuations from 500° C to 700° C during start are normal.

(Continued Next Page)

DUAL ENGINE FLAMEOUT IN CRUISE (ENGINE FAILED L-R CAS MESSAGE) (Continued)

7. Throttles - IDLE ($N_2 \geq$ 10% RPM).

IF ENGINES DO NOT RESTART (APU AVAILABLE AND BELOW FL310)

1. Throttles - CUTOFF.
2. APU - START ($\leq$ FL310).
   a. APU MASTER Switch - ON.
   b. APU START/STOP Switch - START.

NOTE

- Refer to Normal Procedures, APU START Checklist/Start Envelope. One APU start attempt is approved within 30 minutes of dual generator failure (engine flameout) provided that the DC Power Bus 1 and Bus 2 switches were selected to EMER within 5 minutes after loss of the second generator.
- Throttles must be placed in cutoff to reset the FADEC start logic.

   c. APU Generator - ON.
   d. APU Bleed Air Valve - OPEN.
3. DC Power XTIE Switch - CLSD.
4. DC Power Bus 1 and Bus 2 Switches - Verify NORM.
5. Throttles - CUTOFF.
6. Either ENGINE START Button - PRESS ($\leq$ 25,000 FEET).
7. Throttle - IDLE AT $\geq$10% N_2.
8. Opposite Engine - START.

○ **IF ENGINES DO NOT START**

1. Throttles - CUTOFF.
2. Engine START DISENGAGE Button - PRESS, if starter engaged.
3. Refer to Emergency Procedures, MAXIMUM GLIDE/EMERGENCY LANDING.

Procedure completed

○ **IF ENGINES START**

1. HYDRAULIC PUMP “A” Switch - NORM.
2. HYDRAULIC PUMP “B” Switch - NORM (if right engine running).
3. “A” AUX HYDRAULIC PUMP - OFF (if left engine running).
4. DC Power XTIE Switch - OPEN (if both engines running).
5. Land as soon as possible.

Procedure completed

○ **IF ONLY ONE ENGINE STARTS**

1. DC Power XTIE Switch - Verify CLSD.
2. Land as soon as possible. Refer to Abnormal Procedures, SINGLE-ENGINE APPROACH AND LANDING.

Procedure completed

■ MAXIMUM GLIDE/EMERGENCY LANDING

● **IF NO GENERATOR ON-LINE AND LANDING IS NOT IMMINENT** (airborne time >10 minutes from engines flameout)

1. “A” AUX HYDRAULIC PUMP - OFF.
2. DC Power Bus 1 and Bus 2 Switches - EMER. (Refer to Figure 3-1, page 3-50A, for operative/inoperative equipment.)

NOTE

DC Battery Power will be supplied only to the left and right battery and emergency busses and the APU bus for approximately 60 minutes.

3. Battery Ammeters - CHECK.

NOTE

Normal emergency bus load should be less than 20 amps.

4. Airspeed - 250 KIAS if possible or best glide (170 KIAS).

NOTE

At 250 KIAS, the engines will windmill for several minutes at sufficient RPM to provide normal flight control hydraulic pressure.

Procedure completed

● **IF NO GENERATOR ON-LINE AND LANDING IS IMMINENT**

1. “A” AUX HYDRAULIC PUMP - ON (if battery charge believed sufficient).

NOTE

If excessive time was used prior to selecting the DC Power Bus 1 and Bus 2 switches to EMER or by use of AUX hydraulic pump or APU start in descent, further use of the AUX hydraulic pump may deplete the right battery resulting in loss of the right EMER bus.

2. Speed Brakes - RETRACTED.

(Continued Next Page)

■ MAXIMUM GLIDE/EMERGENCY LANDING (Continued)

3. Airspeed - AS REQUIRED.
4. Transponder - EMERGENCY CODE.
5. ATC - ADVISE.
6. Crew Briefing - COMPLETE. Refer to Emergency Procedures, EMERGENCY EVACUATION and/or DITCHING, as applicable.
7. Passengers - BRIEF. Refer to Emergency Procedures, EMERGENCY EVACUATION and/or DITCHING, as applicable.
8. Seats/Seat Belts/Shoulder Harnesses/Aft Divider Sliding Doors - CHECK/ SECURE/LATCHED OPEN (if belted toilet seat occupied).

BEFORE LANDING

1. Landing Data - CONFIRM.
2. Avionics Power Switch - OFF.
3. DC Power - Bus 1 Switch - NORM.
4. Exterior Lights - AS REQUIRED.
5. Flaps - 15° MAXIMUM (if battery charge is sufficient).

WARNING

DO NOT EXTEND FLAPS BEYOND 15° WITH EITHER HYDRAULIC SYSTEM DEPRESSURIZED. IF A SPEED BRAKE OR SPOILER CHECK VALVE FAILS TO SEAT, UNCOMMANDED ROLL MAY RESULT. RETRACT FLAPS TO 15° OR LESS, IF EXTENDED.

NOTE

If excessive time was used prior to selecting the DC Power/Bus 1 and Bus 2 switches to EMER, flap operation could result in depletion of the left battery and loss of the left EMER bus.

6. Landing Gear - AS REQUIRED, use BLOWDOWN.

CAUTION

DO NOT EXTEND THE LANDING GEAR HYDRAULICALLY IF THE “A” SYSTEM IS POWERED ONLY BY THE AUXILIARY HYDRAULIC PUMP. GEAR EXTENSION WILL BE SLOW AND WILL RESULT IN LOW PRESSURE TO THE FLIGHT CONTROL PCUs FOR UP TO 30 SECONDS.

a. Landing Gear Blowdown Handle - PULL (below 210 KIAS).
b. Landing Gear - CHECK DOWN and LOCKED (3 green lights).
c. Gear Handle - DOWN.

NOTE

The gear will not retract after blowdown.

(Continued Next Page)

■ MAXIMUM GLIDE/EMERGENCY LANDING

● **IF NO GENERATOR ON-LINE AND LANDING IS NOT IMMINENT** (airborne time >10 minutes from engines flameout)

1. “A” AUX HYDRAULIC PUMP - OFF.
2. Aileron Latch Handle - PULL.
3. DC Power Bus 1 and Bus 2 Switches - EMER. (Refer to Figure 3-1, page 3-50A, for operative/inoperative equipment.)

NOTE

DC Battery Power will be supplied only to the left and right battery and emergency busses and the APU bus for approximately 60 minutes.

4. Battery Ammeters - CHECK.

NOTE

Normal emergency bus load should be less than 20 amps.

5. Airspeed - 250 KIAS if possible or best glide (170 KIAS).

NOTE

At 250 KIAS, the engines will windmill for several minutes at sufficient RPM to provide normal flight control hydraulic pressure.

Procedure completed

● **IF NO GENERATOR ON-LINE AND LANDING IS IMMINENT**

1. “A” AUX HYDRAULIC PUMP - ON (if battery charge believed sufficient).

NOTE

If excessive time was used prior to selecting the DC Power Bus 1 and Bus 2 switches to EMER or by use of AUX hydraulic pump or APU start in descent, further use of the AUX hydraulic pump may deplete the right battery resulting in loss of the right EMER bus.

2. Aileron Latch Handle - PUSH DOWN (If Pulled and A Aux Hyd Pump is On).
3. Speed Brakes - RETRACTED.

(Continued Next Page)

■ MAXIMUM GLIDE/EMERGENCY LANDING (Continued)

4. Airspeed - AS REQUIRED.
5. Transponder - EMERGENCY CODE.
6. ATC - ADVISE.
7. Crew Briefing - COMPLETE. Refer to Emergency Procedures, EMERGENCY EVACUATION and/or DITCHING, as applicable.
8. Passengers - BRIEF. Refer to Emergency Procedures, EMERGENCY EVACUATION and/or DITCHING, as applicable.
9. Seats/Seat Belts/Shoulder Harnesses/Aft Divider Sliding Doors - CHECK/ SECURE/LATCHED OPEN (if belted toilet seat occupied).

BEFORE LANDING

1. Landing Data - CONFIRM.
2. Avionics Power Switch - OFF.
3. DC Power - Bus 1 Switch - NORM.
4. Exterior Lights - AS REQUIRED.
5. Flaps - 15° MAXIMUM (if battery charge is sufficient).

WARNING

DO NOT EXTEND FLAPS BEYOND 15° WITH EITHER HYDRAULIC SYSTEM DEPRESSURIZED. IF A SPEED BRAKE OR SPOILER CHECK VALVE FAILS TO SEAT, UNCOMMANDED ROLL MAY RESULT. RETRACT FLAPS TO 15° OR LESS, IF EXTENDED.

NOTE

If excessive time was used prior to selecting the DC Power/Bus 1 and Bus 2 switches to EMER, flap operation could result in depletion of the left battery and loss of the left EMER bus.

6. Landing Gear - AS REQUIRED, use BLOWDOWN.

CAUTION

DO NOT EXTEND THE LANDING GEAR HYDRAULICALLY IF THE “A” SYSTEM IS POWERED ONLY BY THE AUXILIARY HYDRAULIC PUMP. GEAR EXTENSION WILL BE SLOW AND WILL RESULT IN LOW PRESSURE TO THE FLIGHT CONTROL PCUs FOR UP TO 30 SECONDS.

   a. Landing Gear Blowdown Handle - PULL (below 210 KIAS).
   b. Landing Gear - CHECK DOWN and LOCKED (3 green lights).
   c. Gear Handle - DOWN.

NOTE

The gear will not retract after blowdown.

(Continued Next Page)

■ MAXIMUM GLIDE/EMERGENCY LANDING (Continued)

7. Airspeed - AS REQUIRED.
   a. The airspeeds in the following table are the minimum recommended until landing flare to ensure sufficient energy to arrest descent rate.

V_{REF} (KIAS)

FLAPS/SLATS	WEIGHT							
	23,000	**25,000**	**27,000**	**29,000**	**31,000**	**33,000**	**34,000**	**35,700**
15°/Extended	113	119	124	129	135	143	145	148
15°/Retracted	123	129	134	139	145	153	155	158
0°/Extended	124	130	136	141	147	154	158	162

   b. Multiply normal **FLAPS 15°** landing distance by 1.3 (slats extended) or by 2.3 (slats retracted).
   c. For 0° flap/slats extended multiply **FLAPS FULL** landing distance by 3.5 (use a factor of 2.5 if altitude is below 5,000 feet and weight is less than 29,000 pounds).

CAUTION

- AVOID LANDING WITH TAILWIND OR DOWNHILL RUNWAY GRADIENT.
- LANDING DISTANCE FACTORS OF 3.0 OR GREATER MAY REQUIRE THE USE OF A RUNWAY WITH AN ARRESTING BARRIER.

Procedure completed

■ TR AUTOSTOW L-R - THRUST REVERSERS NOT DEPLOYED (TR AUTOSTOW L-R RED CAS MESSAGE)

WARNING

THE FADECS REDUCE THE ENGINE THRUST TO IDLE VIA SOFTWARE COMMAND. THIS RESULTS IN THROTTLE REMAINING IN THE LAST POSITION AT WHICH IT WAS SET. THE THROTTLE MUST BE MOVED TO IDLE TO RESET THE FADEC LOGIC TO GAIN CONTROL OF THRUST AND CLEAR THE MESSAGE.

1. Stow Switches (both) - EMER.
2. Throttles (both) - IDLE then NORMAL OPERATION.
3. Land as soon as practical.

Procedure completed

■ THRUST REVERSER INADVERTENT IN-FLIGHT DEPLOYMENT (UNLOCK AND DEPLOY LIGHTS ON)

1. STOW Switch (affected thrust reverser) - EMER.
2. Throttle (affected engine) - CONFIRM, then IDLE.
3. Control Wheel/Autopilot - GRIP/DISENGAGE.
4. Airspeed - REDUCE to 170 KIAS MAXIMUM.
5. Throttle (unaffected engine) - AS REQUIRED.

- **IF REVERSER STOWS**

1. Thrust Reverser Lights - UNLOCK and DEPLOY lights extinguished; ARM light illuminated.

(Continued Next Page)

■ THRUST REVERSER INADVERTENT IN-FLIGHT DEPLOYMENT (UNLOCK AND DEPLOY LIGHTS ON) (Continued)

2. Throttle (affected engine) - ADVANCE SLOWLY, then normal operation.

NOTE

- The affected engine thrust will be regained after the throttle is brought to idle and then advanced.
- The affected TR AUTOSTOW message will clear when the throttle is brought to idle.

3. Land as soon as practical - Refer to Normal Procedures, BEFORE LANDING.

Procedure completed

● **IF REVERSER DOES NOT STOW**

WARNING

- **DO NOT ADVANCE THROTTLE ON THE AFFECTED ENGINE. REVERSE THRUST WILL INCREASE AFTER THE THROTTLE HAS BEEN BROUGHT TO IDLE AND THEN ADVANCED.**
- **DO NOT ENGAGE AUTOPILOT.**

NOTE

- The airplane will roll in the direction of the deployed reverser.
- Buffeting is cyclic in nature and is considered normal for this condition.
- Airplane is controllable through normal use of the flight controls.

☐ **IF DEPLOYMENT OCCURS DURING LANDING APPROACH**

1. Throttle (operating engine) - AS REQUIRED.
2. Throttle (affected engine) - CONFIRM, IDLE/then CUTOFF.
3. Airspeed - INCREASE to V_{REF} +25 KIAS (if possible without developing high sink rate).
4. Flaps - 15°.
5. Sink Rate - CONTROL WITH THRUST.
6. “A” AUX PUMP - ON (if LH engine shutdown).
7. DO NOT ATTEMPT GO-AROUND.

LANDING

1. Throttle - IDLE.
2. Speed Brakes - EXTEND at touchdown.
3. Elevator Control - FORWARD PRESSURE at touchdown.
4. Brakes - APPLY after nose wheel ground contact.
5. Thrust Reverser (operating engine) - DEPLOY after nose wheel ground contact.

Procedure completed

(Continued Next Page)

■ THRUST REVERSER INADVERTENT IN-FLIGHT DEPLOYMENT (UNLOCK AND DEPLOY LIGHTS ON) (Continued)

□ IF DEPLOYMENT OCCURS PRIOR TO LANDING APPROACH

1. Thrust Reverser Circuit Breakers (LH Panel) - IN.

NOTE

The thrust reverser circuit breakers control normal operation on their respective side and emergency stow operation of the opposite side.

2. Throttle (affected engine) - CONFIRM IDLE/THEN CUTOFF.
3. “A” AUX HYDRAULIC PUMP - ON (if LH engine shutdown).
4. Electrical Load - REDUCE as required.
5. DC Power XTIE Switch - Verify CLSD.
6. FUEL CROSSFEED - AS REQUIRED.
7. TCAS - TA only.
8. Airspeed - 170 KIAS MAXIMUM.
9. Land as soon as possible.

APPROACH

1. Altitude - MINIMUM 1000 FEET AGL until landing is assured.

WARNING

- **DO NOT DESCEND BELOW 1000 FEET AGL UNTIL LANDING IS ASSURED. A GO-AROUND AT AN ALTITUDE BELOW 1000 FEET AGL MAY NOT BE POSSIBLE FROM THE PRESCRIBED LANDING CONFIGURATION. DESCENT BELOW 1000 FEET AGL REQUIRES THAT THE LANDING BE COMPLETED.**
- **IT IS UNLIKELY THAT A POSITIVE CLIMB GRADIENT CAN BE MAINTAINED WITH A DEPLOYED THRUST REVERSER ABOVE 4000 FEET MSL.**

BEFORE LANDING

1. Landing Data - CONFIRM, Refer to Section IV, Performance.
   a. Airspeed - V_{REF}(FLAPS 15°) +25 to 150 feet AGL.
      - Slow to V_{REF}(FLAPS 15°) by 50 feet AGL.
   b. Use the Normal **FLAPS 15°** Landing Distance.

CAUTION

AVOID LANDING WITH TAILWIND OR DOWNHILL RUNWAY GRADIENT.

2. Crew Briefing - COMPLETE.

(Continued Next Page)

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■ THRUST REVERSER INADVERTENT IN-FLIGHT DEPLOYMENT (UNLOCK AND DEPLOY LIGHTS ON) (Continued)

3. Avionics and Flight Instruments - CHECK/SET.
4. Minimums - SET (RA/BARO).
5. FUEL CROSSFEED - AS REQUIRED, OFF prior to landing.
6. Exterior Lights - AS REQUIRED.
7. Flaps - 15° MAXIMUM.
8. Passengers - BRIEF.
9. Seats/Seat Belts/Shoulder Harnesses/Aft Divider Sliding Doors - CHECK/SECURE/LATCHED OPEN (if belted toilet seat occupied).
10. Passenger Advisory Lights - PASS SAFETY.
11. IGNITION - NORM.
12. Pressurization - ZERO DIFFERENTIAL at touchdown.
13. Landing Gear - DOWN and LOCKED (3 green lights).
14. EICAS - CHECK.
15. Speed Brakes - RETRACTED.
16. Airspeed - V_{REF} (Flaps 15°) at 50 feet AGL.

LANDING

1. Throttle - IDLE.
2. Speed Brakes - EXTEND at touchdown.
3. Elevator Control - FORWARD PRESSURE at touchdown.
4. Brakes - APPLY after nose wheel ground contact.
5. Thrust Reverser (operating engine) - DEPLOY after nose wheel ground contact.

NOTE

Reverse thrust may need to be reduced during crosswind landings or on wet or icy runways.

Procedure completed

□ GO-AROUND FROM THE FLAPS 15 LANDING CONFIGURATION (ABOVE 1000 FEET AGL)

WARNING

IT IS UNLIKELY THAT A POSITIVE CLIMB GRADIENT CAN BE MAINTAINED WITH A DEPLOYED THRUST REVERSER ABOVE 4000 FEET MSL.

1. Throttle (operating engine) - SET to TAKEOFF.
2. Airplane Pitch Attitude - POSITIVE ROTATION to +7.5°.
3. Flaps - 15.
4. Climb Speed - V_{APP}.
5. Landing Gear - UP (when positive rate of climb is established).

Procedure completed

■ OIL PRESSURE LOW L OR R (OIL PRESS LOW L-R CAS MESSAGE)

1. EICAS - CHECK ENGINE OIL PRESSURE.

● **IF OIL PRESSURE IS LESS THAN 50 PSI BUT NOT BELOW 34 PSI**

1. Throttle (affected engine) - REDUCE to LESS THAN 88% N_2.
   a. Oil Temperature and Quantity - MONITOR.
2. Land as soon as practical. Refer to Normal Procedures, APPROACH AND LANDING.

Procedure completed

● **IF OIL PRESSURE IS BELOW 34 PSI**

1. Engine - SHUT DOWN. Refer to Abnormal Procedures, ENGINE FAILURE/ PRECAUTIONARY SHUTDOWN.
2. Land as soon as practical. Refer to Abnormal Procedures, SINGLE-ENGINE APPROACH AND LANDING.

Procedure completed

● **IF PRESSURE IS AT OR ABOVE 50 PSI AND NO OTHER EVIDENCE OF A PROBLEM EXISTS**

1. Oil Temperature and Quantity - MONITOR.
2. Land as soon as practical. Refer to Normal Procedures, APPROACH AND LANDING.

NOTE

Oil pressure in the transient (amber) range from 34 to 49 PSI is normal during ground idle and in flight for short periods at idle following reduction from high thrust.

Procedure completed

■ COCKPIT/CABIN SMOKE OR FIRE

1. Oxygen Masks - DON and EMER (crew and passengers).
2. Smoke Goggles - DON (as required).

NOTE

Headsets and hats must be removed before donning oxygen mask.

3. Microphone Switches - MIC OXY MASK.
4. Control Wheel INPH/MIC Switches - INPH (as required).
5. Determine source.

(Continued Next Page)

■ COCKPIT/CABIN SMOKE OR FIRE (Continued)

● ENVIRONMENTAL

1. PAC ISOL VALVE - CLSD.

☐ KNOWN PAC

1. Affected PAC Switch - OFF.
2. Altitude - FL 410 MAXIMUM.
3. Land as soon as practical.

Procedure completed

☐ UNKNOWN PAC

1. PAC SWITCHES: CKPT PAC Switch - OFF; CAB PAC Switch - ON (allow time to purge).
2. Altitude - FL 410 MAXIMUM.
3. Land as soon as practical.

Procedure completed

☐ IF SMOKE/ODOR DOES NOT CLEAR

1. PAC Switches: CKPT PAC Switch - ON; CAB PAC Switch - OFF.
2. Altitude - FL410 MAXIMUM.
3. Land as soon as practical.

Procedure completed

● ELECTRICAL

☐ SOURCE KNOWN

1. Isolate Faulty Circuit(s) - PULL CIRCUIT BREAKER(S).

Procedure completed

☐ SOURCE UNKNOWN

1. AUX Panel Lights - FULL BRIGHT (night).
2. Generator Switches - OFF.
3. DC Power Bus 1 and Bus 2 Switches - EMER.
4. Battery Ammeters (forward of pilot’s CB panel) - CHECK.

NOTE

- High battery amperage (> 20 amps with “A” AUX pump off) may indicate the electrical problem is on that EMER bus.
- With no generator on line, and the DC Power Bus switches in EMER, the batteries will supply DC power to the left and right EMER busses and the APU bus for approximately 60 minutes Refer to Figure 3-1, page 3-50, for operative and inoperative equipment.
- The pressurization system will automatically revert to Manual Mode when the main DC electrical system is disabled by turning off the generators and selecting the DC Power Bus 1 and Bus 2 switch annunciators to EMER.

(Continued Next Page)

■ COCKPIT/CABIN SMOKE OR FIRE (Continued)

5. Cockpit Divider Door - OPEN.

○ **IF FAULT ON MAIN OR EXTENSION BUS (NORMAL BATTERY DISCHARGE, SMOKE CLEARING)**

1. Airspeed and Altitude - USE STANDBY INDICATOR (observe placard V_{MO} schedule, FL410 maximum).

NOTE

The standby airspeed placard limits are approximately 0.82 Mach above FL240. Linear airspeed interpolation between altitudes is permitted.

2. Pressurization - CONTROL MANUALLY (use Cabin Altitude UP/DN switch as required).
3. Land as soon as possible. Refer to Emergency Procedures, BEFORE LANDING (SOURCE ISOLATED) and Figure 3-1, page 3-50A, for operative and inoperative equipment.

Procedure completed

○ **IF FAULT IS ON BATT OR EMER BUS (high battery discharge or other indication)**

1. BATT Switch (affected side) - OFF.
2. Generator Switches - BOTH ON.
3. DC Power Bus Switch (affected side) - Verify EMER.
4. Land As Soon As Possible. Refer to Emergency Procedures, BEFORE LANDING (SOURCE ISOLATED) and Figure 3-1, page 3-50A, for operative and inoperative equipment.

Procedure completed

● **COCKPIT FIRE**

1. Fire Extinguisher - UNSTOW and REMOVE SAFETY PIN (under copilot's seat).
2. Fire - LOCATE and EXTINGUISH.
3. Land as soon as possible. Refer to Emergency Procedures, BEFORE LANDING (SOURCE ISOLATED).

Procedure completed

(Continued Next Page)

■ COCKPIT/CABIN SMOKE OR FIRE (Continued)

● CABIN FIRE

1. Oxygen Mask - PLUG INTO PORTABLE O_2 BOTTLE (forward cabin cabinet), DON and EMER.
2. Smoke Goggles -DON (as required).
3. Fire Extinguisher - UNSTOW AND REMOVE SAFETY PIN (forward cabin cabinet).
4. PASS OXY - ON (assure passengers are receiving oxygen).
5. Passenger Safety Lights - PASS SAFETY.
6. Land as soon as possible. Refer to Emergency Procedures, BEFORE LANDING (SOURCE ISOLATED).

Procedure completed

WARNING

WHETHER OR NOT SMOKE HAS DISSIPATED, IF IT CANNOT BE VISIBLY CONFIRMED THAT ANY FIRE HAS BEEN EXTINGUISHED FOLLOWING FIRE SUPPRESSION AND/OR SMOKE EVACUATION, LAND IMMEDIATELY AT THE NEAREST SUITABLE AIRPORT.

□ IF SMOKE NEEDS TO BE CLEARED

○ IF NORMAL DC ELECTRICAL POWER AVAILABLE

1. CABIN DUMP Switch - DUMP (cabin altitude will not exceed approximately 15,000 feet).

NOTE

If the airplane is above 34,500 feet MSL and the autopilot is engaged, it will automatically enter Emergency Descent Mode (EDM) if cabin altitude exceeds approximately 14,500 feet.

2. Autopilot - AS REQUIRED.
3. Emergency Descent - AS REQUIRED.
4. Land as soon as possible. Refer to Emergency Procedures, BEFORE LANDING (SOURCE ISOLATED).

Procedure completed

○ IF DC POWER BUS 1 AND 2 SWITCHES ARE EMER

1. Cabin Altitude UP/DN Switch - UP (as required).

NOTE

The CABIN DUMP switch is disabled if the main DC electrical system has been disabled by turning off the generators and selecting the DC Power Bus 1 and Bus 2 to EMER.

2. Emergency Descent - AS REQUIRED.
3. Land as soon as possible.
4. Refer to Emergency Procedures, BEFORE LANDING (SOURCE ISOLATED).

(Continued Next Page)

■ COCKPIT/CABIN SMOKE OR FIRE (Continued)

● BEFORE LANDING (IF SMOKE SOURCE WAS ISOLATED)

1. Generators - ON.
2. DC Power Bus 1 and Bus 2 Switches - NORM.
3. Refer to Normal Procedures, BEFORE LANDING.

Procedure completed

● BEFORE LANDING (IF SMOKE SOURCE WAS NOT ISOLATED)

1. Battery Ammeters - CHECK.

NOTE

Approximate battery life, from selecting generators off, assuming the bus isolation relays are selected to EMER within 5 minutes, is AMP/30 = hours.

2. ATC - ADVISE (transponder and external lights will be inoperative).
3. Landing Gear - CHECK DOWN AND LOCKED (three green lights).
4. Landing Data - CONFIRM.
   a. Airspeed - V_{REF}.

V_{REF} (KIAS)

FLAPS/SLATS	WEIGHT - POUNDS							
	23,000	25,000	27,000	29,000	31,000	33,000	34,000	35,700
0°/Retracted	134	140	146	151	157	164	168	172

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■ COCKPIT/CABIN SMOKE OR FIRE (Continued)

b. Multiply normal **FLAPS FULL** landing distance by the appropriate landing distance factor in the following table.

LANDING DISTANCE FACTOR

ALTITUDE FEET	WEIGHT - POUNDS							
	23,000	**25,000**	**27,000**	**29,000**	**31,000**	**33,000**	**34,000**	**35,700**
0	2.06	2.08	2.32	2.63	3.53	3.60	4.03	4.03
5,000	2.08	2.27	2.70	3.61	3.73	4.07	4.25	4.26
10,000	2.42	2.82	3.75	3.99	4.36	4.45	4.45	4.62
14,000	2.69	3.55	4.08	4.30	4.39	4.45	4.45	4.62

WARNING

- **STICK SHAKER AND AUTO SLAT WILL BE INOPERATIVE. DO NOT SLOW BELOW V_{REF}.**
- **LANDING DISTANCE ANTISKID BRAKES WILL BE INOPERATIVE; HOWEVER, NORMAL POWER BRAKES WILL FUNCTION. USE CAUTION NOT TO SKID TIRES.**

CAUTION

- AVOID LANDING WITH TAILWIND OR DOWNHILL RUNWAY GRADIENT.
- LANDING DISTANCE FACTORS OF 3.0 OR GREATER MAY REQUIRE THE USE OF AN AIRPORT THAT HAS A RUNWAY WITH AN ARRESTING BARRIER.

5. Speed Brakes - RETRACT.
6. Airspeed - V_{REF}.

Procedure completed.

■ BAGGAGE SMOKE (BAGGAGE SMOKE CAS MESSAGE)

1. Baggage Compartment Isolation Valve (ISO VLV) Switch - LIFT RED COVER and CLOSE (switch up).

NOTE

The baggage compartment isolation valve will not reopen until zero cabin differential pressure is achieved at low cabin altitude.

2. Land as soon as possible.

Procedure completed.

■ DUAL GENERATOR FAILURE (GEN OFF L-R RED CAS MESSAGE)

1. Generator Switches - BOTH RESET/OFF.
2. Generator Voltages - CHECK READINGS (EICAS).

NOTE

If generator voltage is significantly below or above 28 volts, the GCU will not allow that generator to remain on line.

3. Generator Switches - GEN.
4. Fuel Crossfeed - OFF.

● **IF ONLY ONE GENERATOR COMES ON LINE**

1. DC Power XTIE Switch - CLSD.
2. Land As Soon As Practical, Refer to Normal Procedures - BEFORE LANDING.
3. Refer to Amber Abnormal Procedures, GEN OFF L-R (GENERATOR OFF L-R).

● **IF NEITHER GENERATOR IS ON LINE**

1. Descend to FL310 or below.
2. APU - START.

● **IF APU CAN BE STARTED (AT OR BELOW FL310)**

1. APU - START.
   a. APU MASTER Switch - ON.
   b. APU START/STOP Switch - START.

NOTE

Refer to Normal Procedures, APU START Checklist/Start Envelope. One APU start attempt is approved within 60 minutes of dual generator failure.

2. APU Generator - ON.
3. DC Power XTIE Switch - CLSD.
4. Land As Soon As Practical, Refer to Normal Procedures - BEFORE LANDING.

● **IF APU CANNOT BE STARTED AND NO GENERATORS ARE ON LINE (MAIN DC AND APU)**

1. Standby Instruments - MONITOR.
2. Airspeed - 0.82 MACH OR BELOW.
3. Autopilot - DISENGAGE.

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■ DUAL GENERATOR FAILURE (GEN OFF L-R RED CAS MESSAGE)
(Continued)

4. AUX Panel Lights - FULL BRIGHT (Night).
5. Secondary Trim Switch - ON, TRIM AS REQUIRED.

NOTE

- Fuel crossfeed, gravity crossflow and center wing transfer valves will remain in their selected mode. If a mode change is necessary, select it prior to selecting the DC Power Bus 1 and Bus 2 switches to EMER.
- With no generator on line, and the DC Power Bus 1 and Bus 2 switches in EMER, the batteries will supply DC power to the emergency bus equipment for approximately 60 minutes, provided the switches were placed to EMER within 5 minutes after failure of the second generator. Refer to Figure 3-1, page 3-51A, for operative and inoperative equipment.
- While in this condition, transponder and external lighting are not operative. Advise Air Traffic Control.
- Detailed description of emergency power distribution is shown on Figure 3-1.

6. DC Power Bus 1 and Bus 2 Switches - EMER.
7. Avionics Switch - OFF.

(Continued Next Page)

■ DUAL GENERATOR FAILURE (GEN OFF L-R RED CAS MESSAGE)

(Continued)

8. Airspeed and Altitude - USE STANDBY INDICATOR (observe placard V_{MO} schedule, FL410 maximum).

NOTE

The Standby Airspeed Placard Limits are approximately 0.82 Mach above FL240. Linear airspeed interpolation between altitudes is permitted. If EMER bus is selected above .82 mach, overspeed warning will sound until the airplane is slowed below .82 mach.

9. Pressurization - MANUAL mode; ADJUST as required.
10. Land as soon as possible.

BEFORE LANDING

1. Landing Data - CONFIRM.

NOTE

If within 5 minutes of landing and less than 45 minutes from generator failure and the left battery has not been used excessively, sufficient battery charge should be available to extend the flaps.

a. Airspeed - V_{REF}.

V_{REF} (KIAS)

FLAPS/SLATS	WEIGHT								LANDING DISTANCE FACTORS
	23,000	25,000	27,000	28,000	29,000	30,000	31,000	31,800	
0°/Retracted	134	140	146	149	151	154	157	160	3.9 (3.0)*
0°/Extended	124	130	136	139	141	144	147	150	3.1 (2.7)**
5°/Retracted	130	136	142	144	147	150	153	155	3.5 (2.2)*
5°/Extended	120	126	132	134	137	140	143	145	2.8 (2.3)**
15°/Retracted	123	129	134	137	139	142	145	147	2.5

b. Multiply Normal **FLAPS FULL** Landing Distance by the appropriate landing distance factor in the above table. The factors in parenthesis () can be used if the following conditions apply:

* Altitude under 5,000 feet, weight less than 29,000 pounds.
** Altitude under 5,000 feet.

CAUTION

- AVOID LANDING WITH TAILWIND OR DOWNHILL RUNWAY GRADIENT.
- LANDING DISTANCE FACTORS OF 3.0 OR GREATER MAY REQUIRE THE USE OF AN AIRPORT THAT HAS A RUNWAY WITH AN ARRESTING BARRIER.

2. Crew Briefing - COMPLETED.
3. Avionics and Flight Instruments - CHECK.
4. Passengers - BRIEF.
5. Seats/Seat Belts/Shoulder Harnesses/Aft Divider Sliding Doors - CHECK/SECURE/ LATCHED OPEN (if belted toilet seat occupied).
6. Emergency Lights - ON.
7. Pressurization - ZERO DIFFERENTIAL PRESSURE at touchdown.
8. Landing Gear - CHECK DOWN and LOCKED (3 green lights).

(Continued Next Page)

■ DUAL GENERATOR FAILURE (GEN OFF L-R RED CAS MESSAGE)

(Continued)

9. Airspeed - V_{REF}. (Refer to table for flaps/slats retracted.)

CAUTION

IF THE DC BUS 1 AND BUS 2 SWITCHES ARE SELECTED TO EMER, USE BRAKES WITH CAUTION OR PLAN TO USE EMERGENCY BRAKING. NORMAL BRAKES ARE OPERATIVE BUT ANTI-SKID PROTECTION IS NOT AVAILABLE. EMERGENCY BRAKES ARE REGULATED TO AVOID SKID. DO NOT USE BOTH SIMULTANEOUSLY.

● **LANDING ASSURED IF BATTERY CHARGE IS SUFFICIENT (WITHIN 5 MINUTES OF LANDING AND LESS THAN 45 MINUTES AFTER SECOND GENERATOR FAILURE)**

1. Avionics Switch - OFF; ON as required for communications, then OFF.
2. DC Power Bus 1 and Bus 2 switches - NORM.

NOTE

- DC power Bus 1 and Bus 2 switches in NORM will allow DC power to operate flaps, anti-skid, landing light (only if required) and thrust reversers.
- Avionics power should be OFF to reduce electrical load and minimize distraction due to display tubes powering up.

3. Flaps - FULL (if time permits).
4. Airspeed - V_{REF} (as required).

LANDING

1. Throttles - IDLE.
2. Speed Brakes - EXTEND at touchdown.
3. Elevator Control - FORWARD PRESSURE at touchdown.
4. Brakes - APPLY after nose wheel ground contact.
5. Thrust Reversers - DEPLOY after nose wheel ground contact.

Procedure completed

■ BATTERY 1 OR 2 OVERTEMPERATURE (BATT 1-2 O'TEMP CAS MESSAGE)

1. Affected Battery Switch - OFF.

2. Battery Temperature - MONITOR.

NOTE

The BATTERY O'TEMP message will first occur at +63°C. If the battery temperature continues to rise, the MASTER WARNING and aural warning will repeat at +71°C.

● **IF BATTERY TEMPERATURE CONTINUES TO RISE**

1. Land as soon as possible.

Procedure completed

■ LOSS OF CABIN PRESSURE (CABIN ALTITUDE RED CAS MESSAGE)

1. Oxygen Masks - DON AND 100%.
2. Microphone Switches - MIC OXY MASK.
3. Emergency Descent - AS REQUIRED.
4. Control Wheel INPH/MIC Switches - INPH (as required).
5. PASS OXY Switch - ON (assure passengers are receiving oxygen).
6. Transponder - EMERGENCY CODE.

NOTE

CABIN ALTITUDE red CAS message indicates cabin altitude above 10,000 feet. For amber message (cabin altitude above 8500 feet), refer to Amber Abnormal Procedures, CABIN ALTITUDE.

Procedure completed

■ EMERGENCY DESCENT

1. Throttles - IDLE.
2. Speed Brakes - EXTEND.
3. Initial Pitch Attitude - 15° DOWN.

CAUTION

IF STRUCTURAL DAMAGE IS SUSPECTED, LIMIT AIRSPEED TO A REASONABLE VALUE AND LIMIT MANEUVERING LOADS UNTIL DAMAGE ASSESSMENT CAN BE MADE.

4. Airspeed - M_{MO}/V_{MO}.
5. Transponder - EMERGENCY CODE.
6. Autopilot - DISENGAGE (as required).

NOTE

- If the airplane is above 31,000 feet MSL and the autopilot is engaged, it will automatically enter Emergency Descent Mode (EDM) when cabin altitude exceeds approximately 14,500 feet. The autopilot will inititate a pitch-down left-turn (90°) maneuver. The flight crew must retard throttles to idle and extend the speed brakes. The autopilot will control the descent near the M_{MO}/V_{MO} limit and level off at 15,000 feet MSL. The flight crew must then retract the speed brakes and apply thrust to resume normal flight. If the airplane slows to stick shaker the autopilot will disconnect.

(Continued Next Page)

EMERGENCY DESCENT (Continued)

NOTE

- The autopilot Emergency Descent Mode (EDM) is annunciated by EDM message in the PFD and EMERGENCY DESCENT CAS message. This mode can only be cancelled by disengaging the autopilot.
- The autopilot EDM cannot achieve maximum rate-of-descent. It is recommended that the autopilot be disengaged and the airplane hand flown if maximum rate-of-descent is required.

7. ATC - ADVISE and OBTAIN LOCAL ALTIMETER SETTING.
8. Altitude - 15,000 FEET MSL or MINIMUM SAFE ALTITUDE.

WARNING

IT IS THE PILOT’S RESPONSIBILITY TO DETERMINE MINIMUM SAFE ALTITUDE AND TO ENSURE THAT THE AUTOPILOT DOES NOT TURN THE AIRPLANE INTO TRAFFIC OR UNSAFE WEATHER.

9. Passengers - BRIEF.
10. Land as soon as possible.

Procedure completed

■ DUAL HYDRAULIC PUMP FAILURE (HYD PUMP FAIL A-B CAS MESSAGE)

1. “A” AUX HYDRAULIC PUMP Switch - ON.
2. Refer to Emergency Procedure, LANDING IF “A” SYSTEM PRESSURE IS RESTORED BY THE AUXILIARY PUMP.

● **IF “A” SYSTEM PRESSURE IS NOT RESTORED BY THE AUXILIARY PUMP**

1. Autopilot - OFF.
2. Airspeed - REDUCE (maximum 250 KIAS/0.80 MACH).
3. Altitude - FL410 MAXIMUM.
4. HYDRAULIC PUMP “A” and “B” Switches - BOTH UNLOAD.
5. “A” AUX HYDRAULIC PUMP Switch - OFF.
6. Rudder Standby Hydraulic Pressure - CHECK.

NOTE

With normal rudder standby system pressure (>2200 PSI), rudder control will function normally.

7. Land as soon as practical. Refer to Emergency Procedure, LANDING WITH FLIGHT CONTROLS MANUAL REVERSION.

Procedure completed

■ LANDING WITH FLIGHT CONTROLS MANUAL REVERSION

● **‘A’ AND ‘B’ HYDRAULIC SYSTEMS PRESSURE LOST**

1. LH/RH Elevator FLT CONTROL SHUTOFF Switches (two aft switches) - PUSH.
2. Airspeed - 250 KIAS/0.80 MACH MAXIMUM.
3. Altitude - 41,000 FEET MAXIMUM, DESCEND AS REQUIRED.
4. Rudder Standby Hydraulic Pressure - CHECK.

WARNING

- **DO NOT EXTEND FLAPS BEYOND 15° WITH EITHER HYDRAULIC SYSTEM DEPRESSURIZED. IF A SPEED BRAKE OR SPOILER CHECK VALVE FAILS TO SEAT, UNCOMMANDED ROLL MAY RESULT. RETRACT FLAPS TO 15° OR LESS, IF EXTENDED.**
- **IF SLATS ARE RETRACTED, DO NOT SLOW BELOW V_{REF}. AUTO SLAT WILL BE INOPERATIVE.**

NOTE

- Plan to use emergency gear extension and emergency brakes. Thrust reversers, speed brakes, and normal wheel brakes will be inoperative. Nose wheel steering is available only from the accumulator.
- Control response will be slow and forces high. Plan to use the longest available runway which minimizes crosswind. Maximum crosswind component is 10 knots.

(Continued Next Page)

■ LANDING WITH FLIGHT CONTROLS MANUAL REVERSION (Continued)

NOTE (Continued)

- Lateral/Directional control: if the rudder standby system is operational, rudder response and control forces will be normal. If the rudder standby system is not operational, rudder response will be slow and forces high. Aileron response will be slow and forces high. Spoilers will be inoperative.

- Pitch/Airspeed control: stabilizer trim will be normal and should be used to maintain trimmed position. Elevator response will be slow with reduced authority and forces high. Avoid large changes in pitch using elevator to prevent pilot induced oscillations. Elevator Flight Control Shutoff switches must be OFF. Judicious use of rudder control will significantly enhance lateral control.

- In IMC conditions, the flight director should be used for reference only. The flight director gains are not tailored to hydraulics-off control response. Attempting to precisely follow flight director commands can result in pilot induced oscillations.

- Pilot workload can be reduced, through crew coordination, if one pilot operates flight controls and one operates throttles for glidepath control.

- Plan for a stabilized final approach. The airplane should be within 10 to 15 knots above the appropriate V_{REF} and established on glidepath between 3 to 5 NM from the runway on final approach.

- The following systems are inoperative: all roll spoilers, all flight control PCUs except lower rudder, speed brakes, wing leading edge slats including auto slats, both thrust reversers, normal brakes and antiskid. If the speed brakes and/or slats were extended at the time of hydraulic failure, they will remain extended.

- Upper rudder available with flaps 5°.

- Lower rudder is powered by the rudder standby hydraulic system.

- Nose wheel steering has accumulator pressure only.

- Only emergency brakes will be available.

(Continued Next Page)

■ DUAL HYDRAULIC PUMP FAILURE (HYD PUMP FAIL A-B CAS MESSAGE)

1. “A” AUX HYDRAULIC PUMP Switch - ON.
2. Refer to Emergency Procedure, LANDING IF “A” SYSTEM PRESSURE IS RESTORED BY THE AUXILIARY PUMP.

● **IF “A” SYSTEM PRESSURE IS NOT RESTORED BY THE AUXILIARY PUMP**

1. AILERON LATCH Handle - PULL.
2. Autopilot - OFF.
3. Airspeed - REDUCE (maximum 250 KIAS/0.80 MACH).
4. Altitude - FL410 MAXIMUM.
5. HYDRAULIC PUMP “A” and “B” Switches - BOTH UNLOAD.
6. “A” AUX HYDRAULIC PUMP Switch - OFF.
7. Rudder Standby Hydraulic Pressure - CHECK.

NOTE

With normal rudder standby system pressure (>2200 PSI), rudder control will function normally.

8. Land as soon as practical. Refer to Emergency Procedure, LANDING WITH FLIGHT CONTROLS MANUAL REVERSION.

Procedure completed

■ LANDING WITH FLIGHT CONTROLS MANUAL REVERSION

● **‘A’ AND ‘B’ HYDRAULIC SYSTEMS PRESSURE LOST**

1. AILERON LATCH Handle - PULL (ailerons are manual reversion).
2. LH/RH Elevator FLT CONTROL SHUTOFF Switches (two aft switches) - PUSH.
3. Airspeed - 250 KIAS/0.80 MACH MAXIMUM.
4. Altitude - 41,000 FEET MAXIMUM, DESCEND AS REQUIRED.
5. Rudder Standby Hydraulic Pressure - CHECK.

WARNING

- **DO NOT EXTEND FLAPS BEYOND 15° WITH EITHER HYDRAULIC SYSTEM DEPRESSURIZED. IF A SPEED BRAKE OR SPOILER CHECK VALVE FAILS TO SEAT, UNCOMMANDED ROLL MAY RESULT. RETRACT FLAPS TO 15° OR LESS, IF EXTENDED.**
- **IF SLATS ARE RETRACTED, DO NOT SLOW BELOW V_{REF}. AUTO SLAT WILL BE INOPERATIVE.**

NOTE

- Plan to use emergency gear extension and emergency brakes. Thrust reversers, speed brakes, and normal wheel brakes will be inoperative. Nose wheel steering is available only from the accumulator.
- Control response will be slow and forces high. Plan to use the longest available runway which minimizes crosswind. Maximum crosswind component is 10 knots.

(Continued Next Page)

■ LANDING WITH FLIGHT CONTROLS MANUAL REVERSION (Continued)

NOTE (Continued)

- Lateral/Directional control: if the rudder standby system is operational, rudder response and control forces will be normal. If the rudder standby system is not operational, rudder response will be slow and forces high. Aileron response will be slow and forces high. The aileron latch must be pulled. Spoilers will be inoperative.

- Pitch/Airspeed control: stabilizer trim will be normal and should be used to maintain trimmed position. Elevator response will be slow with reduced authority and forces high. Avoid large changes in pitch using elevator to prevent pilot induced oscillations. Elevator Flight Control Shutoff switches must be OFF. Judicious use of rudder control will significantly enhance lateral control.

- In IMC conditions, the flight director should be used for reference only. The flight director gains are not tailored to hydraulics-off control response. Attempting to precisely follow flight director commands can result in pilot induced oscillations.

- Pilot workload can be reduced, through crew coordination, if one pilot operates flight controls and one operates throttles for glidepath control.

- Plan for a stabilized final approach. The airplane should be within 10 to 15 knots above the appropriate V_{REF} and established on glidepath between 3 to 5 NM from the runway on final approach.

- The following systems are inoperative: all roll spoilers, all flight control PCUs except lower rudder, speed brakes, wing leading edge slats including auto slats, both thrust reversers, normal brakes and antiskid. If the speed brakes and/or slats were extended at the time of hydraulic failure, they will remain extended.

- Upper rudder available with flaps 5°.

- Lower rudder is powered by the rudder standby hydraulic system.

- Nose wheel steering has accumulator pressure only.

- Only emergency brakes will be available.

(Continued Next Page)

■ LANDING WITH FLIGHT CONTROLS MANUAL REVERSION (Continued)

BEFORE LANDING (MULTIENGINE OR SINGLE ENGINE DUAL HYDRAULIC FAIL)

1. Landing Data - CONFIRM.
   a. Airspeed - V_{REF}.

V_{REF} (KIAS)

FLAPS/SLATS	WEIGHT - POUNDS							
	23,000	25,000	27,000	29,000	31,000	33,000	34,000	35,700
15°/Extended	113	119	124	129	135	143	145	148
15°/Retracted	123	129	134	139	145	153	155	158

   b. Multiply Normal **FLAPS 15°** Landing Distance by 1.6 (slats extended) or 2.8* (slats retracted).
   *Use a factor of 1.7 if altitude is below 5,000 feet and weight is less than 29,000 pounds.

CAUTION

AVOID LANDING WITH TAILWIND OR DOWNHILL RUNWAY GRADIENT.

2. Crew Briefing - COMPLETE.
3. Avionics and Flight Instruments - CHECK/SET.
4. Minimums - SET (RA/BARO).
5. FUEL CROSSFEED - AS REQUIRED, then OFF.
6. ENGINE SYNC - OFF.
7. External Lights - AS REQUIRED.
8. Flaps - 15° MAXIMUM.
9. Passengers - BRIEF.
10. Seats/Seat Belts/Shoulder Harnesses/Aft Divider Sliding Doors - CHECK/SECURE/ LATCHED OPEN (if belted toilet seat occupied).
11. Passenger Advisory Lights - PASS SAFETY.
12. IGNITION - NORM.
13. Pressurization - ZERO DIFFERENTIAL at touchdown.
14. Landing Gear - BLOW DOWN.
    a. Landing Gear Blowdown Handle - PULL (below 210 KIAS).
    b. Landing Gear - CHECK DOWN and LOCKED (3 green lights).
    c. Gear Handle - DOWN.
15. EICAS - CHECK.
16. Airspeed - V_{REF} (as required).

LANDING

1. Throttles - IDLE (smoothly in flare).
2. Flare - NORMAL ATTITUDE using elevator.
3. Elevator Control - FORWARD PRESSURE at touchdown.

(Continued Next Page)

■ LANDING WITH FLIGHT CONTROLS MANUAL REVERSION (Continued)

4. Emergency Brakes - PULL and HOLD until stopped (after nose wheel ground contact).

CAUTION

- MINIMIZE USE OF NOSE WHEEL STEERING. NOSE WHEEL STEERING WILL BECOME INOPERATIVE WHEN THE ACCUMULATOR IS DISCHARGED.
- THE ANTISKID BRAKE SYSTEM DOES NOT FUNCTION DURING EMERGENCY BRAKING.
- REPEATED APPLICATION AND RELEASE OF EMERGENCY BRAKES MAY CAUSE PREMATURE LOSS OF PNEUMATIC PRESSURE. WHEN CLEAR OF THE RUNWAY, STOP AND SHUT DOWN. DO NOT ATTEMPT TO TAXI IN CLOSE PROXIMITY TO BUILDINGS OR OTHER AIRCRAFT USING EMERGENCY BRAKES OR NOSE WHEEL STEERING.

NOTE

Emergency brake pressure is regulated for optimum braking on most dry surfaces.

Procedure completed

■ LANDING IF “A” SYSTEM PRESSURE IS RESTORED BY THE AUXILIARY PUMP

1. Land as soon as practical.

WARNING

- **DO NOT EXTEND FLAPS BEYOND 15° WITH EITHER HYDRAULIC SYSTEM DEPRESSURIZED. IF A SPEED BRAKE OR SPOILER CHECK VALVE FAILS TO SEAT, UNCOMMANDED ROLL MAY RESULT. RETRACT FLAPS TO 15° OR LESS, IF EXTENDED.**
- **DO NOT USE SPEED BRAKES IN FLIGHT UNLESS “B” SYSTEM PRESSURE IS ZERO. INBOARD AND MIDDLE SPEED BRAKE PANELS MAY NOT RETRACT.**

NOTE

If “B” hydraulic system is inoperative, the following subsystems will be inoperative: PTU, inboard roll spoilers, inboard and middle speed brake panels and RH thrust reverser.

(Continued Next Page)

■ LANDING IF "A" SYSTEM PRESSURE IS RESTORED BY THE AUXILIARY PUMP (Continued)

BEFORE LANDING

1. Landing Data - CONFIRM.
   a. Airspeed - V_{REF}.

V_{REF} (KIAS)

FLAPS/SLATS	WEIGHT							
	23,000	25,000	27,000	29,000	31,000	33,000	34,000	35,700
15°/Extended	113	119	124	129	135	143	145	148

   b. Multiply Normal **FLAPS 15°** Landing Distance by 1.3.

CAUTION

AVOID LANDING WITH TAILWIND OR DOWNHILL RUNWAY GRADIENT.

2. Crew Briefing - COMPLETE.
3. Avionics and Flight Instruments - CHECK/SET.
4. Minimums - SET (RA/BARO).
5. FUEL CROSSFEED - OFF.
6. ENGINE SYNC - OFF.
7. Exterior Lights - AS REQUIRED.
8. Flaps - 15° MAXIMUM.
9. Passengers - BRIEF.
10. Seats/Seat Belts/Shoulder Harnesses/Aft Divider Sliding Doors - CHECK/SECURE/LATCHED OPEN (if belted toilet seat occupied).
11. Passenger Advisory Lights - PASS SAFETY.
12. IGNITION - NORM.
13. Pressurization - ZERO DIFFERENTIAL at touchdown.
14. Landing Gear - BLOW DOWN.

CAUTION

DO NOT EXTEND THE LANDING GEAR HYDRAULICALLY IF THE "A" SYSTEM IS POWERED ONLY BY THE "A" AUX HYDRAULIC PUMP. GEAR EXTENSION WILL BE SLOW AND WILL RESULT IN LOW PRESSURE TO THE FLIGHT CONTROL PCUs FOR UP TO 30 SECONDS.

   a. Landing Gear Blowdown Handle - PULL (below 210 KIAS).
   b. Landing Gear - CHECK DOWN and LOCKED (3 green lights).
   c. Gear Handle - DOWN.

NOTE

The gear will not retract after blowdown.

15. Speed Brakes - RETRACTED.
16. EICAS - CHECK.
17. Airspeed - V_{REF}.

(Continued Next Page)

■ LANDING IF “A” SYSTEM PRESSURE IS RESTORED BY THE AUXILIARY PUMP (Continued)

LANDING

NOTE

- Only the left thrust reverser will deploy. Use caution during single engine reversing.
- Minimize simultaneous use of nose wheel steering, slats, thrust reversers, brakes, and flight controls.

1. Throttles - IDLE.
2. Speed Brakes - EXTEND at touchdown.
3. Elevator Control - FORWARD PRESSURE at touchdown.
4. Brakes - APPLY after nose wheel ground contact.
5. Left Thrust Reverser - DEPLOY after nose wheel ground contact.

Procedure completed

■ JAMMED ROLL OR PITCH CONTROL SYSTEM

1. Control Wheel - RELAX PRESSURE.
2. Pitch/Roll Disconnect Handle - PULL UNTIL LATCHED.
3. Operative Flight Control Wheel - IDENTIFY, RECOVER AIRCRAFT ATTITUDE.
4. Trim - AS REQUIRED.

NOTE

- If aileron is jammed, aileron trim may be ineffective. Rudder trim may improve controllability.
- Relaxing control pressure prior to pulling the disconnect will minimize abrupt control input when the controls disconnect.
- Pilot’s control column controls ailerons and LH elevator. Copilot’s control column controls roll spoilers and RH elevator.
- PITCH/ROLL DISC amber CAS message will illuminate.
- The autopilot, if engaged, will automatically disengage (when the Pitch/Roll disengage handle is pulled) and will not reengage.
- Do not push the disconnect handle down unless rotated to the PITCH/ROLL RECONNECT (9 o’clock) position.

(Continued Next Page)

■ JAMMED ROLL OR PITCH CONTROL SYSTEM (Continued)

● IF PITCH CONTROL JAMMED

1. Pitch/Roll Disconnect Handle - TURN CLOCKWISE to ROLL RECONNECT.
2. Land as soon as possible, use normal procedures.

WARNING

DO NOT USE THRUST REVERSERS.

NOTE

- Minimize large elevator inputs. There will be some minor roll coupling with elevator input.
- Autopilot will not re-engage.
- PITCH/ROLL DISC CAS message will remain on.

Procedure completed

● IF ROLL CONTROL JAMMED

1. Pitch/Roll Disconnect Handle - TURN COUNTER CLOCKWISE TO PITCH RECONNECT.
2. Fuel - BALANCE PRIOR TO LANDING.
3. Land as soon as possible, use Normal procedures.

NOTE

- If the jammed control is not centered, the remaining control authority will be limited in one direction. Use rudder control to assist in producing roll response.
- Fuel must be balanced prior to landing.
- Maximum crosswind is 10 knots.
- Roll spoilers have a dead band around neutral. Make small smooth inputs and return to neutral. Rudder control may also be used to assist in producing roll response.
- Autopilot will not reengage.
- PITCH/ROLL DISC CAS message will remain on.

Procedure completed

■ DUAL RUDDER LIMITER FAILURE, EXCESS TRAVEL (RUDDER LIMIT FAIL CAS MESSAGE)

1. Rudder Pedals - DO NOT APPLY LARGE OR ABRUPT RUDDER INPUT.

WARNING

IF BOTH RUDDER LIMITERS HAVE FAILED, RUDDER AUTHORITY MAY BE MORE THAN SCHEDULED AND MAY BE ENOUGH TO RESULT IN STRUCTURAL DAMAGE IF LARGE PEDAL INPUT IS APPLIED.

2. EICAS - CHECK RUDDER TRAVEL LIMIT (CTRL POS page).

NOTE

The green area on the rudder control position page indicates safe area of rudder deflection for the current airspeed. The red area indicates available but prohibited travel range.

3. Airspeed - REDUCE IF PRACTICAL.

NOTE

- As airspeed is reduced, rudder travel may be limited to less than scheduled. Refer to amber abnormal procedures, RUDDER LIMIT FAIL.
- Single engine controllability may be limited at low airspeed.
- Indicates failure of a single rudder limiter. This failure may restrict rudder travel to less than normal as airspeed is reduced and may reduce nose wheel steering through the rudder pedals after landing.
- Normal lower rudder travel limit varies from $\pm 30°$ (100%) at 140 KIAS to $\pm 4°$ (14%) at 330 KIAS and above.
- The green area on the rudder position display (as indicated on the CAS CTRL POS page) indicates available travel, the area will vary with airspeed.
- If available rudder travel limit (as indicated on the CAS CTRL POS page) is less than 70%, limit crosswind to 10 knots.

4. Land As Soon As Practical.

Procedure completed

■ AUTO SLATS FAIL (AUTO SLATS FAIL CAS MESSAGE)

1. Control Column - PUSH, PITCH DOWN TO HORIZON. 2. Throttles - SET TO CLIMB DETENT. 3. Airspeed - INCREASE.

4. Return to assigned altitude.

WARNING

INDICATES IMMINENT STALL AND AUTO SLATS FAILED TO EXTEND.

Procedure completed

■ HYDRAULIC OVERTEMPERATURE A-B (HYD O'TEMP A-B CAS MESSAGE)

1. Affected HYDRAULIC PUMP Switch - UNLOAD.

NOTE

Indicates that the affected hydraulic system fluid is hot.

● **IF "A" SYSTEM**

1. "A" System Pressure - CHECK (PTU will cycle "A" system pressure between 1500 and 2700 psi).

NOTE

After unloading, the indicated temperature will remain high and may increase due to the small volume of fluid in the unload circuit. However, the system will remain protected.

2. Land as soon as practical.
3. Flaps - 15° MAXIMUM.

□ **BEFORE LANDING**

1. "A" AUX HYDRAULIC PUMP - ON.
2. Refer to Normal Procedures, BEFORE LANDING.

Procedure completed

● **IF "B" SYSTEM**

1. Rudder Standby Pressure - CHECK.
2. Land as soon as practical. Refer to Amber Abnormal Procedures, HYD PUMP FAIL B; BEFORE LANDING.

NOTE

After unloading, the indicated temperature will remain high and may increase due to the small volume of fluid in the unload circuit. However, the system will remain protected.

Procedure completed

■ PRIMARY PITCH TRIM RUNAWAY

1. AP/TRIM/NWS Disengage Button - PRESS and HOLD.

2. Secondary Trim Switch - ON (lift guard cover).
3. AP/TRIM/NWS Disengage Button - RELEASE.
4. Trim - AS REQUIRED.
5. Airspeed - 0.82 MACH MAXIMUM.

6. Altitude - FL410 MAXIMUM.

NOTE

- Flight Guidance Computer trim monitors will detect any stabilizer trim runaway and automatically transfer control to the opposite flight guidance computer.

- Mach trim and autopilot will be inoperative.

7. Land as soon as practical.

Procedure completed

■ SECONDARY PITCH TRIM RUNAWAY

1. Secondary Trim Switch - OFF (close guard cover).

2. Land as soon as practical.
3. Refer to Abnormal Procedures, JAMMED STABILIZER TRIM SYSTEM.

Procedure completed

■ UNCOMMANDED ROLL

- **IF ROLL DUE TO AUTOPILOT OR LATERAL CONTROL INPUT**

1. Control Wheel - APPLY OPPOSITE AILERON AND RUDDER AS REQUIRED.
2. AP/TRIM/NWS Disengage Button - PRESS.
3. Aileron and Rudder Trim - AS REQUIRED.
4. Airspeed - 250 KIAS MAXIMUM (Slow As Required).

WARNING

DO NOT PULL PITCH/ROLL DISCONNECT.

5. Land As Soon As Practical - Refer to Normal Procedures - APPROACH AND LANDING.

Procedure completed

(Continued Next Page)

■ UNCOMMANDED ROLL (Continued)

● IF UNCOMMANDED ROLL OCCURRED AFTER SPEED BRAKES WERE EXTENDED

1. Speed Brakes - RETRACT.

WARNING

DO NOT USE SPEED BRAKES FOR REMAINDER OF FLIGHT.

2. Altitude - MAXIMUM 41,000 FEET, DESCEND AS REQUIRED.
3. Land As Soon As Practical - Refer to Normal Procedures, APPROACH and LANDING.
4. Multiply Normal **FLAPS FULL** Landing Distance by 1.3.

Procedure completed

● IF UNCOMMANDED ROLL OCCURRED AS SPEED BRAKES WERE RETRACTED

1. Speed Brakes - EXTEND TO PREVIOUS POSITION.
2. Land As Soon As Practical. Refer to Abnormal Procedures, SPEED BRAKES FAIL TO RETRACT. DO NOT MOVE SPEED BRAKE LEVER FORWARD.

Procedure completed

● IF UNCOMMANDED ROLL OCCURRED DURING FLAP EXTENSION/RETRACTION

1. Flaps - RETURN TO PREVIOUS POSITION.
2. Land As Soon As Practical. Refer to Abnormal Procedures, LANDING WITH FLAPS OR SLATS INOPERATIVE.

Procedure completed

● IF STILL UNABLE TO REDUCE THE OUT-OF-TRIM FORCE AND AIRCRAFT CONTROL IS NOT IN QUESTION AND NONE OF THE ABOVE APPLY

1. Visually inspect the wing into which the aircraft tends to roll to determine if a roll spoiler is extended.

□ IF ROLL SPOILER IS EXTENDED

1. Left Seat Pilot - FLY AIRPLANE.
2. Pitch/Roll Disconnect Handle - PULL THEN PITCH RECONNECT.
3. Copilot’s Control Wheel - APPLY AND HOLD OPPOSITE INPUT TO BALANCE SPOILERS.
4. Plan a Flaps 15° Landing.
5. Maximum Crosswind Limit 10 Knots.

(Continued Next Page)

■ UNCOMMANDED ROLL (Continued)

● BEFORE LANDING

1. Landing Data - CONFIRM.
   a. Airspeed - V_{REF}.

V_{REF} (KIAS)

FLAPS/SLATS	WEIGHT							
	23,000	25,000	27,000	29,000	31,000	33,000	34,000	35,700
15°/Extended	123	129	134	139	145	153	155	158

   b. Multiply Normal **FLAPS 15°** Landing Distance by 1.9.

CAUTION

AVOID LANDING WITH A TAILWIND OR DOWNHILL RUNWAY GRADIENT.

2. Crew Briefing - COMPLETE.
3. Avionics and Flight Instruments - CHECK/SET.
4. Minimums - SET (RA/BARO).
5. FUEL CROSSFEED - AS REQUIRED, then OFF.
6. ENG SYNC - OFF.
7. Flaps - APPROACH SCHEDULE.
8. Passengers - BRIEF.
9. Seats/Seat Belts/Shoulder Harnesses/Aft Divider Sliding Doors - CHECK/SECURE/LATCHED OPEN (if belted toilet seat occupied).
10. Passenger Advisory Lights - PASS SAFETY.
11. IGNITION - NORM.
12. Pressurization - ZERO DIFFERENTIAL at touchdown.
13. Landing Gear - CHECK DOWN and LOCKED (3 green lights).
14. Flaps - 15°.
15. EICAS - CHECK.
16. Airspeed - V_{REF}.

Procedure completed

■ NOSEWHEEL STEERING MALFUNCTION

1. AP/TRIM/NWS Disengage Button - PRESS and HOLD.
2. Directional Control - MAINTAIN (rudder/brake as required).

Procedure completed

■ LOSS OF INDICATED AIRSPEED/ALTITUDE (AIRSPEED/ALTITUDE RED “X”) AND/OR VERTICAL SPEED DATA (RED VS IN PFD)*

Indicates loss of calibrated airspeed and/or altitude data input.

● IF PILOT’S SIDE

1. Pilot’s ADC REV - PUSH.
2. Confirm Amber ADC2 displayed on PFDs.

Procedure completed

(Continued Next Page)

* Denotes Primus 2000 message

■ LOSS OF INDICATED AIRSPEED/ALTITUDE (AIRSPEED/ALTITUDE RED “X”) AND/OR VERTICAL SPEED DATA (RED VS IN PFD)*
(Continued)

● **IF COPILOT’S SIDE**

1. Copilot’s ADC REV - PUSH
2. Confirm Amber ADC1 displayed on PFDs.

Procedure completed

■ DUAL MICRO AIR DATA COMPUTER FAILURE INDICATED BY LOSS OF PILOT’S AND COPILOT’S AIRSPEED, ALTITUDE, AND VERTICAL SPEED

1. Airspeed and Altitude - USE STANDBY INDICATOR (observe placard V_{MO} schedule, FL410 maximum).

NOTE

- The standby airspeed placard limits are approximately 0.82 Mach above FL240. Linear airspeed interpolation between altitudes is permitted.
- Mach Trim will be inoperative. Refer to Amber Abnormal Procedures, MACH TRIM OFF.
- Both engines will be in ADC reversionary mode. Refer to Amber Abnormal Procedures, FADEC REV ADC-N_1 L-R.

2. Pressurization - MANUAL, ADJUST AS REQUIRED.

WARNING

- **RUDDER LIMITING WILL BE INOPERATIVE. CHECK EICAS. REFER TO EMERGENCY PROCEDURES, DUAL RUDDER LIMITER FAIL.**
- **MINIMUM SPEED SYSTEM WILL BE INOPERATIVE. MINIMUM AIRSPEED ABOVE FL350 IS 150 KIAS.**

NOTE

- Lower rudder yaw dampers will be inoperative.
- Both AHRS will revert to basic mode (AHRS equipped airplanes).
- Transponder altitude reporting and TCAS will be inoperative.
- Autopilot will operate only in basic attitude hold.
- Pitch feel will not vary with airspeed and may be heavy on landing.
- True airspeed and FMS wind data will be inoperative (AHRS equipped airplanes). IRS will use last known true airspeed.
- Overspeed warning and altitude alert will be inoperative.

■ HYDRAULIC WHEEL BRAKE FAILURE

1. Brake Pedals - RELEASE BRAKE PEDAL PRESSURE.
2. EMERGENCY BRAKE Handle - PULL and HOLD until stopped.
3. Directional Control - MAINTAIN with nose wheel steering.

CAUTION

- REPEATED APPLICATION AND RELEASE MAY CAUSE PREMATURE LOSS OF PNEUMATIC PRESSURE.
- WHEN CLEAR OF THE RUNWAY, STOP AND SHUT DOWN. DO NOT ATTEMPT TO TAXI IN CLOSE PROXIMITY TO BUILDINGS OR OTHER AIRCRAFT USING EMERGENCY BRAKES.

NOTE

- The antiskid brake system does not function during emergency braking.
- Multiply normal (**FLAPS FULL**) Landing Distance by 1.25.
- Emergency brake pressure is regulated for optimum braking on most dry surfaces.

■ NO TAKEOFF CAS MESSAGE

1. Takeoff - ABORT, IF BELOW V_1.
2. Correct prior to flight.

NOTE

Select on either MFD, MAIN 2/2 page, push bezel button 5 (under the "NO T/O" text). This enables the NO TAKEOFF TEXT window, which gives the description of the trigger(s) for the NO TAKEOFF warning event. Correct the respective item(s) and then continue the flight. The trigger items will remain in memory, even after having been corrected, until the Avionics power is shutdown at the end of the flight.

Procedure completed

■ LOSS OF INDICATED AIRSPEED/ALTITUDE (AIRSPEED/ALTITUDE RED “X”) AND/OR VERTICAL SPEED DATA (RED VS IN PFD)*
(Continued)

- **IF COPILOT’S SIDE**

1. Copilot’s ADC REV - PUSH
2. Confirm Amber ADC1 displayed on PFDs.

Procedure completed

■ DUAL MICRO AIR DATA COMPUTER FAILURE INDICATED BY LOSS OF PILOT’S AND COPILOT’S AIRSPEED, ALTITUDE, AND VERTICAL SPEED

1. Airspeed and Altitude - USE STANDBY INDICATOR (observe placard V_{MO} schedule, FL410 maximum).

NOTE

- The standby airspeed placard limits are approximately 0.82 Mach above FL240. Linear airspeed interpolation between altitudes is permitted.
- Mach Trim will be inoperative. Refer to Amber Abnormal Procedures, MACH TRIM OFF.
- Both engines will be in ADC reversionary mode. Refer to Amber Abnormal Procedures, FADEC REV ADC-N_1 L-R.

2. Pressurization - MANUAL, ADJUST AS REQUIRED.

WARNING

- **RUDDER LIMITING WILL BE INOPERATIVE. CHECK EICAS. REFER TO EMERGENCY PROCEDURES, DUAL RUDDER LIMITER FAIL.**
- **MINIMUM SPEED SYSTEM WILL BE INOPERATIVE. MINIMUM AIRSPEED ABOVE FL350 IS 150 KIAS.**

NOTE

- Lower rudder yaw dampers will be inoperative.
- Both AHRS will revert to basic mode (AHRS equipped airplanes).
- Transponder altitude reporting and TCAS will be inoperative.
- Autopilot will operate only in basic attitude hold.
- Pitch feel will not vary with airspeed and may be heavy on landing.
- True airspeed and FMS wind data will be inoperative (AHRS equipped airplanes). IRS will use last known true airspeed.
- Overspeed warning and altitude alert will be inoperative.

■ HYDRAULIC WHEEL BRAKE FAILURE

1. Brake Pedals - RELEASE BRAKE PEDAL PRESSURE.
2. EMERGENCY BRAKE Handle - PULL and HOLD until stopped.
3. Directional Control - MAINTAIN with nose wheel steering.

CAUTION

- REPEATED APPLICATION AND RELEASE MAY CAUSE PREMATURE LOSS OF PNEUMATIC PRESSURE.
- WHEN CLEAR OF THE RUNWAY, STOP AND SHUT DOWN. DO NOT ATTEMPT TO TAXI IN CLOSE PROXIMITY TO BUILDINGS OR OTHER AIRCRAFT USING EMERGENCY BRAKES.

NOTE

- The antiskid brake system does not function during emergency braking.
- Multiply normal (**FLAPS FULL**) Landing Distance by 1.25.
- Emergency brake pressure is regulated for optimum braking on most dry surfaces.

■ NO TAKEOFF CAS MESSAGE

1. Takeoff - ABORT, IF BELOW V_1.
2. Correct prior to flight.

NOTE

- If takeoff is continued, the Master Warning and double chime will stop at 80 KIAS. The CAS message will clear upon liftoff.
- NO TAKEOFF Red CAS message indicates engines running with TLA >60° on the ground and one or more of the following:
  - Flaps < 5°.
  - Flaps > 15°.
  - Either slat not extended.
  - Slat asymmetry.
  - Parking brake on.
  - Either start valve open.
  - Speed brakes extended.
  - Stabilizer, aileron, rudder trim not in takeoff limits.
  - Yaw damper not centered.
  - Gust lock on (if installed).
  - Fuel quantity low.
  - ENG SYNC on.
  - AILERON LATCH handle not stowed.
  - Pitch/Roll disconnect handle not stowed.

Procedure completed

■ LOSS OF CAS MESSAGE DISPLAY (RED “X” IN EICAS MESSAGE AREA)*

Indicates failure of FWC 1.

1. Refer to Amber Message Procedure FWC 1-2 FAIL.

■ LOSS OF PITCH/ROLL AND/OR HEADING DATA (ATT FAIL AND/OR HDG FAIL IN PFD)*

Indicates loss of pitch, roll, and/or heading information from the IRS. HDG message is amber.

● **IF PILOT’S SIDE**

1. Standby Attitude - MONITOR.
2. Pilot’s IRS REV - PUSH
3. Confirm ATT2 displayed on PFDs, MAG2 or TRU2 (with IRS) displayed on MFDs and PFDs.

NOTE

Loss of IRS 1 data results in loss of heading data to the standby HSI.

Procedure completed

● **IF COPILOT’S SIDE**

1. Standby Attitude - MONITOR.
2. Copilot’s IRS REV - PUSH
3. Confirm ATT1 displayed on PFDs, MAG1 or TRU1 (with IRS) displayed on MFDs and PFDs.

Procedure completed

■ LOSS OF NAVIGATION DATA (RED “X” OVER GLIDESLOPE AND/OR LATERAL DEVIATION SCALES)*

Indicates loss of data from selected NAV source.

1. Opposite NAV Source - SELECT.
2. Confirm Amber LOC1/LOC2 or VOR1/VOR2 or FMS1/FMS2 Mode annunciation in PFD (and MFDs for FMS).

Procedure completed

* Denotes Primus 2000 Message

■ STABILIZER BLEED LEAK L OR R (STAB BLD LEAK L-R CAS MESSAGE)

1. Affected STABILIZER ANTI-ICE Switch - OFF.
2. Leave icing environment as soon as practical.
3. Refer to Abnormal Procedures, LANDING WITH RESIDUAL ICE, if applicable.

● **IF MESSAGE DOES NOT CLEAR**

1. Opposite STABILIZER ANTI-ICE Switch - OFF.

□ **IF MESSAGE CLEARS WITH OPPOSITE OFF**

1. Affected STABILIZER ANTI-ICE Switch - ON.

NOTE

The stabilizer bleed leak monitor system is enabled whether or not anti-ice is on. If the messsage is displayed with all anti-ice OFF, and it can be verified that anti-ice is off (N_2 and ITT changes), the message may be due to a failed sensor.

2. Refer to Abnormal Procedures, LANDING WITH RESIDUAL ICE, if applicable.

Procedure completed

■ PYLON BLEED LEAK L OR R (PYLON BLD LEAK L-R CAS MESSAGE)

1. Affected ENG BLD AIR Switch - LP.

● **IF IN ICING CONDITIONS**

1. Wing XOVER Switch - WING XOVER.
2. Leave icing conditions as soon as possible.

NOTE

Affected engine inlet anti-ice will not be operative. Increased opposite engine thrust will be required to maintain adequate anti-ice protection to both the stabilizer and wings.

● **IF MESSAGE DOES NOT CLEAR** (approximately 30 seconds)

1. Affected ENG BLD AIR Switch - OFF.
2. PAC ISOL VALVE - OPEN.
3. CKPT and CAB PAC Selector Switches - ON (do not select HIGH above 25,000 feet).

NOTE

CKPT and CAB PAC Switches should not be in HIGH for altitudes above 25,000 feet when the PAC isolation valve is OPEN and either left or right engine bleed air is off.

□ **IF MESSAGE REMAINS ON**

1. Throttle (Affected Side) - IDLE.

○ **IF MESSAGE CLEARS** (probable HP or LP bleed valve failed open)

1. Land as soon as practical.

Procedure completed

(Continued Next Page)

■ PYLON BLEED LEAK L OR R (PYLON BLD LEAK L-R CAS MESSAGE)(Continued)

○ **IF MESSAGE STILL ON** (probable temperature sensor failure)

1. ENG BLD AIR Switch - HP/LP.
2. Land as soon as practical.
3. Use throttle, as required.

Procedure completed

■ CHECK PRIMARY FLIGHT DISPLAYS (CHECK PFD CAS MESSAGE)

1. Standby Instruments - CHECK.
2. PFD(S) - COMPARE DISPLAYED INFORMATION (Attitude, Mach, Airspeed, Altitude, Baro Set).

● **IF PILOT'S DISPLAY INVALID**

3. SG REV Switch - SELECT SG2.

Procedure completed

● **IF COPILOT'S DISPLAY INVALID**

3. SG REV Switch - SELECT SG1.
4. FADEC Switches - LH RESET and RH RESET (to clear FADEC FAULT messages).

Procedure completed

■ EMERGENCY EVACUATION

1. Parking Brake - SET (if gear down).
2. Throttles - BOTH CUTOFF.
3. LH/RH ENG FIRE Switches - BOTH PRESS (if fire suspected).
4. BOTTLE 1 and BOTTLE 2 ARMED Switches - BOTH PRESS (if fire suspected).
5. EMERG LT Switch - ON (night).
6. BATT 1 and BATT 2 Switches - OFF.
7. Airplane and Immediate Area - CHECK FOR BEST ESCAPE ROUTE and DIRECT EVACUATION.

● **IF THRU CABIN DOOR**

1. Cabin Door - OPEN.
2. Move away from airplane.

Procedure completed

● **IF THRU ESCAPE HATCH**

1. Escape Hatch - REMOVE and THROW HATCH OUT OF AIRPLANE.
2. Move away from airplane.

Procedure completed

■ DITCHING

NOTE

The airplane is not certified for ditching under FAR 25.801. Ditching was not conducted during certification testing of the airplane. Should ditching be required, the following procedures are recommended:

(Continued Next Page)

■ DITCHING (Continued)

PRELIMINARY

1. Radio - MAYDAY.
2. Transponder - 7700.
3. ELT - EMER.
4. CKPT PAC, CAB PAC and ENG BLD AIR Switches - OFF (prevents water from entering through bleed valves).
5. Passenger Advisory Lights - PASS SAFETY.
   a. Check aft facing seats full aft and all seats upright and outboard.
6. Water Barrier - IN POSITION.

WARNING

THE WATER BARRIER MUST BE IN POSITION PRIOR TO DITCHING.

NOTE

The water barrier is stowed in the aft bulkhead behind closet door. Crew members should be familiar with its location and use. Passengers should be briefed.

7. Passenger Life Jackets - ON.

CAUTION

LIFE JACKETS MUST NOT BE INFLATED UNTIL OUTSIDE AIRPLANE.

APPROACH

1. Gear - UP.
2. WARN AUDIO 1 and 2 (Copilot's CB Panel) - PULL.
3. Flaps - FULL.
4. Speed - V_{REF}.
5. Rate-of-Descent - 200 TO 300 FEET PER MINUTE.
6. Plan approach to parallel any uniform swell pattern and attempt to touch down along a wave crest or just behind it. If the surface wind is very strong or the water surface rough and irregular, ditch into the wind on the back side of a wave.

WATER CONTACT

1. Airplane Pitch Attitude - Slightly higher than normal landing attitude.
2. Reduce airspeed and rate-of-descent to a minimum but do not stall the airplane.
3. Throttles - CUTOFF just prior to water contact and contact water on a crest of a swell, parallel to the major swell.

AFTER WATER CONTACT

Under reasonable ditching conditions, the airplane should remain afloat an adequate time to launch and board life rafts in an orderly manner.

If possible, the main cabin door should remain closed and evacuation made through the emergency exit. However, the water barrier will allow use of the cabin door as an additional egress route. The water barrier must be in position for ditching and must be installed before the door is opened.

NOTE

The cabin door does not fully open with the water barrier installed.

■ LIFE VEST DONNING PROCEDURES

● ADULT DONNING

1. Grasp the poly bag and tear the pull tab free of the bag, opening the sewn end.
2. Remove the life preserver from the bag.
3. Follow the pictorial instructions in Figure 6-1.
4. The flotation chambers may also be inflated by forcing air into the chamber by mouth using the oral inflation tubes - either for "topping off" the chambers due to gradual air loss - or in the event of failure of the CO_2 gas cartridges.

Procedure completed

LIFE VEST DONNING PROCEDURES

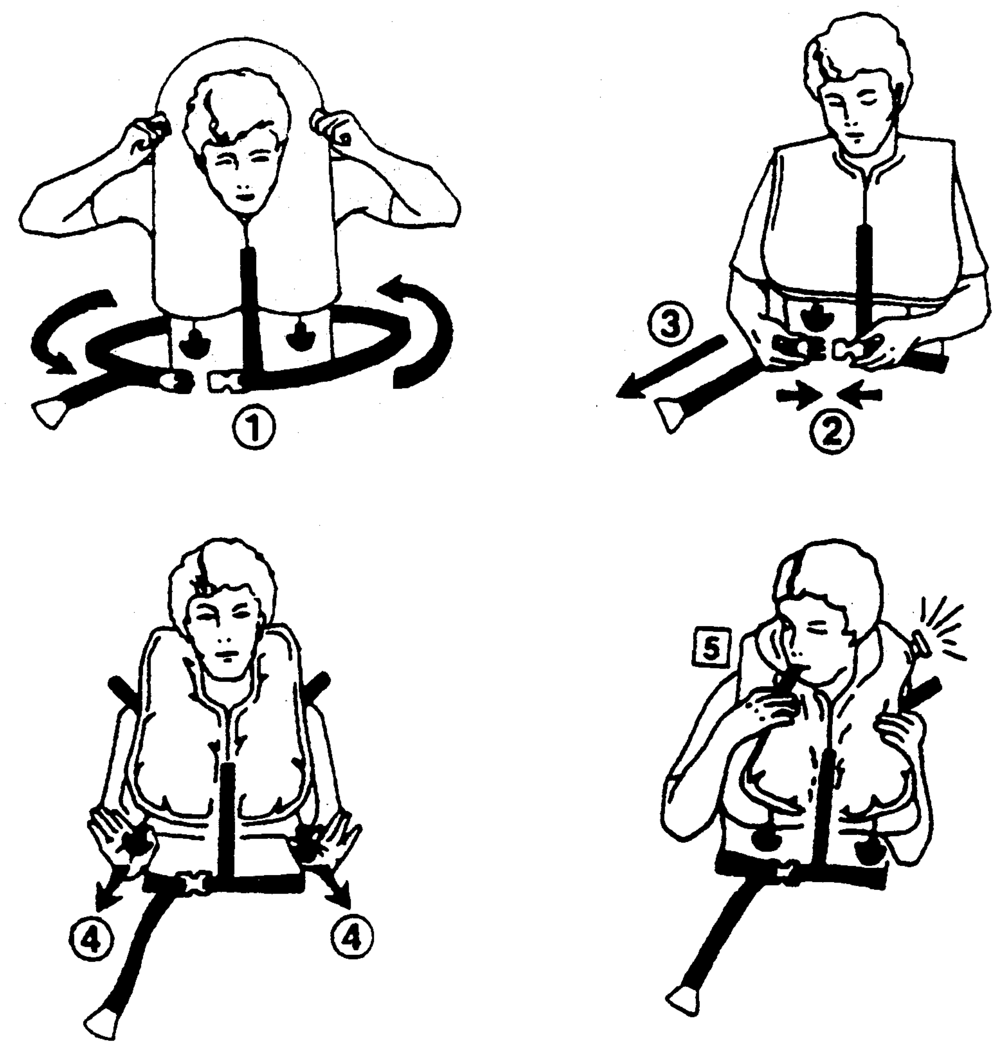


Figure 6-1

■ LIFE VEST DONNING PROCEDURES (continued)

● CHILD DONNING

1. Place life preserver over child's head and down around neck as in adult donning.
2. Run the waist strap around the back of the child's waist and back to the front as in adult donning.
3. Buckle the waist strap together to the center strap as in adult donning.
4. Adjust waist strap so it is tight about child's waist by pulling on the short, tabbed end of the waist strap.
5. For small children whose head may slip through the life preserver's neck opening, pass the excess length of waist strap between the child's legs from front to back. Tie this excess strap securely to the tight waist strap at the child's back. The excess strap should be against the crotch, but not tight.
6. Inflate life preserver as in adult operation. Small children may only require one cell of the life preserver to be inflated.
7. The flotation chambers may also be inflated by forcing air into the chamber by mouth using the oral inflation tubes - either for "topping off" the chambers due to gradual air loss - or in the event of failure of the CO_2 gas cartridges.

Procedure completed

■ MINIMUM SPEED (MINIMUM SPEED RED CAS MESSAGE ILLUMINATED AND AURAL WARNING)

1. Control Column - PUSH, PITCH DOWN TO HORIZON.
2. Throttles - SET TO TO/MC DETENT.
3. Airspeed - ABOVE LOW SPEED AWARENESS WHITE ARC.
4. Climb - TO ASSIGNED ALTITUDE.
5. Throttles - SET CLB, THEN CRU.

WARNING

THE MINIMUM SPEED WARNING SYSTEM, IN ADDITION TO THE STICK SHAKER STALL WARNING, IS TO WARN OF EXCESSIVELY LOW AIRSPEED AT ALTITUDES AT OR ABOVE 35,000 FEET MSL. CONTINUING TO SLOW BELOW THIS WARNING MAY RESULT IN DUAL ENGINE FLAMEOUT.

NOTE

Activation of the minimum speed system below 35,000 feet MSL indicates a system failure and should not be responded to unless other indications of low airspeed are present.

SECTION VII

FLIGHT PLANNING AND PERFORMANCE

CONTENTS

WEIGHT AND BALANCE

The performance of the Model 750 is determined primarily by the gross weight of the airplane and the location of the center-of-gravity. These factors depend on the number and location of passengers and crew as well as the location and weight of cargo, equipment, fuel, etc. For specific details concerning weight and center-of-gravity, refer to the Weight and Balance Data Sheet.

The center-of-gravity of an airplane can be defined as the point on the longitudinal axis about which the airplane would balance. The force of weight always acts through the center-of-gravity. The forces of lift attempt to rotate the airplane about the center-of-gravity.

In flight, the forces of gravity and lift from the wing and horizontal stabilizer must balance about the center-of-gravity so that stability is achieved.

CENTER-OF-GRAVITY FORCES

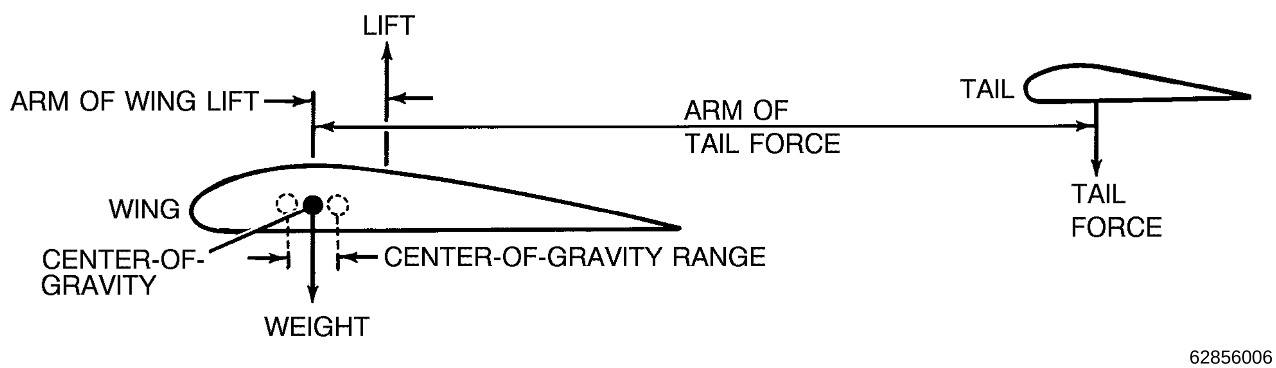


Figure 7-1

As the center-of-gravity changes forward or aft due to airplane loading, the lever or moment arm of the wing and tail lifting surfaces changes.

The horizontal stabilizer must be capable of providing an equalizing moment to that which is produced by the remainder of the airplane. Since the amount of lift produced by the horizontal stabilizer is limited, the range of movement of the center-of-gravity is restricted so that equilibrium can be maintained. Loading must be calculated as being within the allowable envelope to achieve proper stability and control.

The center-of-gravity of an empty airplane is found by accurate weighing to determine the balance point. This point is then defined by labeling it in inches aft of a fixed reference line located forward of the airplane nose. This line is called the Reference Datum Line. Selection of the Reference Datum line is arbitrary, but it does provide a standard from which center-of-gravity movement along the longitudinal axis can be measured.

AIRPLANE WEIGHING INFORMATION

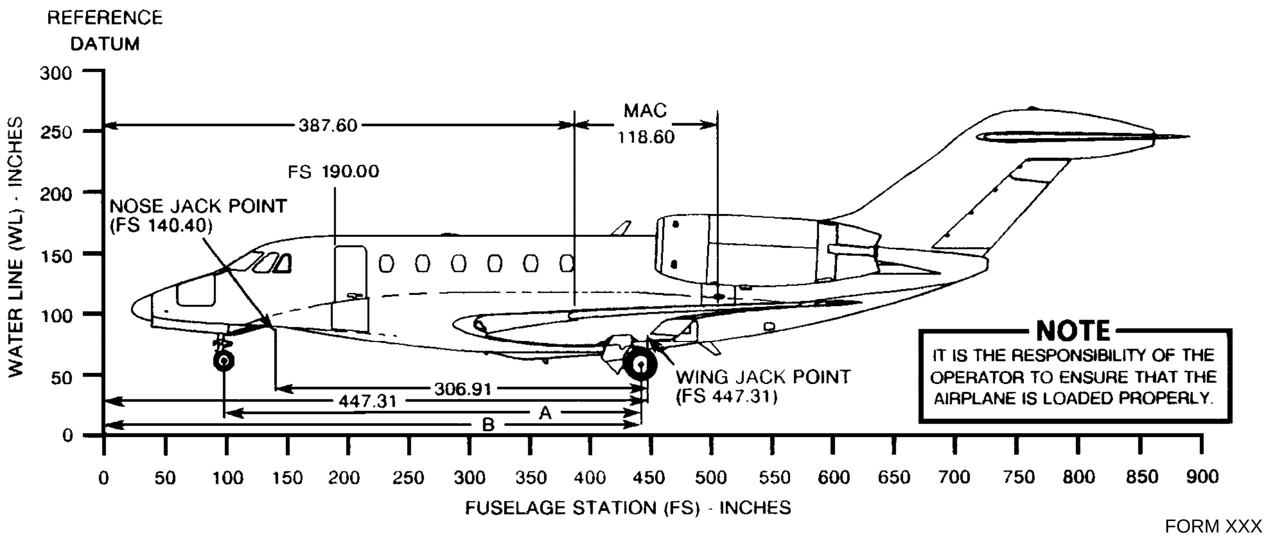


Figure 7-2

The Basic Empty Weight center-of-gravity for a typical Model 750 will be located approximately 436.0 inches aft of the Reference Datum Line. Depending on airplane gross weight, the center-of-gravity of a loaded airplane can move from 405.4 inches to 429.1 inches aft of Datum and remain within limits.

As the airplane is loaded, the center-of-gravity will shift. The amount of shift is dependent on not only the weight added, but the distance the weight is placed from the original center-of-gravity. Both of these factors can be considered by multiplying the weight added by the distance from the Reference Datum Line to produce the loading moment. This information is presented in table form in the Crew and Passenger, Cabinet, Baggage and Fuel Loading Moments Tables in the Weight and Balance Data sheet.

The contribution each load station makes to center-of-gravity shift can be seen by comparing the respective center-of-gravity arm lengths given in the Weight and Moment Table. Any weight placed in the aft baggage compartment will shift the center-of-gravity aft since it is aft of the typical Basic Empty Weight center-of-gravity.

Adding fuel or passengers will shift the center-of-gravity forward since it is forward of the typical Basic Empty Weight center-of-gravity. The magnitude of the shift for any given weight is proportional to the length of the moment arm.

SAMPLE LOADING PROBLEMS

Determining Operational Weights and Center-of-Gravity by Use of Allowable Fuel Graph

Determine the operational takeoff weight and center-of-gravity. Loading tables are found in the Weight and Balance Manual and in the Weight and Balance Data Sheets. The following step-by-step procedure illustrates a logical manner in which to approach the loading problem. The sample computation form represented by Figure 7-3 (Sheet 1 of 2) represents a problem using this method of calculation.

Step 1. Use the Crew and Passenger Weight and Moment Tables obtained from Weight and Balance Data Sheets to determine the moment for each load station. Enter the figures for each load station in the Weight and Balance Computation Form (refer to Figure 7-3).

Step 2. Use the Baggage Loading Table from the Weight and Balance Manual to determine the moment for baggage loading in the tailcone compartment. Enter the weight and moments for each load station in the Weight and Balance Form.

Step 3. Use the Cabinet and Cargo Compartments Weight and Moments Tables obtained from the Weight and Moment Tables in the Weight and Balance Data Sheets to determine the moment for any cabinet contents and enter the figures in the Weight and Balance Computation Form. Do the same for the crew navigation charts.

Step 4. Total the payload items and enter the totals on the Weight and Balance Form (Figure 7-3) (two places).

Step 5. Enter the Airplane Basic Empty weight and moment from the Airplane Weighing Form on the Computation Data Form. If the airplane has been altered, refer to the Weight and Balance Record.

Step 6. Total the Basic Empty Weight and Payload and check the zero fuel weight.

NOTE

- To check approved limits, locate the weight on the Center-of-Gravity Limits Envelope Graph. (Refer to Figure 7-8) Approved points are points located below the Zero Fuel Weight Line.
- Maximum design zero fuel weight is limited to 24,400 pounds.

(Continued Next Page)

Step 7. If the zero fuel weight center-of-gravity is forward of FS 429.11, place a zero on the Ballast Fuel line. If the zero fuel weight center-of-gravity is aft of FS 429.11, plot the point on the Ballast Fuel Graph (refer to Figure 7-6) to determine ballast fuel requirements. Enter the value on the Computation Form.

NOTE

Ballast fuel cannot be used without causing the aft center-of-gravity limit to be exceeded.

Step 8. To determine the amount of fuel which may be loaded on the airplane, plot the zero fuel weight and center-of-gravity on the Allowable Fuel Graph (refer to Figure 7-4). If the point falls within the shaded area, refer to the appropriate Allowable Fuel; Subgraph (Figure 7-5 Sheet 1, Sheet 2, or Sheet 3). Transfer the allowable fuel value found to the Fuel Loading line (item 4) on the computation Form.

Step 9. To determine the moment for the allowable fuel, refer to the Fuel Loading Weight and Moment table (Figure 7-7). Enter and total the weight and moment values for the Wing tank and Center/Fairing Tank on the Allowable Fuel line (item 5).

Step 10. Subtract the ballast fuel weight from the allowable fuel weight to determine the Usable Fuel Quantity (item 7) or the amount of fuel available for ground and flight operations. Ensure value meets flight planning needs.

Step 11. Total the zero fuel weight and moment (item 3) and the allowable fuel weight and moment (item 5) to obtain the ramp weight and moment (item 8). Ensure values are within approved limits.

NOTE

- To check approved limits, locate the weight on the Center-of-Gravity Limits Envelope Graph (refer to Figure 7-8) Approved points are points located below the Maximum Ramp Weight Line.

- Maximum design zero fuel weight is limited to 24,400 pounds.

Step 12. Subtract the weight and moment of the fuel used for taxi (item 9) from the ramp weight and moment (item 8) to determine the takeoff weight and moment and the airplane's center-of-gravity for takeoff (item 10). A standard 300-pound burn-off is assumed. Ensure the values are within the approved limits.

NOTE

- To check the approved limits, locate the weight on the Center-of-Gravity Limits Envelope Graph (refer to figure 7-8). Approved points are points located within the envelope below the Maximum Takeoff Weight line.

- The moment value for 300 pounds of taxi fuel will vary with the amount of allowable fuel loaded. Determine taxi fuel moments by interpolation using the Fuel Loading Weight and Moment table (refer to Figure 7-7).

- Maximum Design Takeoff Weight is limited to 35,700 pounds.

Step 13. Determine the estimated weight of the fuel to be used to arrive at destination. The moment may be obtained from the Fuel Loading Weight and Moment table (refer to Figure 7-7) . Enter the weight of the fuel remaining at arrival (item 11) in the Computation Form.

NOTE

Ballast fuel cannot be used without causing the aft center-of-gravity limit to be exceeded.

Step 14. Add the weight and moment of the fuel remaining at arrival to the zero fuel weight and moment (item 2) to determine the landing weight and center-of-gravity (item 12). Ensure the values are within approved limits.

NOTE

Maximum Design Landing Weight is limited to 31,800 pounds.

Determining Operational Weights and Center-of-Gravity by Flight Planning Method

Determine the operational takeoff weight and center-of-gravity. Loading tables are found in the Weight and Balance Manual and in the Weight and Balance Data Sheets. The sample computation form represented by Figure 7-3 (sheet 2) represents this method of planning. The following step-by-step procedure illustrates a logical manner in which to approach the loading problem.

Step 1. Use the Crew and Passenger Weight and Moment Tables obtained from Weight and Balance Data Sheets to determine the moment for each load station. Enter the figures for each load station in the Weight and Balance Computation Form (refer to Figure 7-3).

Step 2. Use the Baggage Loading Table from the Weight and Balance Manual to determine the moment for baggage loading in the tailcone compartment. Enter the weight and moments for each load station in the Weight and Balance Form.

Step 3. Use the Cabinet and Cargo Compartments Weight and Moments Tables obtained from the Weight and Moment Tables in the Weight and Balance Data Sheets to determine the moment for any cabinet contents and enter the figures in the Weight and Balance Computation Form. Do the same for the crew navigation charts.

Step 4. Total the payload items and enter the totals on the Computation Form (Figure 7-3) (two places).

Step 5. Enter the Airplane Basic Empty weight and moment from the Airplane Weighing Form on the Computation Data Form. If the airplane has been altered, refer to the Weight and Balance Record.

Step 6. Total the Basic Empty Weight and Payload and check the zero fuel weight.

NOTE

- To check approved limits, locate the weight on the Center-of-Gravity Limits Envelope Graph. (Refer to Figure 7-8) Approved points are points located below the Zero Fuel Weight Line.

- Maximum design zero fuel weight is limited to 24,400 pounds.

Step 7. If the zero fuel weight center-of-gravity is forward of FS 429.11, place a zero on the Ballast Fuel line. If the zero fuel weight center-of-gravity is aft of FS 429.11, plot the point on the Ballast Fuel Graph (refer to Figure 7-6) to determine ballast fuel requirements. Enter the value on the Computation Form.

NOTE

Ballast fuel cannot be used without causing the aft center-of-gravity limit to be exceeded.

Step 8. If usable fuel quantity is determined according to flight planning needs, enter the needed amount in item 7. Add this value to the ballast fuel weight determined in step 7 and enter the total weight on the Allowable Fuel line (item 5). Based on this value, determine the weights and moments for the wing tank and center/fairing tank (refer to Figure 7-7) and total the moments for the allowable fuel.

Step 9 Total the zero fuel weight and moment (item 3) and the allowable fuel weight and moment (item 5) to obtain the ramp weight and (item 8). Ensure the values are within the approved limits.

NOTE

- To check approved limits, locate the weight and center-of-gravity on the Center-of-Gravity Limits Envelope Graph (refer to Figure 7-8). Approved points are points located inside the envelope, but not inside the darker shaded portion of the upper left hand side. If the point falls in the darker shaded portion of the envelope, fuel burn may cause the forward center-of-gravity limits to be exceeded. The planned amount of fuel must be reduced from the center/Fairing tank or the payload must be adjusted, and the ramp weight and moment must be recalculated until the point no longer falls in this area.

- Maximum design ramp weight is limited to 36,000 pounds.

Step 10. Subtract the taxi fuel weight and moment (item 9) from the ramp weight and moment (item 8) to determine the takeoff weight and moment and the airplane's center-of-gravity for takeoff (item 10). A standard 300 pound taxi fuel burn-off is assumed. Ensure the values are with in the approved limits.

NOTE

- To check approved limits, locate the point on the Center-of-Gravity Limits Envelope Graph (refer to figure 7-8). Approved points are points located below the Maximum Weight Line and within the envelope.

- The moment value for 300 pounds of taxi fuel will vary with the amount of allowable fuel loaded. Determine taxi fuel moments by interpolation using the Fuel Loading Weight and Moment Table (refer to Figure 7-7).

- Maximum design landing weight is limited to 31,800 pounds.

Step 11. Determine the estimated weight of the fuel remaining at destination. The moment may be obtained from the Fuel Loading Weight and Moment Table (refer to Figure 7-7). Enter the weight of the fuel remaining at arrival (item 11) in the Computation Form.

NOTE

Ballast fuel cannot be used without causing the aft center-of-gravity limit to be exceeded.

Step 12. Add the weight and moment of the fuel remaining at arrival (item 11) to the zero fuel weight and moment (item 2) to determine the landing weight and center-of-gravity (item 12). Ensure the values are within approved limits.

NOTE

Maximum Design Landing Weight is limited to 31,800 pounds.

WEIGHT AND BALANCE FORM

WEIGHT AND BALANCE COMPUTATION FORM

PAYLOAD COMPUTATIONS

OCCUPANTS / ITEMS	ARM (INCHES)	WEIGHT (POUNDS)	MOMENT/100 (INCH-POUNDS)
PILOT	144.6	170	245.82
COPILOT	144.6	170	245.82
SEAT 3	229.2		
SEAT 4	229.2		
SEAT 5	290.2	175	507.85
SEAT 6	290.2	170	493.34
SEAT 7	318.8	180	573.84
SEAT 8	318.8	185	589.78
SEAT 9	379.7	205	778.39
SEAT 10	379.7		
SEAT ____			
SEAT ____			
SEAT ____			
SEAT ____			
TOILET	412.2		
REFRESHMENT CENTER STORES	181.5		
CABINET CONTENTS			
CHARTS	158.1	40	63.24
TAILCONE BAGGAGE	490.0	280	1372.00
SKI COMPARTMENT	492.9		
PAYLOAD (Sub-total)		1575	4870.08

ITEM	WEIGHT (POUNDS)	MOMENT/100 (INCH-POUNDS)
1. BASIC EMPTY WEIGHT (BEW)	20,896	91,733.44
2. PAYLOAD	1575	4870.08
3. ZERO FUEL WEIGHT Sum of Payload and Basic Empty Weight. Do not exceed maximum zero fuel weight of 24,400 pounds. ** Airplane CG *** = 429.9 inches	22,471	96,603.52
4. FUEL LOADING Refer to Allowable Fuel Graph and Fuel Loading Weight and Moment Table.	13,031	
WING TANK	7036	28,852.28
CENTER/FAIRING TANK	5995	20,102.58
5. ALLOWABLE FUEL - Total of Fuel Loading.	13,031	48,954.86
6. BALLAST FUEL - From Graph.	420	
7. USABLE FUEL QUANTITY Allowable Fuel less Ballast Fuel.	12,611	
8. RAMP WEIGHT * Sum of Zero Fuel Weight and Allowable Fuel. Do not exceed maximum ramp weight of 36,000 pounds. ** Airplane CG **** = 410.0 inches	**** 35,502	145,558.38
9. LESS FUEL FOR TAXIING	300	1428.20
10. TAKEOFF WEIGHT * Do not exceed maximum takeoff weight of 35,700 pounds. ** Airplane CG **** = 409.4 inches	**** 35,202	144,130.18
11. FUEL REMAINING AT ARRIVAL	7005	28,702.02
12. LANDING WEIGHT * Sum of Zero Fuel Weight and Fuel Remaining at Arrival. Do not exceed maximum landing weight of 31,800 pounds. ** Airplane CG **** = 425.1 inches	**** 29,476	125,305.54

* Totals must be within approved weight and center-of-gravity limits. It is the responsibility of the operator to ensure that the airplane is loaded properly. The Basic Empty Weight CG is noted on the Airplane Weighing Form. If the airplane has been altered, refer to the Weight and Balance Record for information.

** Airplane CG = $\frac{\text{MOMENT/100}}{\text{WEIGHT}}$ X 100

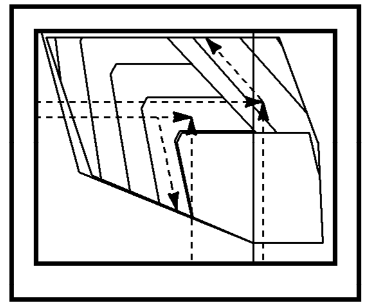
*** If Zero Fuel Weight Center-of-Gravity is greater than 429.11 inches, refer to Ballast Fuel Graph to determine amount of ballast fuel required to remain within the aft CG limit.

**** Enter the Center-of-Gravity Limits Envelope Graph to verify airplane is loaded within approved limits.

FORM NUMBER 1960X1, 1 May 1996
REVISED 9 August 1996

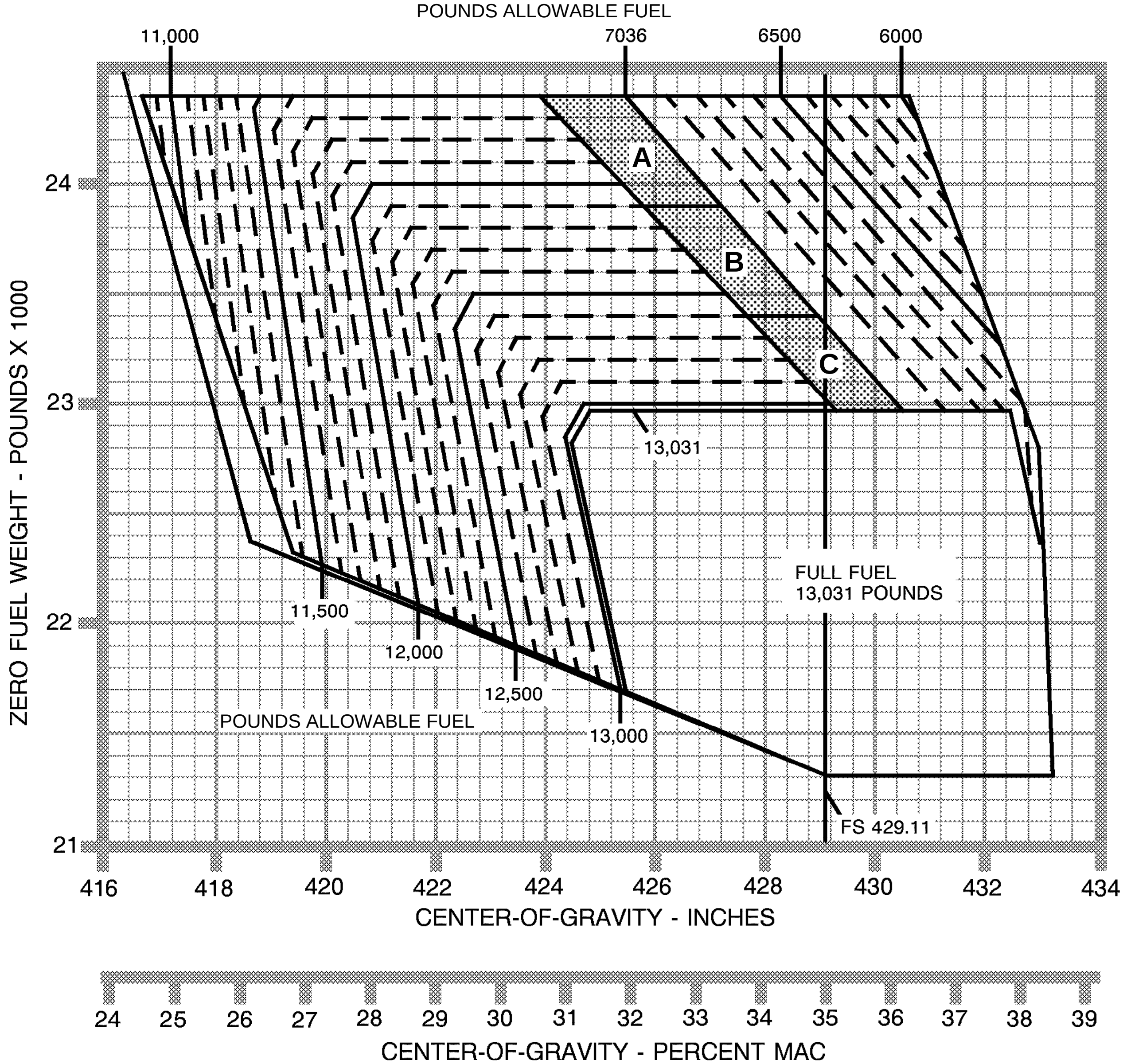
Figure 7-3

ALLOWABLE FUEL GRAPH



NOTE: IF POINT FALLS WITHIN SHADED AREA, REFER TO APPROPRIATE ALLOWABLE FUEL SUBGRAPH.

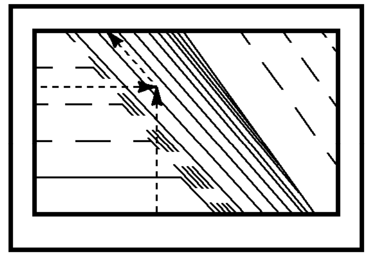
NOTE: ALLOWABLE FUEL IS THE MAXIMUM AMOUNT OF FUEL WHICH MAY BE LOADED (BASED ON ZFW) AND INCLUDES BALLAST FUEL IF ANY.



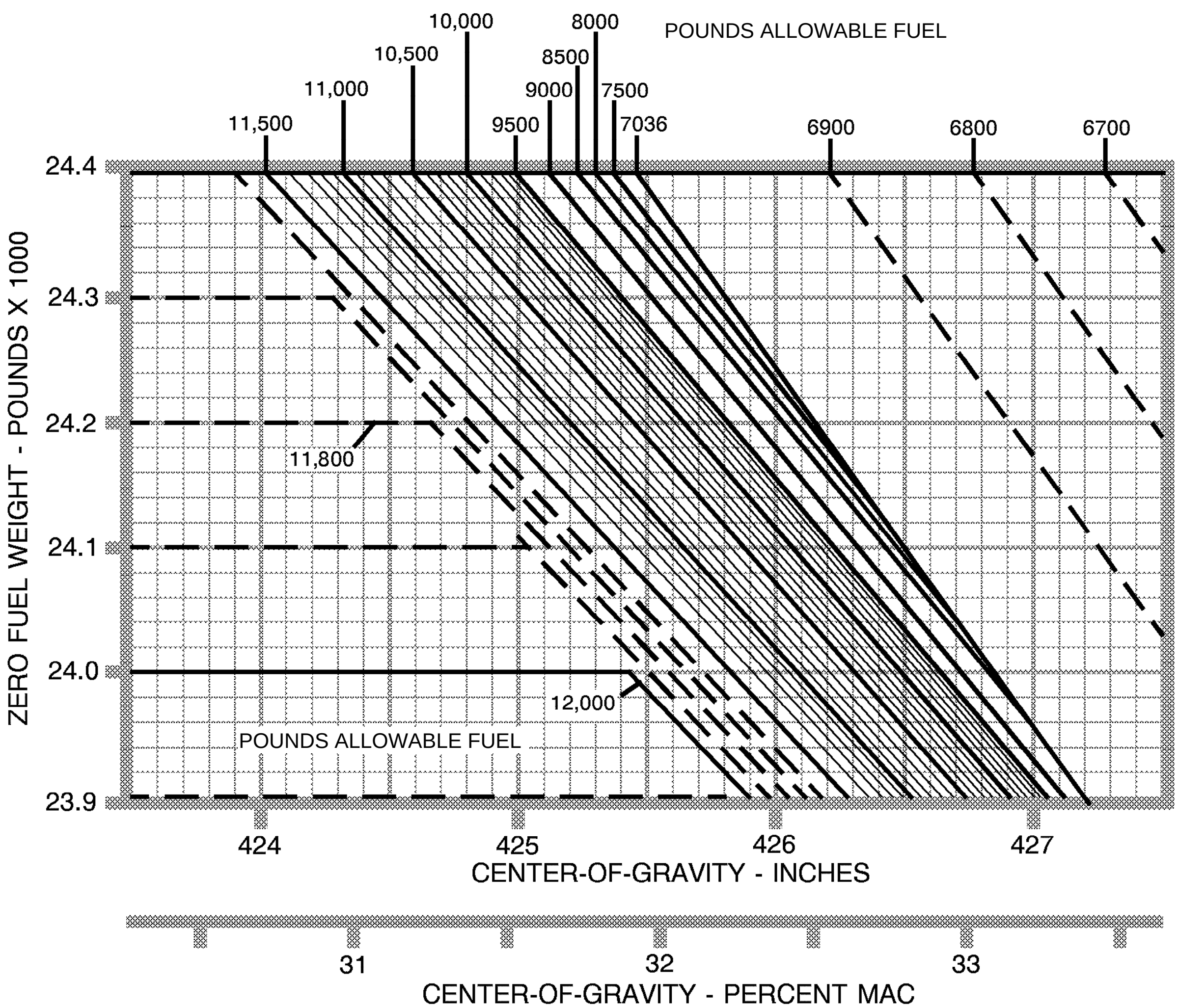
FORM NUMBER 1954, 1 May 1996
REVISED 9 August 1996

Figure 7-4

ALLOWABLE FUEL SUBGRAPH - A



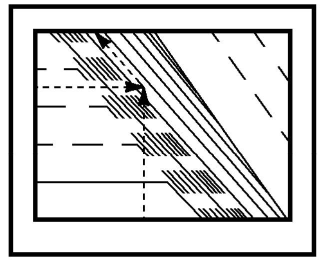
NOTE: ALLOWABLE FUEL GIVEN IN POUNDS.



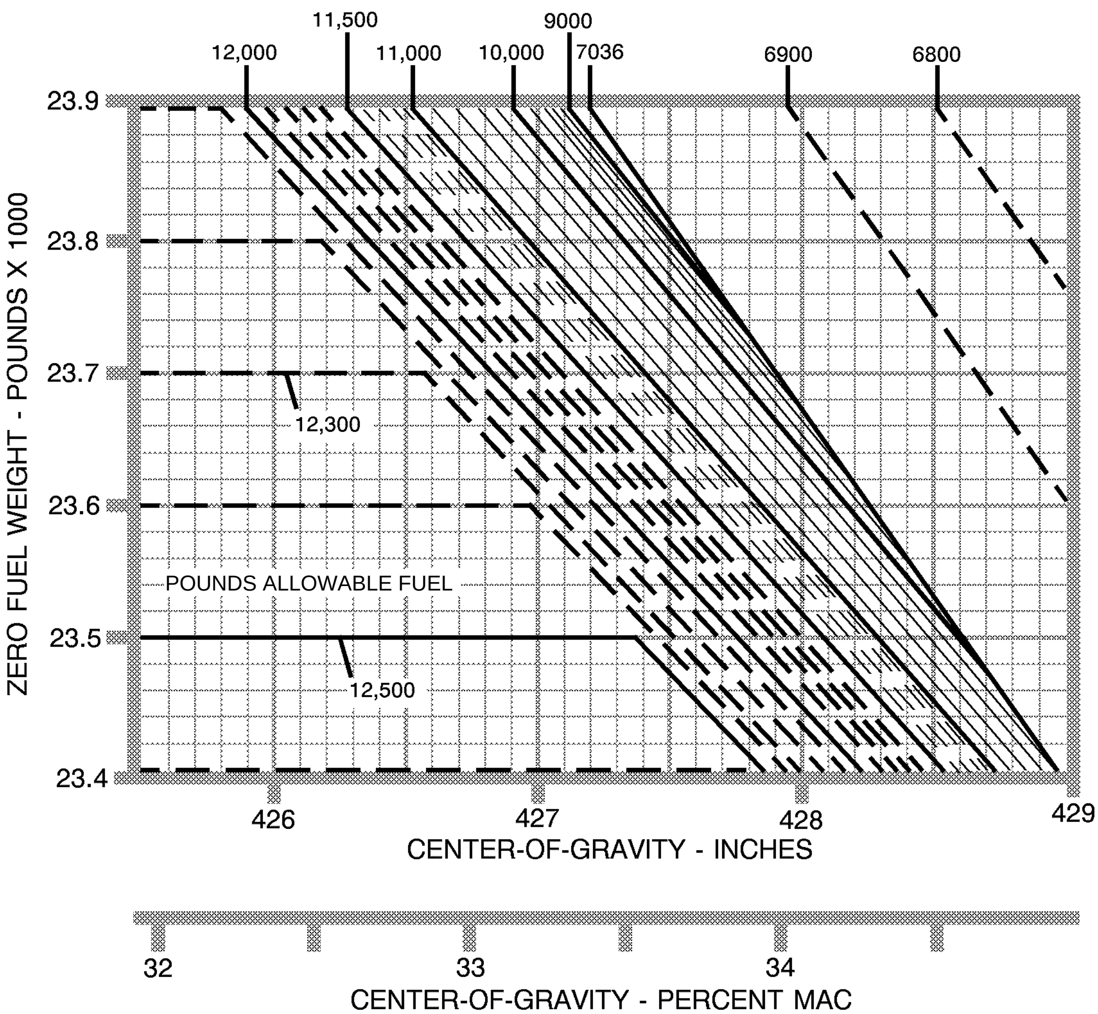
FORM NUMBER 1973, 1 May 1996
REVISED 9 August 1996

Figure 7-5 (Sheet 1 of 3)

ALLOWABLE FUEL SUBGRAPH - B



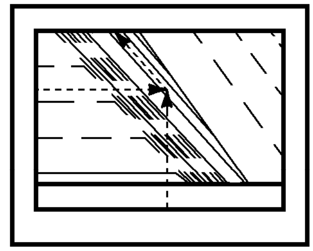
NOTE: ALLOWABLE FUEL GIVEN IN POUNDS.



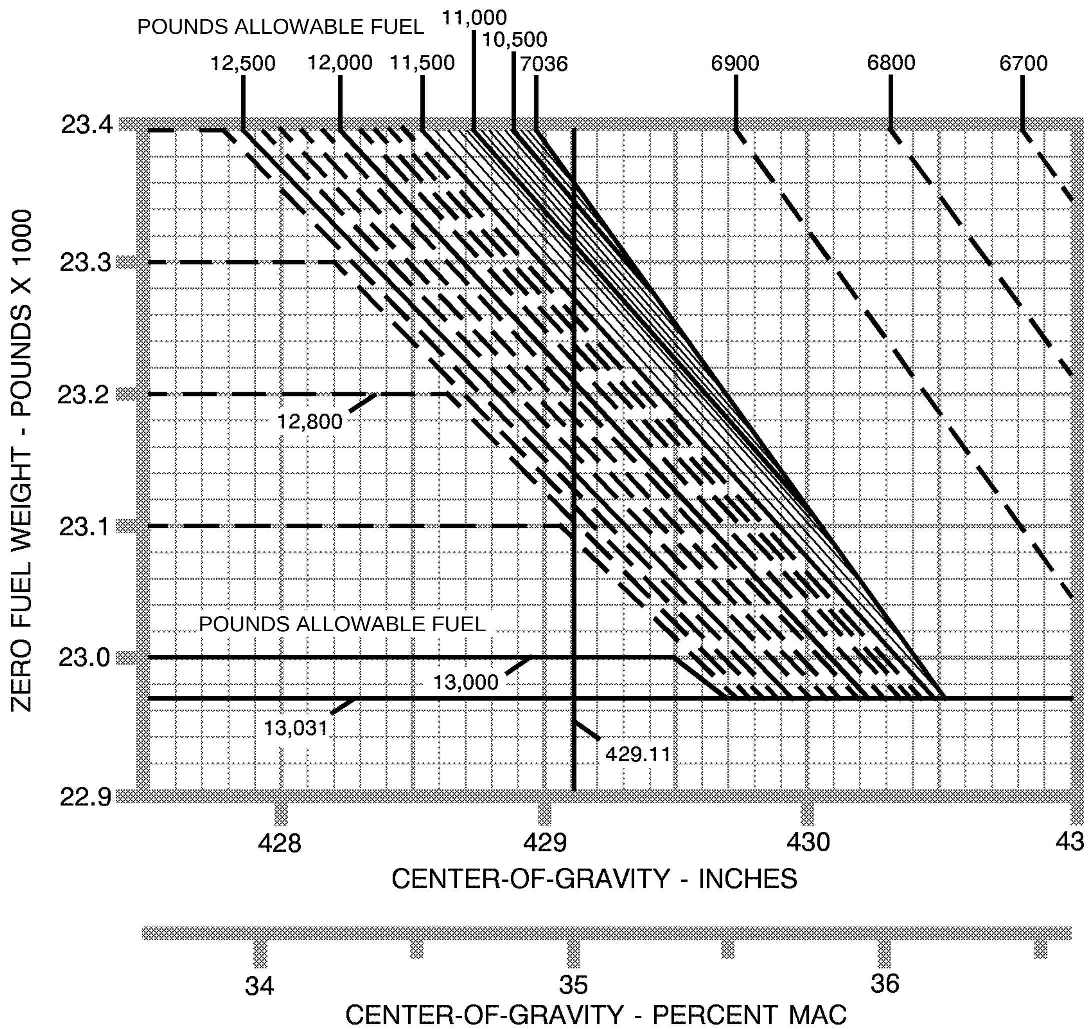
FORM NUMBER 1974, 1 May 1996
REVISED 9 August 1996

Figure 7-5 (Sheet 2 of 3)

ALLOWABLE FUEL SUBGRAPH - C



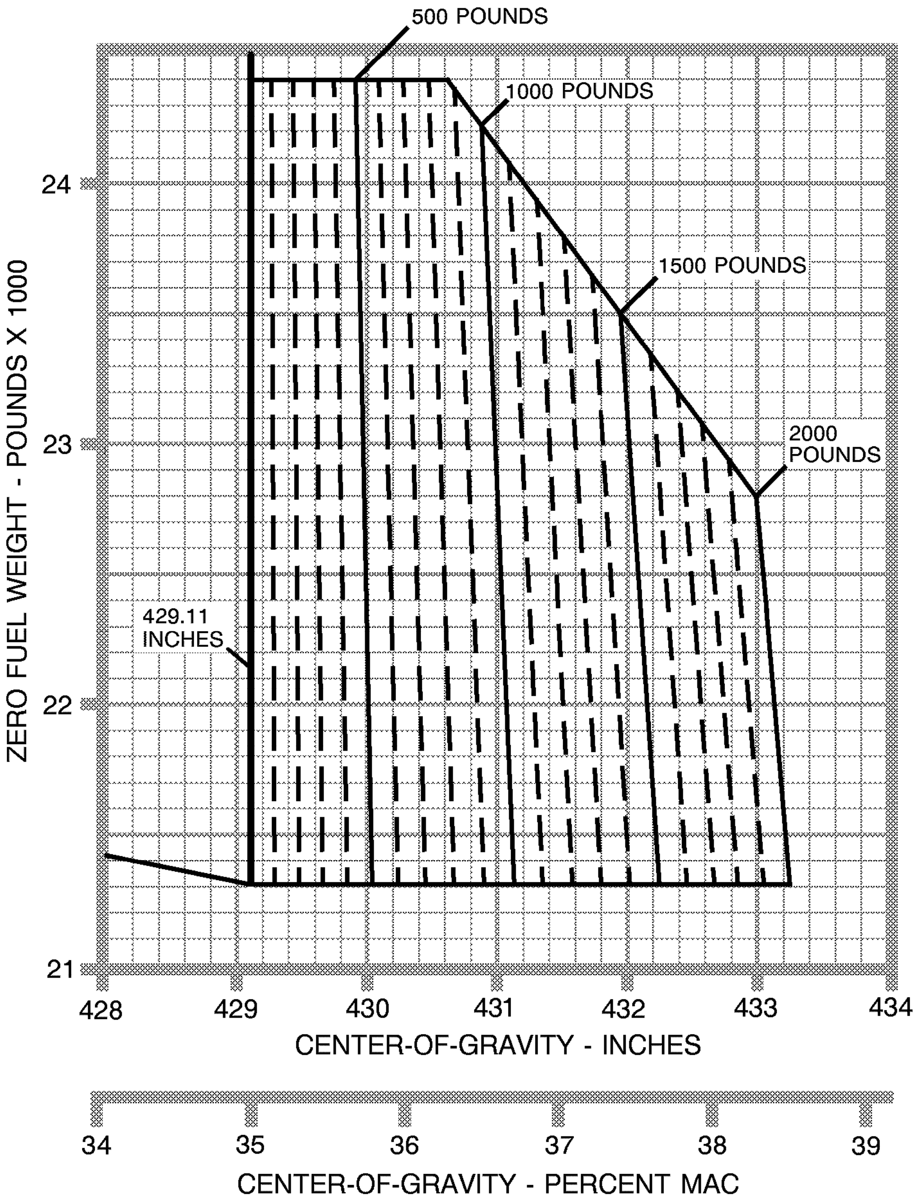
NOTE: ALLOWABLE FUEL GIVEN IN POUNDS.

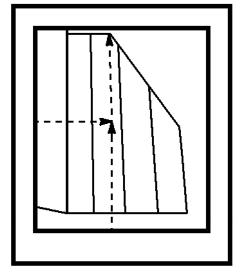


FORM NUMBER 1975, 1 May 1996
REVISED 9 August 1996

Figure 7-5 (Sheet 3 of 3)

BALLAST FUEL GRAPH





FORM NUMBER 1955, 1 May 1996
REVISED 9 August 1996

Figure 7-6

FUEL LOADING WEIGHT AND MOMENT TABLE

WING TANK FUEL

WEIGHT (POUNDS)	MOMENT/100 ARM VARIES (INCH-POUNDS)
470	1832.44
600	2334.78
800	3099.52
1000	3861.60
1200	4623.96
1400	5388.32
1600	6155.68
1800	6926.22
2000	7700.00
2200	8476.82
2400	9256.32
2600	10,039.12
2800	10,825.64
3000	11,616.60
3200	12,411.20
3400	13,209.68
3600	14,012.28
3800	14,818.86
4000	15,630.00
4200	16,445.10
4400	17,264.72
4600	18,088.58
4800	18,916.80
5000	19,751.00
5200	20,592.00
5400	21,442.86
5600	22,304.24
5800	23,176.80
6000	24,060.60
6200	24,956.24
6250	25,181.88
6405	25,887.78
6605	26,809.74
6805	27,747.66
7005	28,702.02
7036	28,852.28

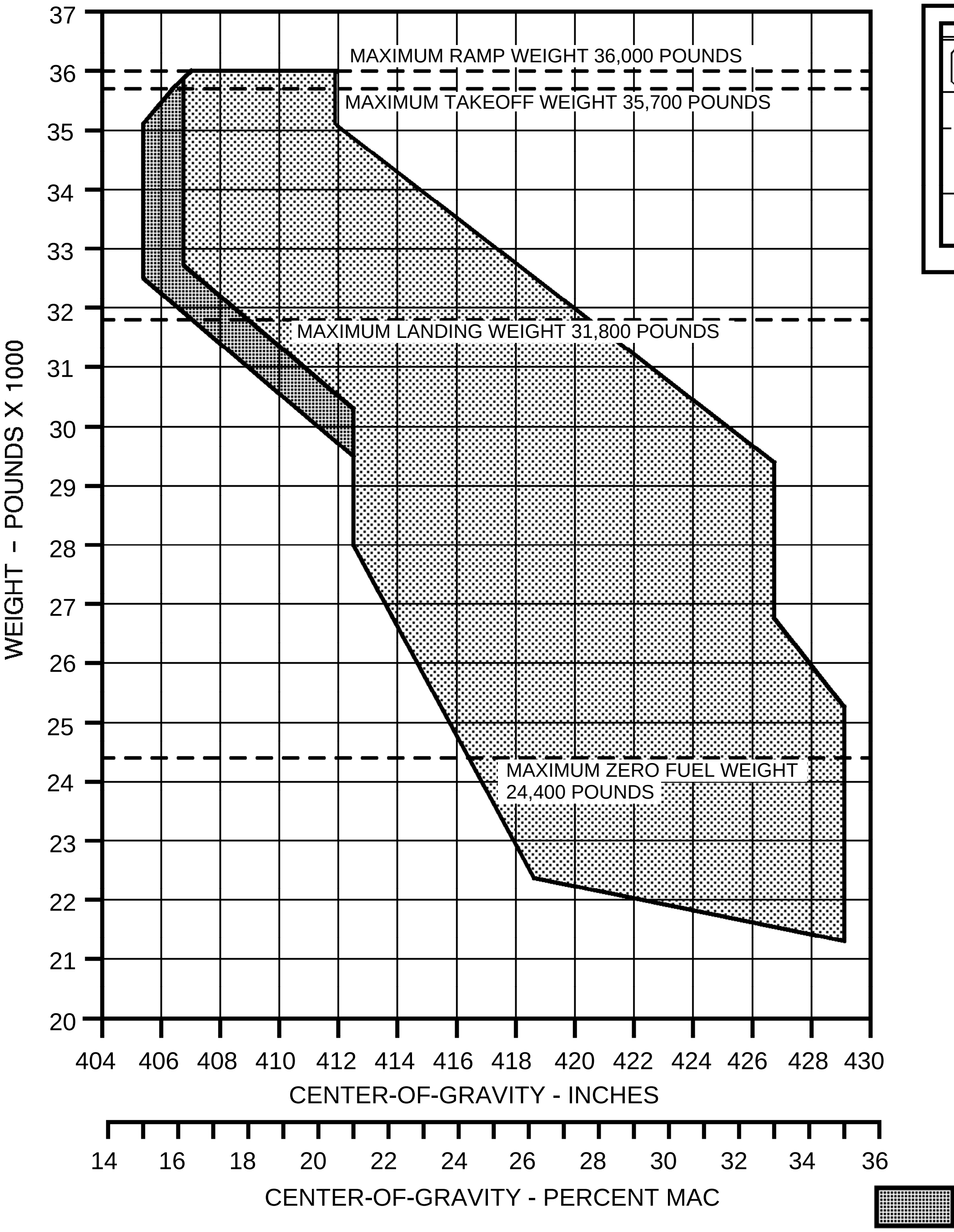
CENTER/FAIRING TANK FUEL

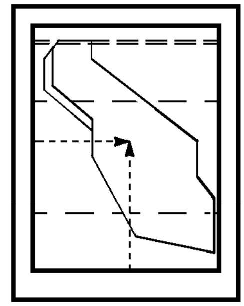
WEIGHT (POUNDS)	MOMENT/100 ARM VARIES (INCH-POUNDS)
150	551.25
350	1246.51
550	1927.69
750	2598.33
950	3266.05
1150	3933.43
1350	4604.05
1550	5274.01
1750	5946.93
1950	6614.45
2150	7288.33
2350	7955.65
2550	8624.21
2750	9294.43
2950	9964.88
3150	10,631.19
3350	11,299.09
3550	11,969.93
3750	12,637.13
3950	13,303.75
4150	13,971.01
4350	14,637.03
4550	15,299.77
4750	15,966.93
4950	16,632.21
5150	17,302.51
5350	17,970.13
5550	18,633.89
5750	19,293.73
5850	19,623.22
5950	19,952.03
5995	20,102.58

FORM NUMBER 1959, 1 May 1996

Figure 7-7

CENTER-OF-GRAVITY LIMITS





= **NOTE:**

IF LOADED IN THIS AREA WITH MORE THAN 3100 POUNDS PER SIDE WING FUEL, CHECK THAT FUEL BURN WILL NOT EXCEED THE FORWARD CG LIMIT.

FORM NUMBER 1953, 1 May 1996
REVISED 9 August 1996

Figure 7-8

PRIMARY TRIM TAKEOFF SETTING VS AIRPLANE CENTER-OF-GRAVITY

EXAMPLE:

TAKEOFF FLAP 15°
HORIZONTAL STABILIZER SETTING AT 23% MAC: = -6.2 DEGREES

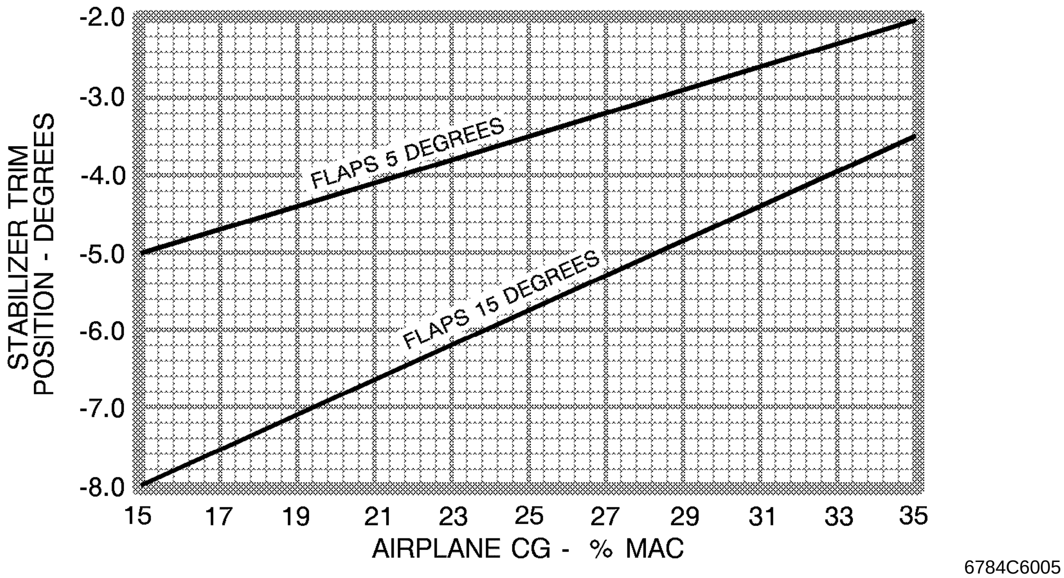


Figure 7-9

FLIGHT PLANNING

Thorough flight planning suggests establishing a preflight goal such as maximum range, minimum time enroute, or maximum fuel reserve within the parameters defined by the FAA Approved Airplane Flight Manual takeoff, climb and landing requirements. Graphs for Maximum Cruise Thrust, Normal Cruise Thrust, and Long Range Cruise are presented in this chapter to aid the crew in determining how best to achieve that goal. Maximum Cruise Thrust results in minimum time, Long Range Cruise in optimum fuel consumption and Normal Cruise represents a balance between the two.

Maximum range at a given altitude is dependent upon airframe efficiency and can be defined in still air as that point on the total drag curve where the relationship of velocity to total airplane drag is most favorable. The cruise angle-of-attack necessary to achieve that point is constant, but airspeed required is affected by airplane weight. The higher the weight, the higher the airspeed necessary to achieve optimum cruise angle-of-attack. This is in evidence when the Long Range Cruise FLIGHT PLANNING graphs are used and result in longer block times for the lighter weights. Enroute, as fuel burn-off occurs, thrust and airspeed required for best range will decrease as specific range increases due to improved performance at the lower operating weights. This should be considered when planning short stage lengths, to avoid carrying excessive weight in stored fuel not operationally necessary.

Wind existing at cruise altitudes requires a more involved planning process to realize best range because it requires a true airspeed faster or slower than that at which optimum range angle-of-attack is achieved in still air. This minimizes the effects of a headwind, or takes maximum advantage of a tailwind. The broad altitude capability of the Model 750 also brings into consideration engine efficiency. Since the fuel flow necessary for a given true airspeed decreases with an increase in altitude, a higher headwind component may be tolerated at the upper flight levels with best results in terms of ground distance covered to fuel consumed. Conversely, large increases in headwind velocity with altitude may dictate a lower cruise level to obtain the best fuel to distance relationship.

To assist altitude selection taking into account upper winds, Cruise tables in Performance Section present specific range as nautical miles per 100 pounds of fuel for different winds.

In comparative calculations, the highest number always represents best specific range. The Maximum Range mode will generally result in optimum specific range, but high headwinds may suggest an increased power setting to realize a shorter trip time without affecting total fuel burn appreciable. At 35,000 feet and 28,000 pounds gross weight with a 100-knot headwind, as an example, Maximum Range and Maximum Cruise Thrust give 19.9 and 14.6 nautical miles/100 pounds, respectively. In that case, Maximum Range will produce only 5.3 nautical miles more distance per 100 pounds of fuel while the ground speed at Maximum Cruise Thrust would be approximately 140 knots faster. For the absolute best range or maximum fuel reserve goal however, cruising at the altitude/wind/thrust combination with the highest specific range number will produce optimum results.

Climb and descent at maximum speed available to achieve desired vertical rate can be used in conjunction with Maximum Cruise Thrust for the minimum time goal. Fuel economy, however, is better served by using the climb and descent schedules presented in the PERFORMANCE chapter of this section.

Once the cruise mode and altitude has been determined, enroute time and fuel required can be approximated from the appropriate FLIGHT PLANNING tables.

The following criteria are used:

1. 300 pounds of taxi fuel.
2. 300 KIAS/.80 MACH climb schedule
3. 60 percent of the cruise wind factor applied to climb; 40 percent to descent.
4. Descent to 10,000 feet from cruise altitude using normal descent profile.
5. Thirty nautical miles from destination at 10,000 feet and long range cruise airspeed.
6. Ten minutes approach fuel at 1900 pounds per hour total fuel flow.
7. No reserve fuel.

FUEL RANGE TABLE USAGE

Entering the table at the planned stage length, read the fuel and time required per the conditions. If the fuel required is in excess of fuel available or if fuel reserves are inadequate, it may be advantageous to utilize one of the more economical cruise airspeed profiles and repeat the flight planning process. Specific data are presented in the PERFORMANCE chapter for separate computation of the climb, cruise and descent phases. If taxi time is known, 15 pounds per minute fuel flow can be used in lieu of the 300-pound figure.

After airplane loading and flight plan fuel requirements are determined, takeoff, climb and landing gross weights should be rechecked for compliance with Flight Manual criteria.

FLIGHT PLANNING
MAXIMUM CRUISE THRUST
CRUISE (82.9% N1)

STANDARD DAY **CRUISE ALTITUDE 19000 FEET**

		TAILWIND						ZERO		HEADWIND					
STAGE	T.O.	100 KT.		50 KT.		25 KT.		WIND		25 KT.		50 KT.		100 KT.	
LENGTH NM.	WEIGHT LBS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.
200	35700	1871.	0.66	1982.	0.69	2047.	0.71	2121.	0.72	2205.	0.74	2300.	0.76	2540.	0.81
	29000	1812.	0.65	1923.	0.68	1989.	0.69	2063.	0.71	2147.	0.73	2242.	0.75	2483.	0.80
	23000	1768.	0.64	1880.	0.67	1945.	0.68	2020.	0.70	2104.	0.72	2200.	0.74	2440.	0.79
400	35700	3023.	1.02	3248.	1.09	3379.	1.12	3526.	1.16	3692.	1.21	3879.	1.26	4342.	1.38
	29000	2960.	1.01	3184.	1.07	3314.	1.11	3461.	1.15	3625.	1.19	3811.	1.24	4270.	1.36
	23000	2913.	1.00	3137.	1.06	3267.	1.09	3413.	1.13	3577.	1.18	3762.	1.23	4219.	1.35
500	35700	3599.	1.20	3881.	1.28	4045.	1.33	4229.	1.38	4436.	1.44	4669.	1.50	5244.	1.66
	29000	3533.	1.19	3814.	1.27	3977.	1.31	4160.	1.36	4365.	1.42	4596.	1.48	5164.	1.63
	23000	3486.	1.18	3765.	1.26	3928.	1.30	4110.	1.35	4314.	1.41	4543.	1.47	5108.	1.62
600	35700	4174.	1.38	4514.	1.48	4711.	1.54	4932.	1.60	5179.	1.67	5458.	1.75	6145.	1.94
	29000	4107.	1.37	4444.	1.46	4640.	1.52	4859.	1.58	5104.	1.65	5380.	1.73	6058.	1.91
	23000	4058.	1.35	4394.	1.45	4589.	1.50	4806.	1.57	5050.	1.64	5325.	1.71	5997.	1.90
700	35700	4750.	1.56	5146.	1.68	5377.	1.75	5634.	1.82	5923.	1.91	6248.	2.00	7046.	2.22
	29000	4681.	1.54	5074.	1.66	5302.	1.72	5557.	1.80	5843.	1.88	6164.	1.97	6952.	2.19
	23000	4631.	1.53	5022.	1.65	5249.	1.71	5503.	1.78	5787.	1.87	6106.	1.95	6886.	2.18
800	35700	5326.	1.74	5779.	1.88	6042.	1.96	6337.	2.04	6666.	2.14	7038.	2.24	7947.	2.51
	29000	5255.	1.72	5704.	1.85	5965.	1.93	6256.	2.02	6582.	2.11	6949.	2.22	7846.	2.47
	23000	5204.	1.71	5651.	1.84	5910.	1.91	6200.	2.00	6523.	2.10	6887.	2.20	7776.	2.45
900	35700	5902.	1.92	6412.	2.08	6708.	2.17	7039.	2.26	7410.	2.37	7827.	2.49	8849.	2.79
	29000	5828.	1.90	6334.	2.05	6628.	2.14	6955.	2.24	7321.	2.34	7733.	2.46	8739.	2.75
	23000	5776.	1.89	6279.	2.04	6571.	2.12	6896.	2.21	7259.	2.32	7668.	2.44	8665.	2.73
1000	35700	6477.	2.10	7045.	2.27	7374.	2.38	7742.	2.48	8153.	2.60	8617.	2.74	9750.	3.07
	29000	6402.	2.08	6964.	2.24	7290.	2.34	7654.	2.45	8060.	2.57	8517.	2.71	9633.	3.02
	23000	6349.	2.06	6908.	2.23	7232.	2.32	7593.	2.43	7996.	2.55	8449.	2.68	9554.	3.00
1100	35700	7053.	2.28	7678.	2.47	8040.	2.58	8445.	2.70	8897.	2.84	9406.	2.98	10651.	3.35
	29000	6976.	2.26	7595.	2.44	7953.	2.55	8353.	2.67	8799.	2.80	9302.	2.95	10527.	3.30
	23000	6921.	2.24	7536.	2.43	7892.	2.53	8289.	2.65	8732.	2.78	9231.	2.92		
1200	35700	7629.	2.46	8311.	2.67	8706.	2.79	9147.	2.92	9641.	3.07	10196.	3.23	11552.	3.64
	29000	7549.	2.44	8225.	2.64	8616.	2.76	9052.	2.89	9538.	3.03	10086.	3.19	11421.	3.58
	23000	7494.	2.42	8165.	2.62	8553.	2.73	8986.	2.86	9469.	3.01				
1300	35700	8205.	2.64	8944.	2.87	9372.	3.00	9850.	3.14	10384.	3.30	10986.	3.48	12453.	3.92
	29000	8123.	2.62	8855.	2.83	9278.	2.96	9750.	3.11	10278.	3.26	10871.	3.44	12314.	3.86
	23000	8066.	2.60	8793.	2.82	9214.	2.94	9683.	3.08						
1400	35700	8781.	2.82	9577.	3.07	10038.	3.21	10553.	3.36	11128.	3.54	11775.	3.72	13355.	4.20
	29000	8697.	2.80	9485.	3.03	9941.	3.17	10449.	3.32	11017.	3.49	11655.	3.68	13208.	4.13
	23000	8639.	2.77	9422.	3.01										
1500	35700	9356.	3.00	10210.	3.27	10704.	3.42	11255.	3.58	11871.	3.77	12565.	3.97	14256.	4.48
	29000	9271.	2.97	10115.	3.22	10604.	3.37	11148.	3.54	11756.	3.72	12439.	3.93	14102.	4.41
	23000	9211.	2.95												
1600	35700	9932.	3.18	10843.	3.46	11370.	3.63	11958.	3.80	12615.	4.00	13354.	4.22		
	29000	9844.	3.15	10745.	3.42	11266.	3.58	11847.	3.76	12495.	3.95	13224.	4.17		
	23000	9784.	3.13												
1700	35700	10508.	3.36	11475.	3.66	12036.	3.84	12660.	4.02	13358.	4.23				
	29000	10418.	3.33	11375.	3.61	11929.	3.79	12546.	3.98	13234.	4.18				
	23000	10356.	3.31												
1800	35700	11084.	3.54	12108.	3.86	12702.	4.05	13363.	4.24						
	29000	10992.	3.51	12005.	3.81	12592.	3.99	13245.	4.20						
	23000	10929.	3.48												
1900	35700	11659.	3.72	12741.	4.06	13368.	4.25								
	29000	11565.	3.69	12636.	4.01	13255.	4.20								
	23000	11501.	3.66												
2000	35700	12235.	3.90	13374.	4.26										
	29000	12139.	3.87	13266.	4.20										
	23000	12074.	3.84												
2100	35700	12811.	4.08	14007.	4.45										
	29000	12713.	4.05	13896.	4.40										
	23000	12646.	4.02												
2200	35700	13387.	4.26												
	29000	13287.	4.22												
	23000	13219.	4.19												

NOTE: FUEL VALUES LARGER THAN THE MAXIMUM USABLE FUEL ARE PRESENTED FOR INTERPOLATION PURPOSES.

Figure 7-10 (Sheet 1 of 14)

FLIGHT PLANNING
MAXIMUM CRUISE THRUST
CRUISE (84.7% N1)

STANDARD DAY **CRUISE ALTITUDE 23000 FEET**

		TAILWIND						ZERO WIND		HEADWIND					
		100 KT.		50 KT.		25 KT.				25 KT.		50 KT.		100 KT.	
STAGE LENGTH NM.	T.O. WEIGHT LBS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.
200	35700	1840.	0.67	1937.	0.69	1994.	0.70	2060.	0.72	2133.	0.73	2216.	0.75	2425.	0.79
	29000	1767.	0.65	1865.	0.67	1923.	0.69	1989.	0.70	2063.	0.72	2146.	0.74	2357.	0.78
	23000	1713.	0.64	1812.	0.66	1870.	0.68	1936.	0.69	2010.	0.71	2094.	0.73	2306.	0.77
400	35700	2923.	1.01	3122.	1.06	3238.	1.09	3367.	1.13	3512.	1.17	3675.	1.21	4075.	1.31
	29000	2846.	0.99	3046.	1.05	3161.	1.08	3290.	1.11	3435.	1.15	3597.	1.19	3995.	1.30
	23000	2790.	0.98	2989.	1.03	3105.	1.06	3234.	1.10	3378.	1.14	3540.	1.18	3936.	1.28
600	35700	4006.	1.35	4307.	1.44	4481.	1.49	4675.	1.54	4891.	1.60	5134.	1.67	5725.	1.83
	29000	3926.	1.33	4226.	1.42	4399.	1.47	4592.	1.52	4807.	1.58	5048.	1.65	5633.	1.81
	23000	3868.	1.32	4167.	1.40	4339.	1.45	4532.	1.51	4745.	1.56	4985.	1.63	5567.	1.79
800	35700	5089.	1.69	5492.	1.81	5724.	1.88	5983.	1.96	6271.	2.04	6593.	2.14	7375.	2.36
	29000	5006.	1.67	5406.	1.79	5637.	1.85	5894.	1.93	6179.	2.02	6498.	2.11	7271.	2.33
	23000	4946.	1.66	5344.	1.77	5574.	1.84	5829.	1.92	6113.	1.99	6430.	2.09	7198.	2.30
900	35700	5631.	1.87	6084.	2.00	6346.	2.08	6637.	2.17	6960.	2.26	7322.	2.37	8200.	2.62
	29000	5546.	1.84	5997.	1.98	6256.	2.05	6544.	2.14	6865.	2.23	7223.	2.33	8090.	2.59
	23000	5484.	1.83	5933.	1.95	6191.	2.03	6478.	2.12	6797.	2.21	7153.	2.31	8013.	2.56
1000	35700	6172.	2.04	6677.	2.19	6967.	2.27	7290.	2.37	7650.	2.48	8052.	2.60	9025.	2.88
	29000	6086.	2.01	6587.	2.16	6875.	2.24	7195.	2.34	7551.	2.45	7949.	2.56	8909.	2.85
	23000	6023.	1.99	6522.	2.14	6809.	2.23	7127.	2.32	7480.	2.42	7875.	2.54	8828.	2.81
1100	35700	6714.	2.21	7269.	2.37	7589.	2.47	7944.	2.58	8339.	2.69	8781.	2.83	9850.	3.14
	29000	6626.	2.18	7177.	2.35	7494.	2.44	7846.	2.55	8237.	2.67	8674.	2.79	9728.	3.10
	23000	6562.	2.16	7111.	2.32	7426.	2.42	7776.	2.53	8164.	2.64	8598.	2.77	9644.	3.07
1200	35700	7255.	2.38	7861.	2.56	8211.	2.67	8598.	2.79	9029.	2.91	9511.	3.06	10675.	3.40
	29000	7166.	2.35	7767.	2.54	8113.	2.63	8497.	2.75	8923.	2.88	9399.	3.02	10548.	3.36
	23000	7101.	2.33	7699.	2.51	8043.	2.61	8425.	2.73	8848.	2.85	9321.	3.00		
1300	35700	7797.	2.55	8454.	2.75	8832.	2.86	9252.	3.00	9719.	3.13	10240.	3.29	11500.	3.66
	29000	7705.	2.52	8357.	2.72	8732.	2.83	9148.	2.96	9609.	3.10	10125.	3.25	11367.	3.62
	23000	7640.	2.50	8288.	2.69	8661.	2.81	9074.	2.93	9532.	3.06				
1400	35700	8338.	2.72	9046.	2.93	9454.	3.06	9906.	3.20	10408.	3.35	10970.	3.52	12325.	3.92
	29000	8245.	2.69	8947.	2.91	9351.	3.02	9798.	3.16	10295.	3.32	10850.	3.48	12186.	3.88
	23000	8179.	2.67	8877.	2.88	9278.	3.00								
1500	35700	8880.	2.90	9639.	3.12	10075.	3.26	10560.	3.41	11098.	3.57	11699.	3.75	13150.	4.18
	29000	8785.	2.86	9538.	3.09	9970.	3.22	10449.	3.37	10981.	3.53	11575.	3.70	13005.	4.14
	23000	8718.	2.84	9466.	3.06										
1600	35700	9421.	3.07	10231.	3.31	10697.	3.45	11214.	3.62	11787.	3.78	12429.	3.99	13975.	4.44
	29000	9325.	3.03	10128.	3.28	10589.	3.41	11100.	3.57	11667.	3.75	12301.	3.93	13824.	4.40
	23000	9256.	3.01												
1700	35700	9963.	3.24	10824.	3.50	11319.	3.65	11867.	3.82	12477.	4.00	13158.	4.22		
	29000	9865.	3.20	10718.	3.47	11208.	3.61	11751.	3.78	12353.	3.97	13026.	4.16		
	23000	9795.	3.18												
1800	35700	10504.	3.41	11416.	3.68	11940.	3.85	12521.	4.03	13167.	4.22				
	29000	10405.	3.37	11308.	3.65	11827.	3.80	12402.	3.98	13039.	4.18				
	23000	10334.	3.35												
1900	35700	11046.	3.58	12008.	3.87	12562.	4.04	13175.	4.24						
	29000	10945.	3.54	11898.	3.84	12446.	4.00	13052.	4.19						
	23000	10873.	3.52												
2000	35700	11588.	3.75	12601.	4.06	13184.	4.24								
	29000	11485.	3.71	12489.	4.02	13065.	4.19								
	23000	11412.	3.69												
2100	35700	12129.	3.92	13193.	4.24										
	29000	12025.	3.88	13079.	4.21										
	23000	11951.	3.86												
2200	35700	12671.	4.10	13786.	4.43										
	29000	12565.	4.05	13669.	4.40										
	23000	12489.	4.02												
2300	35700	13212.	4.27												
	29000	13104.	4.22												
	23000	13028.	4.19												

NOTE: FUEL VALUES LARGER THAN THE MAXIMUM USABLE FUEL ARE PRESENTED FOR INTERPOLATION PURPOSES.

Figure 7-10 (Sheet 2)

FLIGHT PLANNING
MAXIMUM CRUISE THRUST
CRUISE (87.2% N1)

STANDARD DAY | **CRUISE ALTITUDE 27000 FEET**

		TAILWIND						ZERO		HEADWIND					
STAGE	T.O.	100 KT.		50 KT.		25 KT.		WIND		25 KT.		50 KT.		100 KT.	
LENGTH NM.	WEIGHT LBS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.
200	35700	1819.	0.67	1907.	0.69	1958.	0.70	2016.	0.72	2082.	0.73	2156.	0.74	2343.	0.78
	29000	1734.	0.66	1823.	0.68	1875.	0.69	1935.	0.70	2001.	0.71	2077.	0.73	2266.	0.76
	23000	1671.	0.64	1761.	0.66	1814.	0.67	1874.	0.69	1941.	0.70	2017.	0.72	2208.	0.75
400	35700	2858.	1.00	3039.	1.05	3143.	1.08	3259.	1.11	3389.	1.14	3535.	1.18	3890.	1.27
	29000	2772.	0.98	2954.	1.03	3058.	1.06	3176.	1.09	3306.	1.12	3453.	1.16	3809.	1.25
	23000	2708.	0.97	2890.	1.02	2995.	1.04	3112.	1.07	3243.	1.11	3389.	1.14	3745.	1.23
600	35700	3897.	1.33	4170.	1.41	4327.	1.45	4502.	1.50	4697.	1.56	4913.	1.61	5437.	1.76
	29000	3810.	1.31	4084.	1.39	4242.	1.43	4417.	1.48	4611.	1.53	4828.	1.60	5353.	1.73
	23000	3745.	1.29	4019.	1.37	4176.	1.41	4351.	1.46	4544.	1.52	4760.	1.57	5282.	1.71
800	35700	4936.	1.66	5302.	1.77	5512.	1.82	5745.	1.89	6004.	1.97	6292.	2.05	6984.	2.25
	29000	4848.	1.64	5215.	1.74	5425.	1.80	5658.	1.87	5916.	1.94	6204.	2.03	6896.	2.22
	23000	4782.	1.61	5148.	1.72	5357.	1.78	5589.	1.85	5846.	1.92	6132.	2.00	6818.	2.20
1000	35700	5974.	1.98	6434.	2.12	6697.	2.20	6988.	2.28	7311.	2.38	7670.	2.48	8532.	2.74
	29000	5886.	1.96	6345.	2.10	6608.	2.18	6900.	2.26	7222.	2.35	7580.	2.46	8439.	2.70
	23000	5819.	1.94	6277.	2.08	6538.	2.15	6828.	2.23	7148.	2.33	7503.	2.43	8355.	2.68
1100	35700	6494.	2.15	7000.	2.30	7289.	2.38	7610.	2.48	7965.	2.59	8359.	2.70	9305.	2.98
	29000	6405.	2.13	6911.	2.27	7200.	2.36	7520.	2.45	7874.	2.56	8268.	2.68	9211.	2.95
	23000	6338.	2.10	6841.	2.25	7129.	2.34	7447.	2.43	7798.	2.53	8189.	2.64	9124.	2.92
1200	35700	7013.	2.31	7566.	2.48	7882.	2.57	8231.	2.68	8618.	2.80	9049.	2.92	10079.	3.22
	29000	6924.	2.29	7476.	2.45	7792.	2.55	8141.	2.65	8527.	2.77	8956.	2.90	9982.	3.19
	23000	6856.	2.26	7405.	2.43	7719.	2.52	8066.	2.62	8449.	2.74	8875.	2.86	9892.	3.16
1300	35700	7533.	2.47	8131.	2.66	8474.	2.76	8853.	2.87	9272.	3.00	9738.	3.14	10852.	3.47
	29000	7443.	2.45	8041.	2.63	8383.	2.74	8761.	2.84	9179.	2.97	9644.	3.11	10754.	3.43
	23000	7375.	2.42	7970.	2.61	8310.	2.71	8685.	2.81	9100.	2.94	9561.	3.07		
1400	35700	8052.	2.64	8697.	2.84	9067.	2.94	9474.	3.07	9926.	3.21	10427.	3.35	11626.	3.71
	29000	7962.	2.62	8607.	2.81	8975.	2.92	9382.	3.04	9832.	3.18	10332.	3.33	11525.	3.68
	23000	7893.	2.59	8534.	2.78	8900.	2.89	9304.	3.01						
1500	35700	8571.	2.80	9263.	3.02	9659.	3.13	10096.	3.26	10579.	3.42	11116.	3.57	12400.	3.96
	29000	8481.	2.78	9172.	2.99	9567.	3.11	10003.	3.23	10484.	3.38	11020.	3.55	12297.	3.92
	23000	8412.	2.75	9099.	2.96	9491.	3.08								
1600	35700	9091.	2.97	9829.	3.20	10251.	3.32	10717.	3.46	11233.	3.62	11806.	3.79	13173.	4.20
	29000	9001.	2.95	9737.	3.16	10159.	3.29	10623.	3.43	11137.	3.59	11708.	3.76	13069.	4.16
	23000	8931.	2.91	9663.	3.14										
1700	35700	9610.	3.13	10395.	3.37	10844.	3.50	11339.	3.66	11886.	3.83	12495.	4.01	13947.	4.45
	29000	9520.	3.11	10303.	3.34	10750.	3.48	11244.	3.62	11789.	3.79	12396.	3.98	13840.	4.40
	23000	9449.	3.07												
1800	35700	10130.	3.29	10961.	3.55	11436.	3.69	11960.	3.85	12540.	4.04	13184.	4.22		
	29000	10039.	3.27	10868.	3.52	11342.	3.67	11865.	3.82	12442.	4.00	13084.	4.20		
	23000	9968.	3.23												
1900	35700	10649.	3.46	11527.	3.73	12028.	3.88	12582.	4.05	13194.	4.24				
	29000	10558.	3.44	11433.	3.70	11934.	3.85	12485.	4.01	13094.	4.20				
	23000	10486.	3.39												
2000	35700	11168.	3.62	12093.	3.91	12621.	4.06	13203.	4.25						
	29000	11077.	3.60	11999.	3.87	12525.	4.04	13106.	4.21						
	23000	11005.	3.56												
2100	35700	11688.	3.78	12658.	4.09	13213.	4.25								
	29000	11596.	3.76	12564.	4.05	13117.	4.23								
	23000	11523.	3.72												
2200	35700	12207.	3.95	13224.	4.27										
	29000	12115.	3.93	13129.	4.23										
	23000	12042.	3.88												
2300	35700	12727.	4.11	13790.	4.45										
	29000	12634.	4.09	13695.	4.41										
	23000	12560.	4.04												
2400	35700	13246.	4.28												
	29000	13153.	4.25												
	23000	13079.	4.20												

NOTE: FUEL VALUES LARGER THAN THE MAXIMUM USABLE FUEL ARE PRESENTED FOR INTERPOLATION PURPOSES.

Figure 7-10 (Sheet 3)

FLIGHT PLANNING
MAXIMUM CRUISE THRUST
CRUISE (89.8% N1)

STANDARD DAY CRUISE ALTITUDE 31000 FEET

		TAILWIND						ZERO WIND		HEADWIND					
		100 KT.		50 KT.		25 KT.				25 KT.		50 KT.		100 KT.	
STAGE LENGTH NM.	T.O. WEIGHT LBS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.
200	35700	1808.	0.68	1887.	0.70	1933.	0.71	1986.	0.72	2046.	0.73	2113.	0.74	2283.	0.77
	29000	1710.	0.66	1791.	0.68	1839.	0.69	1894.	0.70	1955.	0.71	2024.	0.73	2198.	0.76
	23000	1639.	0.65	1722.	0.67	1770.	0.68	1826.	0.69	1888.	0.70	1959.	0.71	2136.	0.75
400	35700	2813.	1.00	2980.	1.05	3076.	1.07	3184.	1.10	3304.	1.13	3438.	1.17	3765.	1.25
	29000	2714.	0.98	2884.	1.03	2981.	1.05	3090.	1.08	3211.	1.11	3347.	1.15	3677.	1.23
	23000	2642.	0.97	2813.	1.01	2911.	1.04	3021.	1.07	3143.	1.10	3279.	1.13	3611.	1.21
600	35700	3818.	1.32	4073.	1.40	4219.	1.44	4382.	1.48	4562.	1.53	4762.	1.59	5246.	1.72
	29000	3719.	1.30	3976.	1.37	4123.	1.42	4287.	1.46	4468.	1.51	4670.	1.57	5156.	1.70
	23000	3646.	1.29	3904.	1.36	4051.	1.40	4216.	1.45	4397.	1.50	4599.	1.55	5086.	1.68
800	35700	4823.	1.64	5166.	1.75	5362.	1.80	5580.	1.87	5820.	1.93	6087.	2.01	6727.	2.19
	29000	4724.	1.62	5068.	1.72	5265.	1.78	5483.	1.85	5724.	1.91	5992.	1.99	6635.	2.17
	23000	4650.	1.60	4995.	1.70	5192.	1.76	5410.	1.83	5651.	1.89	5919.	1.97	6562.	2.15
1000	35700	5829.	1.96	6259.	2.10	6505.	2.16	6777.	2.25	7078.	2.33	7412.	2.43	8208.	2.66
	29000	5729.	1.94	6160.	2.07	6407.	2.14	6680.	2.23	6981.	2.31	7315.	2.41	8114.	2.64
	23000	5654.	1.92	6086.	2.05	6332.	2.12	6605.	2.21	6906.	2.29	7240.	2.39	8037.	2.62
1100	35700	6331.	2.12	6806.	2.27	7077.	2.35	7376.	2.44	7707.	2.53	8074.	2.65	8949.	2.89
	29000	6231.	2.10	6707.	2.24	6978.	2.33	7278.	2.42	7609.	2.51	7977.	2.62	8853.	2.87
	23000	6156.	2.08	6631.	2.22	6903.	2.31	7202.	2.40	7533.	2.49	7900.	2.60	8775.	2.85
1200	35700	6834.	2.28	7353.	2.45	7649.	2.53	7975.	2.63	8336.	2.73	8736.	2.86	9690.	3.13
	29000	6733.	2.26	7253.	2.42	7549.	2.51	7876.	2.61	8237.	2.71	8638.	2.84	9593.	3.11
	23000	6658.	2.24	7177.	2.40	7473.	2.49	7800.	2.59	8160.	2.69	8560.	2.81	9512.	3.09
1300	35700	7337.	2.44	7899.	2.62	8220.	2.71	8574.	2.82	8965.	2.93	9399.	3.07	10430.	3.37
	29000	7236.	2.42	7799.	2.59	8120.	2.69	8475.	2.80	8866.	2.91	9299.	3.05	10332.	3.35
	23000	7159.	2.40	7722.	2.57	8043.	2.67	8397.	2.78	8787.	2.89	9220.	3.02		
1400	35700	7839.	2.61	8446.	2.79	8792.	2.89	9173.	3.01	9594.	3.13	10061.	3.28	11171.	3.60
	29000	7738.	2.58	8345.	2.76	8691.	2.87	9073.	2.99	9494.	3.11	9961.	3.26	11071.	3.58
	23000	7661.	2.56	8268.	2.74	8613.	2.85	8994.	2.97	9414.	3.09				
1500	35700	8342.	2.77	8992.	2.97	9363.	3.08	9772.	3.20	10223.	3.33	10723.	3.49	11912.	3.84
	29000	8240.	2.74	8891.	2.94	9262.	3.05	9671.	3.18	10122.	3.31	10622.	3.47	11811.	3.82
	23000	8163.	2.72	8813.	2.91	9184.	3.03	9592.	3.16						
1600	35700	8845.	2.93	9539.	3.14	9935.	3.26	10371.	3.39	10852.	3.53	11386.	3.70	12652.	4.07
	29000	8743.	2.90	9437.	3.11	9833.	3.24	10270.	3.37	10750.	3.51	11284.	3.68	12550.	4.05
	23000	8665.	2.88	9359.	3.09										
1700	35700	9347.	3.09	10086.	3.32	10506.	3.44	10970.	3.59	11481.	3.73	12048.	3.91	13393.	4.31
	29000	9245.	3.06	9984.	3.28	10404.	3.42	10868.	3.56	11379.	3.71	11945.	3.89	13290.	4.29
	23000	9167.	3.04												
1800	35700	9850.	3.25	10632.	3.49	11078.	3.62	11569.	3.78	12110.	3.93	12710.	4.12	14134.	4.54
	29000	9748.	3.22	10530.	3.46	10975.	3.60	11466.	3.75	12007.	3.91	12606.	4.10	14029.	4.52
	23000	9669.	3.20												
1900	35700	10353.	3.41	11179.	3.67	11649.	3.80	12167.	3.97	12738.	4.13	13372.	4.34		
	29000	10250.	3.38	11076.	3.63	11546.	3.78	12064.	3.95	12635.	4.11	13268.	4.31		
	23000	10171.	3.36												
2000	35700	10855.	3.57	11725.	3.84	12221.	3.99	12766.	4.16	13367.	4.33				
	29000	10752.	3.54	11622.	3.81	12117.	3.96	12663.	4.14	13263.	4.31				
	23000	10673.	3.52												
2100	35700	11358.	3.73	12272.	4.02	12792.	4.17	13365.	4.35						
	29000	11255.	3.70	12168.	3.98	12688.	4.14	13261.	4.33						
	23000	11175.	3.68												
2200	35700	11861.	3.89	12819.	4.19	13364.	4.35								
	29000	11757.	3.86	12714.	4.15	13259.	4.33								
	23000	11676.	3.84												
2300	35700	12363.	4.05	13365.	4.37										
	29000	12260.	4.02	13260.	4.33										
	23000	12178.	4.00												
2400	35700	12866.	4.21	13912.	4.54										
	29000	12762.	4.18	13807.	4.50										
	23000	12680.	4.16												
2500	35700	13369.	4.37												
	29000	13264.	4.34												
	23000	13182.	4.32												

NOTE: FUEL VALUES LARGER THAN THE MAXIMUM USABLE FUEL ARE PRESENTED FOR INTERPOLATION PURPOSES.

Figure 7-10 (Sheet 4)

FLIGHT PLANNING
MAXIMUM CRUISE THRUST
CRUISE (90.7% N1)

STANDARD DAY **CRUISE ALTITUDE 33000 FEET**

		TAILWIND						ZERO		HEADWIND					
STAGE	T.O.	100 KT.		50 KT.		25 KT.		WIND		25 KT.		50 KT.		100 KT.	
LENGTH NM.	WEIGHT LBS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.
200	35700	1801.	0.69	1876.	0.70	1920.	0.71	1971.	0.72	2027.	0.73	2091.	0.74	2253.	0.77
	29000	1695.	0.67	1773.	0.68	1818.	0.69	1870.	0.70	1929.	0.71	1995.	0.73	2161.	0.76
	23000	1619.	0.65	1698.	0.67	1745.	0.68	1798.	0.69	1857.	0.70	1925.	0.71	2094.	0.74
400	35700	2776.	1.01	2936.	1.05	3028.	1.07	3131.	1.10	3246.	1.13	3374.	1.16	3687.	1.24
	29000	2669.	0.98	2832.	1.03	2925.	1.05	3030.	1.08	3146.	1.11	3276.	1.14	3593.	1.23
	23000	2592.	0.97	2756.	1.01	2850.	1.04	2956.	1.07	3073.	1.10	3204.	1.13	3523.	1.21
600	35700	3751.	1.32	3996.	1.40	4136.	1.44	4292.	1.48	4464.	1.53	4657.	1.58	5121.	1.71
	29000	3644.	1.30	3891.	1.37	4032.	1.42	4189.	1.46	4363.	1.51	4557.	1.56	5025.	1.69
	23000	3566.	1.29	3814.	1.36	3956.	1.40	4114.	1.44	4289.	1.49	4483.	1.55	4953.	1.68
800	35700	4726.	1.64	5055.	1.74	5244.	1.80	5452.	1.86	5683.	1.93	5940.	2.00	6555.	2.18
	29000	4618.	1.62	4949.	1.72	5139.	1.78	5349.	1.84	5581.	1.91	5838.	1.98	6456.	2.16
	23000	4540.	1.60	4872.	1.71	5062.	1.76	5272.	1.82	5505.	1.89	5763.	1.97	6382.	2.14
1000	35700	5701.	1.96	6115.	2.09	6352.	2.16	6613.	2.24	6901.	2.33	7222.	2.42	7989.	2.65
	29000	5592.	1.94	6008.	2.07	6246.	2.14	6508.	2.22	6798.	2.31	7120.	2.40	7888.	2.63
	23000	5513.	1.92	5930.	2.05	6168.	2.12	6431.	2.20	6720.	2.28	7042.	2.38	7811.	2.61
1200	35700	6676.	2.28	7175.	2.44	7459.	2.52	7774.	2.62	8120.	2.73	8505.	2.84	9422.	3.12
	29000	6567.	2.26	7067.	2.41	7353.	2.50	7668.	2.60	8015.	2.71	8401.	2.82	9320.	3.10
	23000	6487.	2.24	6988.	2.40	7274.	2.48	7589.	2.58	7936.	2.68	8322.	2.80	9240.	3.07
1300	35700	7163.	2.44	7705.	2.61	8013.	2.70	8354.	2.81	8729.	2.93	9147.	3.05	10139.	3.36
	29000	7054.	2.42	7597.	2.59	7906.	2.68	8248.	2.78	8624.	2.90	9042.	3.03	10035.	3.33
	23000	6974.	2.40	7517.	2.57	7826.	2.66	8168.	2.77	8544.	2.88	8962.	3.01	9954.	3.31
1400	35700	7651.	2.60	8234.	2.79	8567.	2.88	8934.	3.00	9339.	3.13	9788.	3.26	10856.	3.60
	29000	7541.	2.58	8126.	2.76	8460.	2.87	8827.	2.97	9233.	3.10	9682.	3.24	10751.	3.57
	23000	7461.	2.56	8046.	2.74	8379.	2.84	8747.	2.96	9152.	3.08	9601.	3.22		
1500	35700	8138.	2.76	8764.	2.96	9121.	3.06	9515.	3.19	9948.	3.33	10430.	3.47	11573.	3.83
	29000	8028.	2.74	8656.	2.93	9013.	3.05	9407.	3.16	9841.	3.30	10323.	3.45	11467.	3.80
	23000	7948.	2.72	8575.	2.92	8932.	3.02	9326.	3.15						
1600	35700	8626.	2.92	9294.	3.13	9675.	3.25	10095.	3.38	10557.	3.53	11071.	3.68	12290.	4.07
	29000	8515.	2.90	9185.	3.11	9567.	3.23	9987.	3.35	10450.	3.50	10964.	3.65	12183.	4.04
	23000	8434.	2.87	9104.	3.09	9485.	3.20								
1700	35700	9113.	3.08	9824.	3.31	10229.	3.43	10675.	3.57	11166.	3.73	11712.	3.89	13007.	4.30
	29000	9003.	3.06	9714.	3.28	10120.	3.41	10567.	3.54	11059.	3.70	11604.	3.86	12899.	4.27
	23000	8921.	3.03	9633.	3.26										
1800	35700	9601.	3.24	10354.	3.48	10783.	3.61	11256.	3.76	11776.	3.93	12354.	4.10	13724.	4.54
	29000	9490.	3.22	10244.	3.45	10673.	3.59	11146.	3.73	11668.	3.90	12245.	4.07	13614.	4.50
	23000	9408.	3.19												
1900	35700	10088.	3.40	10884.	3.65	11337.	3.79	11836.	3.95	12385.	4.13	12995.	4.31	14441.	4.77
	29000	9977.	3.38	10773.	3.62	11227.	3.77	11726.	3.92	12276.	4.10	12886.	4.28	14330.	4.74
	23000	9895.	3.35												
2000	35700	10576.	3.56	11414.	3.83	11891.	3.97	12416.	4.14	12994.	4.33	13637.	4.52		
	29000	10464.	3.54	11303.	3.80	11780.	3.95	12306.	4.11	12885.	4.30	13526.	4.49		
	23000	10382.	3.51												
2100	35700	11063.	3.72	11943.	4.00	12445.	4.15	12997.	4.33	13604.	4.53				
	29000	10951.	3.70	11832.	3.97	12334.	4.13	12886.	4.30	13494.	4.50				
	23000	10869.	3.67												
2200	35700	11551.	3.87	12473.	4.18	12999.	4.33	13577.	4.52						
	29000	11439.	3.86	12362.	4.14	12887.	4.32	13465.	4.49						
	23000	11355.	3.83												
2300	35700	12038.	4.03	13003.	4.35	13553.	4.51								
	29000	11926.	4.02	12891.	4.32	13441.	4.50								
	23000	11842.	3.99												
2400	35700	12525.	4.19	13533.	4.52										
	29000	12413.	4.18	13421.	4.49										
	23000	12329.	4.15												
2500	35700	13013.	4.35	14063.	4.70										
	29000	12900.	4.34	13950.	4.66										
	23000	12816.	4.30												
2600	35700	13500.	4.51												
	29000	13387.	4.50												
	23000	13303.	4.46												

NOTE: FUEL VALUES LARGER THAN THE MAXIMUM USABLE FUEL ARE PRESENTED FOR INTERPOLATION PURPOSES.

Figure 7-10 (Sheet 5)

FLIGHT PLANNING
MAXIMUM CRUISE THRUST
CRUISE (91.1% N1)

STANDARD DAY **CRUISE ALTITUDE 35000 FEET**

		TAILWIND						ZERO		HEADWIND					
		100 KT.		50 KT.		25 KT.		WIND		25 KT.		50 KT.		100 KT.	
STAGE LENGTH NM.	T.O. WEIGHT LBS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.
200	35700	1803.	0.69	1874.	0.71	1915.	0.72	1963.	0.72	2017.	0.73	2077.	0.75	2232.	0.77
	29000	1687.	0.67	1760.	0.68	1803.	0.69	1853.	0.70	1908.	0.72	1971.	0.73	2131.	0.76
	23000	1603.	0.65	1679.	0.67	1723.	0.68	1773.	0.69	1830.	0.70	1895.	0.71	2057.	0.74
400	35700	2736.	1.01	2888.	1.05	2975.	1.08	3074.	1.11	3183.	1.13	3305.	1.17	3604.	1.24
	29000	2619.	0.99	2773.	1.03	2862.	1.06	2962.	1.08	3073.	1.11	3197.	1.15	3500.	1.23
	23000	2535.	0.97	2691.	1.02	2781.	1.04	2881.	1.07	2993.	1.10	3118.	1.13	3424.	1.21
600	35700	3669.	1.33	3902.	1.40	4036.	1.44	4185.	1.49	4349.	1.53	4533.	1.59	4977.	1.71
	29000	3551.	1.31	3786.	1.38	3921.	1.42	4071.	1.46	4237.	1.51	4422.	1.56	4870.	1.69
	23000	3466.	1.29	3703.	1.36	3838.	1.40	3989.	1.45	4157.	1.50	4342.	1.55	4791.	1.68
800	35700	4602.	1.65	4916.	1.75	5096.	1.80	5295.	1.87	5516.	1.93	5761.	2.01	6349.	2.18
	29000	4483.	1.63	4799.	1.72	4980.	1.78	5180.	1.84	5402.	1.91	5648.	1.98	6239.	2.16
	23000	4397.	1.60	4715.	1.71	4896.	1.76	5097.	1.82	5320.	1.89	5566.	1.97	6158.	2.15
1000	35700	5535.	1.97	5930.	2.09	6156.	2.17	6406.	2.25	6682.	2.33	6989.	2.43	7722.	2.65
	29000	5415.	1.95	5812.	2.07	6039.	2.14	6290.	2.22	6566.	2.31	6874.	2.40	7609.	2.63
	23000	5329.	1.92	5727.	2.05	5954.	2.13	6205.	2.20	6483.	2.29	6790.	2.38	7525.	2.61
1200	35700	6468.	2.29	6944.	2.44	7216.	2.53	7517.	2.63	7848.	2.73	8216.	2.85	9094.	3.12
	29000	6347.	2.27	6825.	2.42	7098.	2.51	7399.	2.60	7731.	2.71	8100.	2.82	8978.	3.10
	23000	6260.	2.24	6739.	2.40	7012.	2.49	7313.	2.58	7646.	2.69	8014.	2.80	8892.	3.08
1400	35700	7401.	2.61	7958.	2.79	8277.	2.89	8628.	3.01	9015.	3.13	9444.	3.28	10467.	3.59
	29000	7279.	2.58	7838.	2.76	8157.	2.87	8508.	2.98	8896.	3.11	9325.	3.24	10348.	3.57
	23000	7192.	2.56	7752.	2.74	8070.	2.85	8421.	2.96	8809.	3.09	9238.	3.22		
1500	35700	7867.	2.77	8465.	2.96	8807.	3.08	9183.	3.20	9598.	3.33	10058.	3.49	11153.	3.83
	29000	7745.	2.74	8344.	2.94	8686.	3.05	9063.	3.17	9478.	3.31	9938.	3.45	11032.	3.80
	23000	7657.	2.72	8258.	2.92	8599.	3.03	8975.	3.15	9391.	3.29				
1600	35700	8333.	2.93	8972.	3.13	9337.	3.26	9738.	3.39	10181.	3.53	10672.	3.70	11839.	4.06
	29000	8211.	2.90	8851.	3.11	9216.	3.23	9617.	3.36	10060.	3.50	10551.	3.66	11717.	4.04
	23000	8123.	2.87	8764.	3.09	9127.	3.21	9529.	3.34						
1700	35700	8800.	3.09	9480.	3.31	9867.	3.44	10294.	3.58	10764.	3.73	11286.	3.91	12525.	4.30
	29000	8677.	3.06	9357.	3.28	9745.	3.41	10172.	3.55	10642.	3.70	11164.	3.87	12402.	4.27
	23000	8589.	3.03	9270.	3.26										
1800	35700	9266.	3.25	9987.	3.48	10397.	3.62	10849.	3.77	11347.	3.93	11900.	4.12	13212.	4.54
	29000	9143.	3.22	9864.	3.46	10274.	3.59	10727.	3.73	11225.	3.90	11777.	4.08	13087.	4.51
	23000	9055.	3.19												
1900	35700	9733.	3.41	10494.	3.66	10927.	3.80	11405.	3.96	11931.	4.13	12514.	4.33	13898.	4.77
	29000	9609.	3.38	10370.	3.63	10804.	3.78	11281.	3.92	11807.	4.10	12389.	4.29	13771.	4.74
	23000	9520.	3.35												
2000	35700	10199.	3.57	11001.	3.83	11457.	3.98	11960.	4.16	12514.	4.33	13128.	4.54		
	29000	10075.	3.54	10877.	3.80	11333.	3.96	11836.	4.11	12389.	4.30	13002.	4.50		
	23000	9986.	3.51												
2100	35700	10666.	3.73	11508.	4.00	11987.	4.17	12515.	4.35	13097.	4.53				
	29000	10542.	3.70	11383.	3.97	11863.	4.14	12390.	4.30	12972.	4.50				
	23000	10452.	3.67												
2200	35700	11132.	3.89	12015.	4.18	12518.	4.35	13071.	4.54						
	29000	11008.	3.86	11890.	4.15	12392.	4.32	12945.	4.49						
	23000	10917.	3.83												
2300	35700	11599.	4.05	12522.	4.35	13048.	4.53								
	29000	11474.	4.02	12396.	4.32	12922.	4.50								
	23000	11383.	3.98												
2400	35700	12065.	4.21	13029.	4.52										
	29000	11940.	4.18	12903.	4.49										
	23000	11849.	4.14												
2500	35700	12531.	4.37	13536.	4.70										
	29000	12406.	4.34	13409.	4.67										
	23000	12314.	4.30												
2600	35700	12998.	4.53	14043.	4.87										
	29000	12872.	4.50	13916.	4.84										
	23000	12780.	4.46												
2700	35700	13464.	4.69												
	29000	13338.	4.66												
	23000	13246.	4.62												

NOTE: FUEL VALUES LARGER THAN THE MAXIMUM USABLE FUEL ARE PRESENTED FOR INTERPOLATION PURPOSES.

Figure 7-10 (Sheet 6)

FLIGHT PLANNING
MAXIMUM CRUISE THRUST
CRUISE (91.6% N1)

STANDARD DAY — **CRUISE ALTITUDE 37000 FEET**

		TAILWIND						ZERO		HEADWIND					
STAGE	T.O.	100 KT.		50 KT.		25 KT.		WIND		25 KT.		50 KT.		100 KT.	
LENGTH NM.	WEIGHT LBS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.
200	35700	1805.	0.70	1871.	0.71	1909.	0.72	1954.	0.73	2004.	0.74	2062.	0.75	2208.	0.77
	29000	1676.	0.67	1745.	0.69	1785.	0.70	1832.	0.71	1884.	0.72	1944.	0.73	2095.	0.76
	23000	1584.	0.66	1655.	0.67	1697.	0.68	1745.	0.69	1799.	0.70	1860.	0.71	2015.	0.74
400	35700	2690.	1.02	2833.	1.06	2916.	1.08	3009.	1.11	3112.	1.14	3227.	1.17	3511.	1.24
	29000	2561.	0.99	2706.	1.03	2790.	1.06	2885.	1.08	2990.	1.12	3107.	1.15	3395.	1.22
	23000	2469.	0.97	2616.	1.02	2701.	1.04	2797.	1.07	2903.	1.10	3021.	1.13	3312.	1.21
600	35700	3576.	1.33	3796.	1.41	3922.	1.44	4063.	1.49	4219.	1.54	4393.	1.59	4814.	1.71
	29000	3445.	1.31	3668.	1.38	3795.	1.42	3938.	1.46	4095.	1.51	4270.	1.57	4695.	1.69
	23000	3353.	1.29	3577.	1.36	3705.	1.40	3848.	1.45	4006.	1.50	4183.	1.55	4609.	1.68
800	35700	4461.	1.65	4758.	1.75	4929.	1.81	5117.	1.87	5327.	1.94	5559.	2.01	6117.	2.18
	29000	4330.	1.63	4629.	1.73	4801.	1.78	4990.	1.84	5200.	1.91	5434.	1.98	5994.	2.16
	23000	4237.	1.61	4537.	1.71	4709.	1.76	4900.	1.83	5110.	1.89	5344.	1.96	5906.	2.14
1000	35700	5347.	1.97	5721.	2.10	5935.	2.17	6172.	2.25	6434.	2.34	6725.	2.43	7420.	2.65
	29000	5215.	1.95	5591.	2.07	5806.	2.15	6043.	2.22	6306.	2.31	6597.	2.40	7294.	2.62
	23000	5121.	1.93	5498.	2.05	5713.	2.12	5951.	2.21	6214.	2.29	6506.	2.38	7203.	2.61
1200	35700	6232.	2.29	6684.	2.45	6942.	2.53	7226.	2.63	7542.	2.74	7891.	2.85	8724.	3.12
	29000	6100.	2.27	6553.	2.42	6811.	2.51	7096.	2.60	7411.	2.71	7760.	2.82	8593.	3.09
	23000	6005.	2.25	6458.	2.40	6717.	2.49	7003.	2.58	7318.	2.69	7667.	2.80	8500.	3.08
1400	35700	7118.	2.61	7646.	2.80	7948.	2.89	8281.	3.01	8649.	3.14	9057.	3.27	10027.	3.59
	29000	6985.	2.59	7514.	2.76	7816.	2.87	8149.	2.98	8516.	3.11	8924.	3.24	9893.	3.56
	23000	6889.	2.56	7419.	2.74	7721.	2.85	8054.	2.96	8422.	3.08	8829.	3.21	9798.	3.54
1600	35700	8003.	2.93	8609.	3.15	8955.	3.26	9335.	3.39	9756.	3.54	10222.	3.70	11330.	4.06
	29000	7870.	2.91	8476.	3.11	8821.	3.23	9202.	3.36	9622.	3.51	10087.	3.66	11193.	4.02
	23000	7773.	2.88	8380.	3.09	8725.	3.21	9106.	3.34	9526.	3.48	9990.	3.63		
1700	35700	8446.	3.09	9090.	3.32	9458.	3.44	9863.	3.58	10310.	3.74	10805.	3.91	11982.	4.30
	29000	8312.	3.07	8956.	3.28	9324.	3.41	9728.	3.55	10174.	3.70	10669.	3.87	11843.	4.26
	23000	8216.	3.04	8860.	3.26	9227.	3.39								
1800	35700	8889.	3.25	9572.	3.49	9961.	3.62	10390.	3.77	10864.	3.94	11388.	4.12	12633.	4.53
	29000	8754.	3.23	9437.	3.46	9826.	3.60	10255.	3.74	10727.	3.90	11250.	4.08	12492.	4.49
	23000	8658.	3.20	9340.	3.43										
1900	35700	9331.	3.41	10053.	3.67	10464.	3.80	10917.	3.96	11418.	4.14	11971.	4.33	13285.	4.77
	29000	9197.	3.38	9918.	3.63	10329.	3.78	10781.	3.92	11280.	4.10	11832.	4.29	13142.	4.72
	23000	9100.	3.36												
2000	35700	9774.	3.57	10534.	3.84	10967.	3.98	11444.	4.15	11971.	4.34	12554.	4.54	13936.	5.00
	29000	9639.	3.54	10399.	3.80	10831.	3.96	11308.	4.11	11832.	4.30	12414.	4.50	13792.	4.96
	23000	9542.	3.52												
2100	35700	10217.	3.73	11016.	4.01	11471.	4.16	11972.	4.34	12525.	4.54	13137.	4.75		
	29000	10082.	3.70	10880.	3.98	11334.	4.14	11834.	4.30	12385.	4.50	12995.	4.70		
	23000	9984.	3.68												
2200	35700	10660.	3.89	11497.	4.19	11974.	4.35	12499.	4.53	13079.	4.74				
	29000	10524.	3.86	11360.	4.15	11837.	4.32	12361.	4.49	12938.	4.70				
	23000	10426.	3.83												
2300	35700	11103.	4.05	11978.	4.36	12477.	4.53	13026.	4.72	13632.	4.94				
	29000	10967.	4.02	11841.	4.32	12339.	4.50	12887.	4.68	13490.	4.90				
	23000	10868.	3.99												
2400	35700	11545.	4.21	12460.	4.54	12980.	4.71	13553.	4.92						
	29000	11409.	4.18	12322.	4.50	12842.	4.68	13413.	4.87						
	23000	11310.	4.15												
2500	35700	11988.	4.37	12941.	4.71	13484.	4.89								
	29000	11851.	4.34	12803.	4.67	13344.	4.86								
	23000	11752.	4.31												
2600	35700	12431.	4.53	13422.	4.88										
	29000	12294.	4.50	13284.	4.84										
	23000	12194.	4.47												
2700	35700	12874.	4.69	13904.	5.06										
	29000	12736.	4.66	13764.	5.02										
	23000	12636.	4.63												
2800	35700	13316.	4.85												
	29000	13179.	4.82												
	23000	13078.	4.79												

NOTE: FUEL VALUES LARGER THAN THE MAXIMUM USABLE FUEL ARE PRESENTED FOR INTERPOLATION PURPOSES.

Figure 7-10 (Sheet 7)

FLIGHT PLANNING
MAXIMUM CRUISE THRUST
CRUISE (91.3% N1)

STANDARD DAY **CRUISE ALTITUDE 39000 FEET**

		TAILWIND						ZERO WIND		HEADWIND					
		100 KT.		50 KT.		25 KT.				25 KT.		50 KT.		100 KT.	
STAGE LENGTH NM.	T.O. WEIGHT LBS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.
200	35700	1827.	0.70	1887.	0.72	1922.	0.72	1963.	0.73	2008.	0.74	2061.	0.75	2195.	0.77
	29000	1676.	0.68	1739.	0.69	1776.	0.70	1819.	0.71	1867.	0.72	1922.	0.73	2062.	0.76
	23000	1570.	0.66	1635.	0.67	1673.	0.68	1717.	0.69	1767.	0.70	1823.	0.72	1967.	0.74
400	35700	2629.	1.02	2759.	1.07	2834.	1.09	2918.	1.12	3012.	1.14	3118.	1.18	3379.	1.25
	29000	2475.	1.00	2608.	1.04	2684.	1.06	2770.	1.09	2866.	1.12	2973.	1.15	3238.	1.23
	23000	2368.	0.98	2502.	1.02	2580.	1.05	2667.	1.07	2764.	1.10	2873.	1.13	3140.	1.21
600	35700	3431.	1.35	3631.	1.42	3746.	1.46	3874.	1.50	4017.	1.55	4176.	1.60	4562.	1.73
	29000	3275.	1.31	3476.	1.39	3592.	1.42	3722.	1.47	3865.	1.52	4025.	1.57	4413.	1.70
	23000	3167.	1.30	3370.	1.37	3487.	1.41	3617.	1.45	3762.	1.50	3923.	1.55	4313.	1.68
800	35700	4233.	1.67	4503.	1.77	4658.	1.82	4830.	1.88	5021.	1.95	5233.	2.03	5746.	2.20
	29000	4074.	1.63	4345.	1.73	4500.	1.79	4673.	1.85	4864.	1.91	5077.	1.99	5588.	2.16
	23000	3965.	1.62	4238.	1.71	4394.	1.77	4567.	1.83	4759.	1.90	4972.	1.97	5485.	2.15
1000	35700	5034.	1.99	5375.	2.12	5570.	2.19	5786.	2.27	6025.	2.35	6291.	2.45	6929.	2.68
	29000	4873.	1.95	5214.	2.08	5408.	2.15	5624.	2.23	5863.	2.31	6128.	2.41	6763.	2.63
	23000	4764.	1.93	5106.	2.06	5301.	2.13	5517.	2.21	5756.	2.30	6022.	2.39	6658.	2.61
1200	35700	5836.	2.31	6247.	2.47	6482.	2.56	6742.	2.65	7029.	2.75	7348.	2.88	8113.	3.15
	29000	5672.	2.27	6082.	2.43	6317.	2.51	6576.	2.61	6861.	2.71	7180.	2.83	7939.	3.10
	23000	5563.	2.25	5974.	2.40	6208.	2.49	6468.	2.59	6754.	2.70	7072.	2.81	7831.	3.08
1400	35700	6638.	2.64	7119.	2.82	7394.	2.92	7697.	3.03	8033.	3.16	8406.	3.30	9296.	3.63
	29000	6471.	2.59	6951.	2.77	7225.	2.87	7527.	2.99	7860.	3.11	8231.	3.25	9114.	3.57
	23000	6361.	2.57	6841.	2.75	7115.	2.86	7418.	2.96	7751.	3.09	8122.	3.23	9004.	3.55
1600	35700	7439.	2.96	7991.	3.17	8306.	3.29	8653.	3.42	9037.	3.56	9463.	3.73	10480.	4.10
	29000	7271.	2.91	7820.	3.12	8133.	3.23	8478.	3.37	8859.	3.51	9283.	3.67	10289.	4.04
	23000	7160.	2.89	7709.	3.10	8022.	3.22	8368.	3.34	8749.	3.49	9171.	3.65		
1800	35700	8241.	3.28	8863.	3.52	9218.	3.66	9609.	3.80	10041.	3.96	10521.	4.15	11663.	4.58
	29000	8070.	3.23	8688.	3.47	9041.	3.60	9430.	3.75	9858.	3.91	10334.	4.09	11464.	4.51
	23000	7958.	3.21	8577.	3.44	8929.	3.58	9318.	3.72	9746.	3.89				
2000	35700	9043.	3.60	9735.	3.87	10130.	4.03	10565.	4.19	11045.	4.36	11578.	4.58	12847.	5.05
	29000	8869.	3.54	9557.	3.82	9949.	3.96	10381.	4.13	10857.	4.30	11386.	4.51	12640.	4.98
	23000	8757.	3.53	9444.	3.79	9836.	3.94								
2200	35700	9845.	3.93	10607.	4.22	11042.	4.39	11521.	4.57	12049.	4.77	12636.	5.00	14030.	5.53
	29000	9668.	3.86	10426.	4.16	10857.	4.32	11332.	4.51	11856.	4.70	12438.	4.93	13815.	5.45
	23000	9555.	3.85												
2300	35700	10245.	4.09	11043.	4.39	11498.	4.58	11999.	4.76	12551.	4.97	13165.	5.21		
	29000	10068.	4.02	10860.	4.34	11311.	4.50	11808.	4.70	12355.	4.90	12963.	5.14		
	23000	9955.	4.01												
2400	35700	10646.	4.25	11479.	4.57	11954.	4.76	12476.	4.95	13053.	5.17				
	29000	10467.	4.18	11294.	4.51	11765.	4.68	12284.	4.89	12855.	5.10				
	23000	10354.	4.17												
2500	35700	11047.	4.41	11915.	4.74	12410.	4.94	12954.	5.14	13555.	5.37				
	29000	10867.	4.34	11729.	4.68	12219.	4.86	12759.	5.08	13354.	5.30				
	23000	10753.	4.33												
2600	35700	11448.	4.57	12351.	4.92	12866.	5.13	13432.	5.34						
	29000	11267.	4.50	12163.	4.86	12673.	5.05	13235.	5.27						
	23000	11152.	4.49												
2700	35700	11849.	4.73	12787.	5.09	13322.	5.31								
	29000	11666.	4.66	12597.	5.03	13127.	5.23								
	23000	11552.	4.64												
2800	35700	12250.	4.89	13223.	5.27										
	29000	12066.	4.82	13032.	5.20										
	23000	11951.	4.80												
2900	35700	12651.	5.06	13659.	5.44										
	29000	12465.	4.98	13466.	5.38										
	23000	12350.	4.96												
3000	35700	13051.	5.22												
	29000	12865.	5.14												
	23000	12749.	5.12												

NOTE: FUEL VALUES LARGER THAN THE MAXIMUM USABLE FUEL ARE PRESENTED FOR INTERPOLATION PURPOSES.

Figure 7-10 (Sheet 8)

FLIGHT PLANNING
MAXIMUM CRUISE THRUST
CRUISE (91.0% N1)

STANDARD DAY **CRUISE ALTITUDE 41000 FEET**

		TAILWIND						ZERO WIND		HEADWIND					
STAGE LENGTH NM.	T.O. WEIGHT LBS.	100 KT. FUEL LBS.	100 KT. TIME HRS.	50 KT. FUEL LBS.	50 KT. TIME HRS.	25 KT. FUEL LBS.	25 KT. TIME HRS.	FUEL LBS.	TIME HRS.	25 KT. FUEL LBS.	25 KT. TIME HRS.	50 KT. FUEL LBS.	50 KT. TIME HRS.	100 KT. FUEL LBS.	100 KT. TIME HRS.
200	35700	1862.	0.71	1915.	0.72	1946.	0.73	1983.	0.73	2024.	0.74	2071.	0.75	2194.	0.77
	29000	1685.	0.68	1742.	0.69	1776.	0.70	1815.	0.71	1860.	0.72	1910.	0.73	2041.	0.76
	23000	1563.	0.66	1622.	0.68	1657.	0.68	1698.	0.69	1744.	0.70	1796.	0.72	1930.	0.74
400	35700	2589.	1.03	2706.	1.07	2774.	1.10	2850.	1.12	2936.	1.15	3032.	1.18	3271.	1.25
	29000	2407.	1.00	2527.	1.04	2597.	1.07	2675.	1.09	2763.	1.12	2861.	1.15	3104.	1.23
	23000	2284.	0.98	2406.	1.02	2477.	1.05	2557.	1.07	2645.	1.10	2745.	1.13	2991.	1.21
600	35700	3315.	1.36	3496.	1.43	3601.	1.47	3718.	1.51	3848.	1.56	3993.	1.61	4348.	1.74
	29000	3130.	1.32	3313.	1.39	3418.	1.43	3536.	1.47	3666.	1.52	3812.	1.57	4167.	1.70
	23000	3006.	1.30	3191.	1.37	3297.	1.41	3416.	1.45	3547.	1.50	3694.	1.55	4051.	1.68
800	35700	4042.	1.68	4287.	1.78	4428.	1.84	4585.	1.90	4760.	1.96	4954.	2.04	5425.	2.22
	29000	3852.	1.64	4098.	1.74	4239.	1.79	4396.	1.85	4569.	1.92	4763.	2.00	5230.	2.17
	23000	3727.	1.62	3975.	1.72	4116.	1.77	4274.	1.83	4448.	1.90	4643.	1.97	5112.	2.15
1000	35700	4768.	2.01	5078.	2.13	5255.	2.21	5453.	2.29	5671.	2.37	5915.	2.47	6502.	2.70
	29000	4574.	1.96	4883.	2.09	5060.	2.16	5256.	2.24	5473.	2.32	5714.	2.42	6293.	2.64
	23000	4449.	1.94	4759.	2.06	4936.	2.14	5133.	2.21	5350.	2.30	5592.	2.39	6173.	2.62
1200	35700	5494.	2.33	5868.	2.49	6083.	2.58	6320.	2.67	6583.	2.78	6876.	2.90	7579.	3.18
	29000	5296.	2.28	5668.	2.43	5881.	2.52	6116.	2.62	6376.	2.72	6665.	2.84	7356.	3.11
	23000	5170.	2.26	5543.	2.41	5756.	2.50	5992.	2.59	6252.	2.70	6541.	2.81	7233.	3.09
1400	35700	6220.	2.66	6659.	2.84	6910.	2.95	7188.	3.06	7495.	3.18	7837.	3.33	8656.	3.66
	29000	6018.	2.60	6453.	2.78	6702.	2.89	6976.	3.00	7279.	3.13	7616.	3.26	8419.	3.58
	23000	5892.	2.58	6327.	2.76	6575.	2.86	6851.	2.97	7153.	3.10	7490.	3.23	8294.	3.56
1600	35700	6947.	2.98	7450.	3.19	7737.	3.32	8055.	3.45	8407.	3.59	8798.	3.76	9733.	4.15
	29000	6741.	2.92	7238.	3.13	7522.	3.25	7836.	3.38	8182.	3.53	8567.	3.68	9483.	4.06
	23000	6613.	2.90	7111.	3.10	7395.	3.22	7709.	3.35	8055.	3.50	8438.	3.65	9354.	4.02
1800	35700	7673.	3.31	8240.	3.55	8565.	3.69	8923.	3.84	9319.	4.00	9759.	4.19	10809.	4.63
	29000	7463.	3.24	8023.	3.48	8343.	3.62	8696.	3.76	9086.	3.93	9517.	4.10	10546.	4.53
	23000	7335.	3.21	7895.	3.45	8215.	3.59	8568.	3.73	8956.	3.90	9387.	4.07		
2000	35700	8400.	3.63	9031.	3.90	9392.	4.06	9790.	4.22	10230.	4.41	10720.	4.62	11886.	5.11
	29000	8185.	3.56	8809.	3.82	9164.	3.98	9556.	4.14	9989.	4.33	10468.	4.53	11609.	5.00
	23000	8056.	3.53	8679.	3.79	9034.	3.95	9427.	4.11	9858.	4.30				
2200	35700	9126.	3.96	9822.	4.25	10219.	4.43	10658.	4.61	11142.	4.81	11680.	5.05	12963.	5.59
	29000	8907.	3.88	9594.	4.17	9985.	4.34	10416.	4.52	10892.	4.73	11419.	4.95	12672.	5.47
	23000	8778.	3.85	9463.	4.14										
2400	35700	9852.	4.28	10612.	4.61	11047.	4.80	11525.	5.00	12054.	5.22	12641.	5.48	14040.	6.07
	29000	9630.	4.20	10379.	4.52	10806.	4.71	11277.	4.90	11795.	5.13	12370.	5.37	13735.	5.94
	23000	9499.	4.17												
2600	35700	10579.	4.61	11403.	4.96	11874.	5.17	12393.	5.39	12966.	5.63	13602.	5.91		
	29000	10352.	4.52	11164.	4.87	11627.	5.07	12137.	5.28	12698.	5.53	13321.	5.79		
	23000	10221.	4.49												
2800	35700	11305.	4.93	12194.	5.32	12701.	5.54	13260.	5.78	13878.	6.03				
	29000	11074.	4.84	11949.	5.22	12448.	5.44	12997.	5.66	13602.	5.93				
	23000	10942.	4.81												
2900	35700	11668.	5.10	12589.	5.49	13115.	5.73								
	29000	11435.	5.00	12342.	5.39	12858.	5.62								
	23000	11303.	4.97												
3000	35700	12031.	5.26	12984.	5.67	13528.	5.91								
	29000	11796.	5.16	12734.	5.56	13269.	5.80								
	23000	11663.	5.13												
3100	35700	12394.	5.42	13380.	5.85										
	29000	12157.	5.32	13127.	5.74										
	23000	12024.	5.29												
3200	35700	12758.	5.58	13775.	6.02										
	29000	12518.	5.48	13520.	5.91										
	23000	12385.	5.45												
3300	35700	13121.	5.75												
	29000	12880.	5.64												
	23000	12746.	5.61												

NOTE: FUEL VALUES LARGER THAN THE MAXIMUM USABLE FUEL ARE PRESENTED FOR INTERPOLATION PURPOSES.

Figure 7-10 (Sheet 9)

FLIGHT PLANNING
MAXIMUM CRUISE THRUST
CRUISE (90.7% N1)

STANDARD DAY **CRUISE ALTITUDE 43000 FEET**

		TAILWIND						ZERO		HEADWIND					
		100 KT.		50 KT.		25 KT.		WIND		25 KT.		50 KT.		100 KT.	
STAGE LENGTH NM.	T.O. WEIGHT LBS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.
200	35700	1922.	0.72	1967.	0.73	1994.	0.74	2026.	0.74	2062.	0.75	2103.	0.76	2213.	0.77
	29000	1706.	0.69	1758.	0.70	1789.	0.71	1826.	0.72	1867.	0.73	1914.	0.74	2036.	0.76
	23000	1568.	0.67	1622.	0.68	1655.	0.69	1693.	0.70	1736.	0.71	1785.	0.72	1911.	0.74
400	35700	2583.	1.05	2688.	1.09	2748.	1.11	2818.	1.14	2895.	1.16	2982.	1.19	3199.	1.26
	29000	2363.	1.01	2473.	1.05	2536.	1.07	2609.	1.10	2689.	1.13	2780.	1.16	3005.	1.23
	23000	2223.	0.99	2335.	1.03	2400.	1.05	2473.	1.08	2555.	1.11	2647.	1.14	2875.	1.21
600	35700	3245.	1.38	3409.	1.45	3503.	1.49	3610.	1.53	3728.	1.58	3860.	1.63	4186.	1.75
	29000	3019.	1.33	3187.	1.40	3283.	1.44	3391.	1.48	3511.	1.53	3646.	1.58	3974.	1.71
	23000	2878.	1.31	3047.	1.38	3144.	1.42	3253.	1.46	3374.	1.51	3509.	1.56	3839.	1.68
800	35700	3907.	1.71	4130.	1.80	4258.	1.86	4402.	1.92	4561.	1.99	4739.	2.06	5172.	2.24
	29000	3676.	1.65	3901.	1.75	4030.	1.81	4174.	1.87	4334.	1.93	4512.	2.01	4943.	2.18
	23000	3533.	1.63	3759.	1.72	3889.	1.78	4033.	1.84	4193.	1.91	4371.	1.98	4803.	2.16
1000	35700	4569.	2.04	4851.	2.16	5013.	2.24	5194.	2.31	5394.	2.40	5617.	2.50	6158.	2.73
	29000	4333.	1.97	4615.	2.10	4777.	2.17	4957.	2.25	5156.	2.34	5378.	2.43	5912.	2.66
	23000	4189.	1.95	4472.	2.07	4634.	2.14	4813.	2.22	5012.	2.31	5234.	2.40	5767.	2.63
1200	35700	5231.	2.36	5572.	2.52	5768.	2.61	5986.	2.71	6227.	2.81	6496.	2.93	7144.	3.22
	29000	4990.	2.30	5330.	2.45	5524.	2.54	5740.	2.63	5978.	2.74	6244.	2.86	6881.	3.13
	23000	4844.	2.26	5184.	2.42	5378.	2.51	5593.	2.60	5831.	2.71	6096.	2.82	6730.	3.10
1400	35700	5892.	2.69	6293.	2.88	6523.	2.99	6778.	3.10	7060.	3.23	7374.	3.37	8130.	3.71
	29000	5646.	2.62	6044.	2.80	6271.	2.90	6523.	3.01	6801.	3.14	7110.	3.28	7849.	3.61
	23000	5499.	2.58	5896.	2.76	6123.	2.87	6373.	2.98	6650.	3.11	6958.	3.24	7694.	3.57
1600	35700	6554.	3.02	7014.	3.23	7278.	3.36	7570.	3.49	7893.	3.64	8253.	3.80	9116.	4.20
	29000	6303.	2.94	6758.	3.15	7018.	3.27	7305.	3.40	7623.	3.55	7976.	3.70	8818.	4.08
	23000	6154.	2.90	6608.	3.11	6868.	3.23	7154.	3.36	7469.	3.51	7821.	3.66	8658.	4.04
1800	35700	7216.	3.35	7735.	3.59	8032.	3.74	8362.	3.89	8726.	4.05	9131.	4.24	10103.	4.68
	29000	6960.	3.26	7472.	3.50	7765.	3.63	8088.	3.78	8445.	3.95	8842.	4.13	9787.	4.56
	23000	6810.	3.22	7321.	3.46	7613.	3.60	7934.	3.74	8288.	3.91	8683.	4.08	9622.	4.51
2000	35700	7878.	3.68	8456.	3.95	8787.	4.11	9154.	4.28	9559.	4.46	10009.	4.67	11089.	5.17
	29000	7616.	3.58	8186.	3.85	8512.	4.00	8871.	4.16	9267.	4.35	9708.	4.55	10756.	5.03
	23000	7465.	3.54	8033.	3.80	8357.	3.96	8714.	4.12	9107.	4.31	9545.	4.50		
2200	35700	8540.	4.01	9178.	4.31	9542.	4.49	9946.	4.67	10392.	4.88	10888.	5.11	12075.	5.66
	29000	8273.	3.90	8901.	4.20	9259.	4.37	9654.	4.54	10090.	4.75	10573.	4.98	11725.	5.51
	23000	8120.	3.86	8745.	4.15	9102.	4.32	9494.	4.50						
2400	35700	9202.	4.33	9899.	4.66	10297.	4.86	10738.	5.06	11225.	5.29	11766.	5.54	13061.	6.15
	29000	8930.	4.22	9615.	4.55	10006.	4.73	10437.	4.93	10912.	5.16	11439.	5.40	12694.	5.98
	23000	8775.	4.18	9457.	4.50										
2600	35700	9863.	4.66	10620.	5.02	11052.	5.24	11530.	5.46	12058.	5.70	12645.	5.98	14047.	6.64
	29000	9587.	4.54	10329.	4.90	10753.	5.10	11220.	5.31	11734.	5.56	12305.	5.82	13663.	6.46
	23000	9431.	4.50												
2800	35700	10525.	4.99	11341.	5.38	11807.	5.61	12322.	5.85	12891.	6.11	13523.	6.41		
	29000	10243.	4.87	11043.	5.25	11500.	5.46	12002.	5.69	12557.	5.96	13171.	6.25		
	23000	10086.	4.82												
3000	35700	11187.	5.32	12062.	5.74	12562.	5.98	13114.	6.24	13724.	6.53				
	29000	10900.	5.19	11758.	5.60	12247.	5.83	12785.	6.08	13379.	6.37				
	23000	10741.	5.14												
3200	35700	11849.	5.65	12783.	6.09	13316.	6.36								
	29000	11557.	5.51	12472.	5.96	12994.	6.19								
	23000	11396.	5.46												
3400	35700	12511.	5.98	13504.	6.45										
	29000	12214.	5.83	13186.	6.31										
	23000	12052.	5.78												
3500	35700	12842.	6.14	13865.	6.63										
	29000	12542.	5.99	13543.	6.48										
	23000	12379.	5.94												
3600	35700	13172.	6.30												
	29000	12870.	6.15												
	23000	12707.	6.10												

NOTE: FUEL VALUES LARGER THAN THE MAXIMUM USABLE FUEL ARE PRESENTED FOR INTERPOLATION PURPOSES.

Figure 7-10 (Sheet 10)

FLIGHT PLANNING
MAXIMUM CRUISE THRUST
CRUISE (90.5% N1)

STANDARD DAY **CRUISE ALTITUDE 45000 FEET**

		TAILWIND						ZERO		HEADWIND					
STAGE	T.O.	100 KT.		50 KT.		25 KT.		WIND		25 KT.		50 KT.		100 KT.	
LENGTH NM.	WEIGHT LBS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.
200	35700	2183.	0.75	2219.	0.76	2242.	0.76	2268.	0.77	2298.	0.77	2334.	0.78	2428.	0.78
	29000	1735.	0.70	1783.	0.71	1811.	0.71	1844.	0.72	1882.	0.73	1925.	0.74	2038.	0.76
	23000	1577.	0.67	1628.	0.69	1658.	0.69	1693.	0.70	1733.	0.71	1778.	0.72	1897.	0.74
400	35700	2782.	1.08	2873.	1.12	2927.	1.14	2987.	1.16	3055.	1.19	3132.	1.22	3326.	1.28
	29000	2331.	1.02	2430.	1.06	2488.	1.08	2555.	1.11	2628.	1.14	2712.	1.17	2919.	1.24
	23000	2170.	0.99	2272.	1.03	2332.	1.06	2399.	1.08	2474.	1.11	2559.	1.14	2770.	1.22
600	35700	3382.	1.41	3527.	1.48	3612.	1.52	3706.	1.56	3812.	1.60	3931.	1.66	4223.	1.77
	29000	2926.	1.34	3078.	1.41	3166.	1.45	3265.	1.50	3375.	1.54	3498.	1.59	3801.	1.72
	23000	2763.	1.31	2917.	1.38	3005.	1.42	3105.	1.47	3216.	1.51	3340.	1.56	3643.	1.69
800	35700	3982.	1.75	4182.	1.84	4296.	1.89	4425.	1.96	4568.	2.02	4729.	2.10	5121.	2.27
	29000	3521.	1.67	3726.	1.77	3844.	1.82	3976.	1.88	4122.	1.95	4285.	2.02	4682.	2.20
	23000	3356.	1.63	3561.	1.73	3679.	1.79	3811.	1.85	3957.	1.91	4121.	1.99	4516.	2.16
1000	35700	4582.	2.08	4836.	2.20	4981.	2.27	5144.	2.35	5325.	2.44	5527.	2.53	6018.	2.76
	29000	4117.	1.99	4374.	2.12	4522.	2.19	4686.	2.27	4869.	2.36	5072.	2.45	5564.	2.68
	23000	3948.	1.95	4206.	2.08	4353.	2.15	4517.	2.23	4699.	2.31	4901.	2.41	5389.	2.63
1200	35700	5182.	2.41	5490.	2.56	5666.	2.65	5864.	2.75	6082.	2.86	6325.	2.97	6916.	3.26
	29000	4712.	2.32	5022.	2.47	5200.	2.56	5397.	2.66	5616.	2.76	5859.	2.88	6446.	3.16
	23000	4541.	2.28	4850.	2.43	5027.	2.52	5223.	2.61	5440.	2.71	5682.	2.83	6262.	3.11
1400	35700	5782.	2.74	6144.	2.92	6351.	3.03	6583.	3.14	6839.	3.27	7124.	3.41	7813.	3.76
	29000	5307.	2.64	5670.	2.82	5877.	2.93	6108.	3.04	6362.	3.17	6646.	3.31	7327.	3.64
	23000	5134.	2.60	5495.	2.78	5701.	2.88	5930.	2.99	6182.	3.11	6463.	3.25	7135.	3.58
1600	35700	6382.	3.07	6798.	3.28	7036.	3.41	7302.	3.54	7596.	3.69	7922.	3.85	8711.	4.25
	29000	5902.	2.97	6318.	3.18	6555.	3.30	6818.	3.43	7109.	3.57	7433.	3.73	8209.	4.12
	23000	5727.	2.92	6139.	3.12	6375.	3.25	6636.	3.37	6924.	3.52	7243.	3.67	8008.	4.05
1800	35700	6982.	3.40	7452.	3.64	7721.	3.79	8021.	3.94	8353.	4.11	8720.	4.29	9608.	4.75
	29000	6498.	3.29	6965.	3.53	7233.	3.67	7529.	3.82	7856.	3.98	8220.	4.16	9090.	4.60
	23000	6320.	3.24	6784.	3.47	7049.	3.61	7342.	3.76	7665.	3.92	8024.	4.09	8881.	4.52
2000	35700	7582.	3.73	8106.	4.00	8406.	4.16	8740.	4.33	9110.	4.52	9519.	4.73	10506.	5.24
	29000	7093.	3.61	7613.	3.88	7911.	4.04	8240.	4.20	8603.	4.39	9007.	4.59	9972.	5.08
	23000	6912.	3.56	7428.	3.82	7723.	3.98	8048.	4.14	8407.	4.32	8805.	4.52	9754.	4.99
2200	35700	8182.	4.06	8760.	4.36	9091.	4.54	9459.	4.73	9867.	4.94	10317.	5.17	11403.	5.74
	29000	7688.	3.94	8261.	4.23	8589.	4.41	8950.	4.59	9350.	4.79	9794.	5.02	10853.	5.56
	23000	7505.	3.88	8073.	4.17	8397.	4.34	8754.	4.52	9148.	4.72	9586.	4.94		
2400	35700	8782.	4.39	9414.	4.72	9776.	4.92	10178.	5.13	10624.	5.36	11115.	5.61	12301.	6.23
	29000	8284.	4.26	8909.	4.59	9266.	4.78	9661.	4.98	10097.	5.20	10580.	5.45	11735.	6.04
	23000	8098.	4.20	8717.	4.52	9071.	4.71	9460.	4.90						
2600	35700	9382.	4.72	10068.	5.08	10461.	5.30	10897.	5.52	11381.	5.78	11913.	6.05	13198.	6.73
	29000	8879.	4.59	9557.	4.94	9944.	5.15	10371.	5.36	10843.	5.61	11367.	5.87	12616.	6.52
	23000	8691.	4.52	9362.	4.87										
2800	35700	9981.	5.05	10722.	5.45	11146.	5.68	11617.	5.92	12137.	6.19	12712.	6.49	14096.	7.22
	29000	9474.	4.91	10205.	5.29	10622.	5.52	11082.	5.75	11590.	6.01	12154.	6.30	13498.	7.00
	23000	9284.	4.84												
3000	35700	10581.	5.38	11377.	5.81	11831.	6.05	12336.	6.32	12894.	6.61	13510.	6.93		
	29000	10069.	5.23	10853.	5.64	11300.	5.89	11793.	6.14	12337.	6.42	12941.	6.73		
	23000	9876.	5.16												
3200	35700	11181.	5.71	12031.	6.17	12516.	6.43	13055.	6.71	13651.	7.03				
	29000	10665.	5.56	11500.	6.00	11978.	6.26	12503.	6.53	13084.	6.82				
	23000	10469.	5.48												
3400	35700	11781.	6.05	12685.	6.53	13201.	6.81								
	29000	11260.	5.88	12148.	6.35	12655.	6.62								
	23000	11062.	5.80												
3600	35700	12381.	6.38	13339.	6.89										
	29000	11855.	6.21	12796.	6.70										
	23000	11655.	6.12												
3800	35700	12981.	6.71	13993.	7.25										
	29000	12451.	6.53	13444.	7.05										
	23000	12248.	6.44												
3900	35700	13281.	6.87												
	29000	12748.	6.69												
	23000	12544.	6.60												

NOTE: FUEL VALUES LARGER THAN THE MAXIMUM USABLE FUEL ARE PRESENTED FOR INTERPOLATION PURPOSES.

Figure 7-10 (Sheet 11)

FLIGHT PLANNING
MAXIMUM CRUISE THRUST
CRUISE (90.1% N1)

STANDARD DAY **CRUISE ALTITUDE 47000 FEET**

		TAILWIND						ZERO WIND		HEADWIND					
STAGE	T.O.	100 KT.		50 KT.		25 KT.				25 KT.		50 KT.		100 KT.	
LENGTH NM.	WEIGHT LBS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.
400	35700	3299.	1.11	3378.	1.14	3423.	1.17	3476.	1.19	3536.	1.20	3603.	1.22	3774.	1.29
	29000	2327.	1.04	2416.	1.08	2468.	1.10	2528.	1.12	2595.	1.15	2670.	1.18	2860.	1.25
	23000	2133.	1.00	2226.	1.04	2281.	1.06	2343.	1.09	2412.	1.12	2490.	1.15	2686.	1.22
600	35700	3841.	1.44	3970.	1.51	4043.	1.55	4127.	1.59	4221.	1.62	4327.	1.67	4588.	1.79
	29000	2866.	1.37	3003.	1.43	3083.	1.47	3172.	1.51	3272.	1.56	3385.	1.61	3662.	1.74
	23000	2668.	1.32	2808.	1.39	2889.	1.43	2980.	1.47	3081.	1.52	3195.	1.57	3474.	1.70
800	35700	4383.	1.77	4561.	1.87	4663.	1.93	4778.	1.99	4907.	2.04	5050.	2.12	5403.	2.29
	29000	3404.	1.69	3590.	1.79	3697.	1.85	3816.	1.91	3950.	1.97	4099.	2.05	4463.	2.22
	23000	3202.	1.64	3389.	1.74	3497.	1.80	3617.	1.86	3751.	1.92	3900.	2.00	4262.	2.17
1000	35700	4926.	2.11	5153.	2.23	5283.	2.31	5429.	2.39	5592.	2.47	5774.	2.56	6218.	2.79
	29000	3943.	2.02	4176.	2.15	4311.	2.22	4460.	2.30	4627.	2.38	4813.	2.48	5265.	2.71
	23000	3737.	1.96	3971.	2.09	4105.	2.16	4254.	2.24	4420.	2.32	4604.	2.42	5051.	2.64
1200	35700	5468.	2.44	5744.	2.60	5903.	2.69	6080.	2.79	6278.	2.89	6498.	3.01	7032.	3.29
	29000	4481.	2.35	4763.	2.50	4925.	2.59	5105.	2.69	5304.	2.80	5527.	2.91	6066.	3.20
	23000	4271.	2.29	4552.	2.44	4713.	2.53	4891.	2.62	5089.	2.73	5309.	2.84	5839.	3.12
1400	35700	6010.	2.78	6336.	2.96	6523.	3.07	6731.	3.19	6963.	3.31	7222.	3.45	7847.	3.79
	29000	5020.	2.67	5349.	2.86	5539.	2.97	5749.	3.08	5982.	3.21	6242.	3.35	6868.	3.69
	23000	4806.	2.61	5133.	2.79	5321.	2.89	5529.	3.00	5758.	3.13	6014.	3.27	6627.	3.59
1600	35700	6552.	3.11	6928.	3.33	7143.	3.45	7383.	3.58	7648.	3.73	7945.	3.90	8662.	4.29
	29000	5558.	3.00	5936.	3.21	6153.	3.34	6393.	3.47	6659.	3.62	6956.	3.78	7670.	4.18
	23000	5341.	2.93	5715.	3.14	5929.	3.26	6166.	3.39	6427.	3.53	6719.	3.69	7416.	4.07
1800	35700	7095.	3.44	7519.	3.69	7763.	3.83	8034.	3.98	8334.	4.15	8669.	4.34	9476.	4.79
	29000	6096.	3.33	6522.	3.57	6767.	3.71	7037.	3.86	7336.	4.03	7670.	4.22	8471.	4.66
	23000	5875.	3.25	6296.	3.49	6537.	3.62	6803.	3.77	7097.	3.93	7423.	4.11	8204.	4.54
2000	35700	7637.	3.78	8111.	4.05	8383.	4.21	8685.	4.38	9019.	4.58	9393.	4.79	10291.	5.29
	29000	6635.	3.65	7109.	3.93	7381.	4.09	7681.	4.25	8014.	4.44	8384.	4.65	9273.	5.15
	23000	6410.	3.57	6878.	3.84	7145.	3.99	7440.	4.15	7766.	4.33	8128.	4.54	8992.	5.02
2200	35700	8179.	4.11	8702.	4.42	9003.	4.59	9336.	4.78	9705.	5.00	10116.	5.23	11106.	5.79
	29000	7173.	3.98	7695.	4.28	7995.	4.46	8325.	4.65	8691.	4.85	9099.	5.08	10075.	5.64
	23000	6944.	3.89	7459.	4.18	7753.	4.36	8077.	4.54	8435.	4.74	8833.	4.96	9781.	5.49
2400	35700	8722.	4.44	9294.	4.78	9623.	4.97	9987.	5.18	10390.	5.42	10840.	5.68	11920.	6.29
	29000	7712.	4.31	8282.	4.64	8609.	4.83	8969.	5.04	9368.	5.26	9813.	5.52	10876.	6.13
	23000	7479.	4.21	8040.	4.53	8361.	4.72	8714.	4.92	9104.	5.14	9537.	5.38		
2600	35700	9264.	4.78	9886.	5.14	10243.	5.35	10638.	5.58	11075.	5.84	11564.	6.13	12735.	6.80
	29000	8250.	4.64	8868.	5.00	9223.	5.21	9613.	5.43	10046.	5.68	10527.	5.95	11678.	6.62
	23000	8014.	4.53	8622.	4.88	8969.	5.09	9351.	5.30						
2800	35700	9806.	5.11	10477.	5.51	10863.	5.73	11289.	5.98	11761.	6.26	12287.	6.57	13549.	7.30
	29000	8789.	4.96	9455.	5.35	9837.	5.58	10258.	5.82	10723.	6.09	11241.	6.39	12479.	7.10
	23000	8548.	4.86	9203.	5.23	9576.	5.45								
3000	35700	10349.	5.45	11069.	5.87	11483.	6.11	11940.	6.38	12446.	6.68	13011.	7.02	14364.	7.80
	29000	9327.	5.29	10041.	5.71	10451.	5.95	10902.	6.21	11400.	6.50	11956.	6.82	13281.	7.59
	23000	9083.	5.18												
3200	35700	10891.	5.78	11660.	6.24	12103.	6.49	12591.	6.78	13132.	7.11	13735.	7.46		
	29000	9866.	5.62	10628.	6.06	11065.	6.33	11546.	6.60	12078.	6.91	12670.	7.25		
	23000	9617.	5.50												
3400	35700	11433.	6.11	12252.	6.60	12723.	6.87	13242.	7.17						
	29000	10404.	5.94	11214.	6.42	11679.	6.70	12190.	7.00						
	23000	10152.	5.82												
3600	35700	11975.	6.45	12844.	6.96	13343.	7.25								
	29000	10943.	6.27	11801.	6.78	12293.	7.07								
	23000	10687.	6.14												
3800	35700	12518.	6.78	13435.	7.33										
	29000	11481.	6.60	12387.	7.13										
	23000	11221.	6.46												
4000	35700	13060.	7.11												
	29000	12020.	6.93												
	23000	11756.	6.78												

NOTE: FUEL VALUES LARGER THAN THE MAXIMUM USABLE FUEL ARE PRESENTED FOR INTERPOLATION PURPOSES.

Figure 7-10 (Sheet 12)

FLIGHT PLANNING
MAXIMUM CRUISE THRUST
CRUISE (89.8% N1)

STANDARD DAY | **CRUISE ALTITUDE 49000 FEET**

		TAILWIND						ZERO		HEADWIND					
STAGE	T.O.	100 KT.		50 KT.		25 KT.		WIND		25 KT.		50 KT.		100 KT.	
LENGTH NM.	WEIGHT LBS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.
400	35700	4044.	1.13	4106.	1.16	4144.	1.20	4189.	1.16	4234.	1.18	4295.	1.20	4437.	1.31
	29000	2551.	1.08	2631.	1.11	2677.	1.13	2732.	1.16	2792.	1.18	2860.	1.21	3033.	1.28
	23000	2110.	1.01	2196.	1.05	2246.	1.07	2303.	1.10	2366.	1.13	2439.	1.16	2620.	1.23
600	35700	4537.	1.46	4644.	1.52	4708.	1.58	4782.	1.56	4859.	1.60	4954.	1.65	5181.	1.81
	29000	3040.	1.41	3164.	1.47	3236.	1.51	3317.	1.55	3408.	1.60	3510.	1.65	3764.	1.77
	23000	2596.	1.33	2724.	1.40	2798.	1.44	2882.	1.48	2975.	1.53	3079.	1.58	3338.	1.70
800	35700	5030.	1.80	5183.	1.89	5273.	1.96	5374.	1.97	5483.	2.03	5614.	2.10	5924.	2.31
	29000	3529.	1.74	3697.	1.83	3794.	1.89	3903.	1.95	4025.	2.01	4161.	2.09	4494.	2.26
	23000	3081.	1.66	3252.	1.75	3350.	1.81	3460.	1.87	3583.	1.94	3720.	2.01	4055.	2.18
1000	35700	5523.	2.13	5721.	2.25	5837.	2.34	5967.	2.37	6108.	2.46	6273.	2.54	6667.	2.81
	29000	4018.	2.07	4230.	2.19	4352.	2.26	4489.	2.34	4641.	2.43	4811.	2.52	5225.	2.75
	23000	3566.	1.98	3779.	2.11	3902.	2.18	4039.	2.26	4191.	2.34	4361.	2.44	4772.	2.66
1200	35700	6015.	2.47	6259.	2.62	6401.	2.72	6559.	2.78	6732.	2.88	6932.	2.99	7411.	3.31
	29000	4507.	2.40	4764.	2.55	4911.	2.64	5075.	2.74	5257.	2.84	5461.	2.96	5955.	3.24
	23000	4051.	2.30	4307.	2.46	4454.	2.54	4618.	2.64	4799.	2.75	5002.	2.86	5489.	3.14
1400	35700	6508.	2.80	6797.	2.98	6965.	3.10	7152.	3.18	7357.	3.31	7592.	3.44	8154.	3.81
	29000	4997.	2.73	5297.	2.91	5469.	3.01	5661.	3.13	5874.	3.26	6111.	3.40	6685.	3.74
	23000	4536.	2.63	4835.	2.81	5006.	2.91	5197.	3.03	5407.	3.15	5642.	3.29	6207.	3.62
1600	35700	7001.	3.13	7335.	3.35	7529.	3.48	7745.	3.58	7981.	3.73	8251.	3.89	8897.	4.31
	29000	5486.	3.06	5830.	3.27	6028.	3.39	6247.	3.52	6490.	3.67	6762.	3.84	7416.	4.23
	23000	5022.	2.95	5363.	3.16	5558.	3.28	5776.	3.41	6015.	3.56	6283.	3.72	6924.	4.09
1800	35700	7494.	3.47	7874.	3.71	8093.	3.86	8337.	3.99	8606.	4.16	8910.	4.34	9641.	4.81
	29000	5975.	3.38	6363.	3.63	6586.	3.77	6833.	3.92	7107.	4.09	7412.	4.28	8146.	4.72
	23000	5507.	3.27	5891.	3.51	6111.	3.64	6355.	3.80	6623.	3.96	6924.	4.14	7641.	4.57
2000	35700	7987.	3.80	8412.	4.08	8657.	4.24	8930.	4.39	9230.	4.58	9570.	4.79	10384.	5.31
	29000	6464.	3.71	6896.	3.99	7144.	4.14	7418.	4.31	7723.	4.50	8062.	4.71	8877.	5.21
	23000	5992.	3.60	6419.	3.86	6663.	4.01	6933.	4.18	7231.	4.37	7564.	4.57	8358.	5.05
2200	35700	8480.	4.14	8950.	4.44	9221.	4.62	9522.	4.80	9855.	5.01	10229.	5.24	11127.	5.81
	29000	6953.	4.04	7429.	4.35	7703.	4.52	8004.	4.71	8339.	4.92	8713.	5.15	9607.	5.70
	23000	6477.	3.92	6947.	4.21	7215.	4.38	7512.	4.57	7839.	4.77	8205.	5.00	9076.	5.53
2400	35700	8972.	4.47	9488.	4.81	9785.	5.00	10115.	5.20	10479.	5.43	10888.	5.69	11870.	6.31
	29000	7442.	4.37	7963.	4.71	8261.	4.90	8590.	5.10	8956.	5.33	9363.	5.59	10338.	6.20
	23000	6963.	4.24	7474.	4.57	7767.	4.75	8091.	4.96	8447.	5.18	8846.	5.43	9793.	6.01
2600	35700	9465.	4.81	10027.	5.17	10350.	5.38	10708.	5.60	11104.	5.86	11548.	6.14	12614.	6.81
	29000	7932.	4.70	8496.	5.07	8819.	5.27	9176.	5.50	9572.	5.75	10013.	6.03	11068.	6.69
	23000	7448.	4.56	8002.	4.92	8319.	5.11	8670.	5.34	9055.	5.58	9487.	5.85		
2800	35700	9958.	5.14	10565.	5.54	10914.	5.76	11300.	6.01	11729.	6.28	12207.	6.59	13357.	7.31
	29000	8421.	5.03	9029.	5.43	9378.	5.65	9762.	5.89	10189.	6.16	10663.	6.47	11799.	7.18
	23000	7933.	4.89	8530.	5.27	8871.	5.48	9249.	5.73						
3000	35700	10451.	5.47	11103.	5.90	11478.	6.14	11893.	6.41	12353.	6.71	12866.	7.04	14100.	7.81
	29000	8910.	5.36	9562.	5.79	9936.	6.02	10348.	6.29	10805.	6.58	11314.	6.90	12529.	7.67
	23000	8418.	5.21	9058.	5.62	9424.	5.85								
3200	35700	10944.	5.81	11641.	6.26	12042.	6.52	12485.	6.82	12978.	7.14	13526.	7.49		
	29000	9399.	5.69	10095.	6.15	10494.	6.40	10934.	6.68	11421.	6.99	11964.	7.34		
	23000	8903.	5.53	9586.	5.97										
3400	35700	11437.	6.14	12180.	6.63	12606.	6.90	13078.	7.22	13602.	7.56				
	29000	9888.	6.02	10629.	6.51	11053.	6.78	11519.	7.08	12038.	7.41				
	23000	9389.	5.86												
3600	35700	11929.	6.48	12718.	6.99	13170.	7.28								
	29000	10378.	6.35	11162.	6.87	11611.	7.15								
	23000	9874.	6.18												
3800	35700	12422.	6.81	13256.	7.36										
	29000	10867.	6.68	11695.	7.23										
	23000	10359.	6.50												
4000	35700	12915.	7.15	13794.	7.72										
	29000	11356.	7.01	12228.	7.59										
	23000	10844.	6.83												
4100	35700	13161.	7.31												
	29000	11600.	7.18												
	23000	11087.	6.99												

NOTE: FUEL VALUES LARGER THAN THE MAXIMUM USABLE FUEL ARE PRESENTED FOR INTERPOLATION PURPOSES.

Figure 7-10 (Sheet 13)

FLIGHT PLANNING
MAXIMUM CRUISE THRUST
CRUISE (89.3% N1)

STANDARD DAY **CRUISE ALTITUDE 51000 FEET**

STAGE LENGTH NM.	T.O. WEIGHT LBS.	TAILWIND 100 KT. FUEL LBS.	TAILWIND 100 KT. TIME HRS.	TAILWIND 50 KT. FUEL LBS.	TAILWIND 50 KT. TIME HRS.	TAILWIND 25 KT. FUEL LBS.	TAILWIND 25 KT. TIME HRS.	ZERO WIND FUEL LBS.	ZERO WIND TIME HRS.	HEADWIND 25 KT. FUEL LBS.	HEADWIND 25 KT. TIME HRS.	HEADWIND 50 KT. FUEL LBS.	HEADWIND 50 KT. TIME HRS.	HEADWIND 100 KT. FUEL LBS.	HEADWIND 100 KT. TIME HRS.
400	32000	3901.	1.10	3963.	1.12	4000.	1.15	4042.	1.17	4090.	1.19	4145.	1.20	4283.	1.27
	29000	3104.	1.10	3175.	1.14	3216.	1.15	3263.	1.18	3317.	1.20	3377.	1.22	3533.	1.29
	23000	2107.	1.03	2183.	1.07	2228.	1.09	2280.	1.11	2338.	1.14	2403.	1.17	2570.	1.24
600	32000	4341.	1.44	4443.	1.49	4504.	1.53	4571.	1.57	4647.	1.61	4733.	1.65	4946.	1.78
	29000	3543.	1.43	3653.	1.50	3717.	1.53	3789.	1.57	3870.	1.62	3962.	1.66	4190.	1.79
	23000	2542.	1.36	2658.	1.42	2724.	1.46	2800.	1.50	2885.	1.55	2980.	1.60	3217.	1.72
800	32000	4782.	1.77	4924.	1.85	5007.	1.92	5100.	1.98	5204.	2.03	5321.	2.09	5609.	2.28
	29000	3981.	1.76	4131.	1.87	4218.	1.91	4315.	1.97	4424.	2.04	4546.	2.11	4847.	2.28
	23000	2978.	1.68	3132.	1.78	3221.	1.83	3321.	1.89	3432.	1.96	3557.	2.03	3864.	2.21
1000	32000	5222.	2.11	5404.	2.22	5511.	2.30	5629.	2.38	5762.	2.46	5910.	2.54	6272.	2.78
	29000	4420.	2.10	4609.	2.23	4719.	2.29	4841.	2.37	4978.	2.46	5130.	2.55	5504.	2.78
	23000	3413.	2.01	3606.	2.13	3717.	2.21	3842.	2.28	3980.	2.37	4134.	2.47	4511.	2.69
1200	32000	5662.	2.44	5885.	2.59	6015.	2.68	6158.	2.78	6319.	2.88	6498.	2.99	6935.	3.28
	29000	4858.	2.43	5088.	2.59	5220.	2.67	5367.	2.77	5531.	2.87	5715.	2.99	6161.	3.28
	23000	3849.	2.34	4080.	2.49	4213.	2.58	4362.	2.67	4527.	2.78	4711.	2.90	5158.	3.18
1400	32000	6102.	2.78	6366.	2.95	6518.	3.06	6687.	3.18	6876.	3.30	7087.	3.44	7598.	3.78
	29000	5297.	2.76	5566.	2.95	5721.	3.05	5893.	3.17	6085.	3.29	6299.	3.43	6819.	3.77
	23000	4284.	2.66	4555.	2.85	4710.	2.95	4883.	3.06	5074.	3.19	5288.	3.33	5806.	3.66
1600	32000	6543.	3.11	6846.	3.32	7022.	3.45	7217.	3.58	7433.	3.73	7675.	3.89	8261.	4.29
	29000	5736.	3.09	6044.	3.31	6222.	3.43	6419.	3.56	6639.	3.71	6883.	3.88	7476.	4.27
	23000	4720.	2.99	5029.	3.20	5206.	3.32	5404.	3.45	5622.	3.60	5865.	3.76	6453.	4.15
1800	32000	6983.	3.45	7327.	3.68	7525.	3.83	7746.	3.98	7990.	4.15	8263.	4.33	8924.	4.79
	29000	6174.	3.43	6523.	3.67	6723.	3.81	6945.	3.96	7192.	4.13	7468.	4.32	8133.	4.77
	23000	5156.	3.32	5503.	3.56	5703.	3.69	5924.	3.84	6169.	4.01	6442.	4.20	7100.	4.64
2000	32000	7423.	3.78	7808.	4.05	8029.	4.21	8275.	4.38	8547.	4.57	8852.	4.78	9587.	5.29
	29000	6613.	3.76	7001.	4.03	7224.	4.19	7471.	4.36	7746.	4.55	8052.	4.76	8790.	5.26
	23000	5591.	3.64	5978.	3.91	6199.	4.07	6445.	4.23	6717.	4.42	7020.	4.63	7747.	5.12
2200	32000	7863.	4.12	8288.	4.42	8533.	4.59	8804.	4.79	9104.	5.00	9440.	5.23	10250.	5.79
	29000	7051.	4.09	7479.	4.39	7725.	4.57	7997.	4.76	8299.	4.97	8636.	5.21	9447.	5.76
	23000	6027.	3.97	6452.	4.27	6695.	4.44	6966.	4.62	7264.	4.83	7597.	5.06	8394.	5.61
2400	32000	8304.	4.45	8769.	4.78	9036.	4.98	9333.	5.19	9661.	5.42	10029.	5.68	10913.	6.29
	29000	7490.	4.42	7958.	4.76	8226.	4.95	8524.	5.16	8853.	5.39	9221.	5.65	10105.	6.26
	23000	6462.	4.30	6926.	4.62	7192.	4.81	7486.	5.01	7811.	5.24	8174.	5.49	9042.	6.09
2600	32000	8744.	4.79	9249.	5.15	9540.	5.36	9862.	5.59	10219.	5.84	10617.	6.12	11576.	6.79
	29000	7929.	4.75	8436.	5.12	8727.	5.33	9050.	5.56	9407.	5.81	9805.	6.09	10762.	6.75
	23000	6898.	4.62	7401.	4.98	7688.	5.18	8007.	5.40	8359.	5.65	8751.	5.93	9689.	6.58
2800	32000	9184.	5.12	9730.	5.51	10043.	5.74	10391.	5.99	10776.	6.27	11205.	6.57	12239.	7.30
	29000	8367.	5.09	8914.	5.48	9228.	5.71	9576.	5.95	9960.	6.23	10389.	6.54	11419.	7.25
	23000	7333.	4.95	7875.	5.34	8184.	5.55	8528.	5.79	8906.	6.06	9328.	6.36		
3000	32000	9625.	5.46	10211.	5.88	10547.	6.12	10920.	6.39	11333.	6.69	11794.	7.02	12902.	7.80
	29000	8806.	5.42	9393.	5.84	9729.	6.09	10102.	6.35	10514.	6.65	10974.	6.98	12076.	7.75
	23000	7769.	5.27	8349.	5.69	8681.	5.93	9048.	6.18	9453.	6.47				
3200	32000	10065.	5.79	10691.	6.25	11051.	6.51	11449.	6.79	11890.	7.11	12382.	7.47	13565.	8.30
	29000	9244.	5.75	9871.	6.20	10230.	6.47	10628.	6.75	11068.	7.07	11558.	7.42	12733.	8.25
	23000	8205.	5.60	8824.	6.05	9177.	6.30								
3400	32000	10505.	6.12	11172.	6.61	11554.	6.89	11978.	7.20	12447.	7.54	12971.	7.92		
	29000	9683.	6.08	10349.	6.56	10731.	6.85	11154.	7.15	11621.	7.49	12142.	7.86		
	23000	8640.	5.93	9298.	6.40										
3600	32000	10945.	6.46	11652.	6.98	12058.	7.27	12507.	7.60	13004.	7.96				
	29000	10121.	6.42	10828.	6.92	11232.	7.22	11680.	7.55	12175.	7.91				
	23000	9076.	6.25												
3800	32000	11386.	6.79	12133.	7.35	12561.	7.66								
	29000	10560.	6.75	11306.	7.28	11733.	7.60								
	23000	9511.	6.58												
4000	32000	11826.	7.13	12614.	7.71										
	29000	10999.	7.08	11784.	7.65										
	23000	9947.	6.91												
4200	32000	12266.	7.46	13094.	8.08										
	29000	11437.	7.41	12262.	8.01										
	23000	10382.	7.23												

NOTE: FUEL VALUES LARGER THAN THE MAXIMUM USABLE FUEL ARE PRESENTED FOR INTERPOLATION PURPOSES.

Figure 7-10 (Sheet 14)

FLIGHT PLANNING
NORMAL CRUISE THRUST
CRUISE (0.82 MACH)

STANDARD DAY **CRUISE ALTITUDE 31000 FEET**

		TAILWIND						ZERO		HEADWIND					
STAGE	T.O.	100 KT.		50 KT.		25 KT.		WIND		25 KT.		50 KT.		100 KT.	
LENGTH NM.	WEIGHT LBS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.
200	35700	1821.	0.68	1891.	0.70	1932.	0.71	1980.	0.72	2034.	0.73	2095.	0.75	2253.	0.78
	29000	1690.	0.66	1762.	0.68	1804.	0.69	1853.	0.71	1908.	0.72	1970.	0.74	2131.	0.77
	23000	1591.	0.65	1664.	0.67	1706.	0.68	1756.	0.70	1811.	0.71	1875.	0.73	2037.	0.77
400	35700	2650.	1.02	2798.	1.07	2884.	1.10	2981.	1.14	3090.	1.17	3212.	1.21	3516.	1.30
	29000	2495.	1.01	2642.	1.06	2727.	1.09	2824.	1.12	2932.	1.16	3054.	1.20	3356.	1.29
	23000	2379.	1.00	2526.	1.05	2611.	1.08	2707.	1.11	2815.	1.15	2936.	1.19	3237.	1.29
600	35700	3480.	1.37	3705.	1.45	3836.	1.50	3983.	1.55	4146.	1.61	4330.	1.67	4780.	1.82
	29000	3299.	1.35	3522.	1.43	3651.	1.48	3795.	1.54	3957.	1.59	4138.	1.66	4582.	1.81
	23000	3167.	1.34	3388.	1.42	3516.	1.47	3658.	1.53	3818.	1.58	3998.	1.65	4438.	1.81
800	35700	4309.	1.71	4613.	1.82	4788.	1.89	4984.	1.96	5201.	2.04	5447.	2.13	6043.	2.35
	29000	4104.	1.69	4402.	1.81	4574.	1.87	4767.	1.95	4981.	2.03	5222.	2.12	5807.	2.34
	23000	3956.	1.68	4250.	1.80	4420.	1.86	4610.	1.94	4822.	2.02	5059.	2.11	5638.	2.33
1000	35700	5139.	2.05	5520.	2.20	5740.	2.28	5986.	2.38	6257.	2.48	6564.	2.59	7306.	2.87
	29000	4909.	2.03	5282.	2.19	5498.	2.27	5738.	2.36	6006.	2.47	6305.	2.58	7033.	2.86
	23000	4744.	2.02	5112.	2.17	5325.	2.26	5561.	2.35	5825.	2.46	6121.	2.57	6838.	2.85
1200	35700	5968.	2.39	6427.	2.57	6692.	2.68	6987.	2.79	7313.	2.91	7681.	3.05	8570.	3.39
	29000	5713.	2.38	6162.	2.56	6421.	2.66	6710.	2.78	7030.	2.90	7389.	3.04	8258.	3.38
	23000	5532.	2.37	5974.	2.54	6229.	2.65	6512.	2.77	6829.	2.89	7182.	3.03	8038.	3.37
1400	35700	6797.	2.74	7335.	2.94	7644.	3.07	7988.	3.21	8369.	3.35	8799.	3.51	9833.	3.91
	29000	6518.	2.72	7043.	2.94	7345.	3.05	7681.	3.19	8054.	3.34	8473.	3.50	9484.	3.90
	23000	6320.	2.71	6836.	2.92	7134.	3.04	7464.	3.18	7832.	3.33	8244.	3.49	9239.	3.89
1600	35700	7627.	3.08	8242.	3.32	8596.	3.46	8990.	3.62	9425.	3.79	9916.	3.97	11097.	4.43
	29000	7322.	3.06	7923.	3.31	8269.	3.45	8652.	3.61	9079.	3.77	9557.	3.96	10709.	4.42
	23000	7108.	3.05	7698.	3.29	8038.	3.44	8415.	3.60	8836.	3.77	9305.	3.96		
1800	35700	8456.	3.42	9149.	3.69	9548.	3.85	9991.	4.04	10481.	4.22	11033.	4.44	12360.	4.95
	29000	8127.	3.40	8803.	3.69	9192.	3.84	9624.	4.02	10103.	4.21	10640.	4.42	11935.	4.94
	23000	7896.	3.39	8560.	3.67	8943.	3.83	9366.	4.01	9839.	4.20				
2000	35700	9286.	3.76	10057.	4.07	10500.	4.25	10993.	4.45	11537.	4.66	12150.	4.90	13624.	5.47
	29000	8932.	3.75	9683.	4.06	10116.	4.23	10595.	4.43	11128.	4.65	11724.	4.88	13160.	5.46
	23000	8684.	3.73	9423.	4.04	9848.	4.22								
2100	35700	9700.	3.93	10510.	4.25	10976.	4.44	11493.	4.66	12065.	4.88	12709.	5.13	14255.	5.73
	29000	9334.	3.92	10123.	4.25	10577.	4.43	11081.	4.64	11640.	4.86	12266.	5.11	13773.	5.72
	23000	9078.	3.91												
2200	35700	10115.	4.11	10964.	4.44	11452.	4.64	11994.	4.86	12593.	5.10	13268.	5.36		
	29000	9736.	4.09	10563.	4.44	11039.	4.63	11567.	4.85	12152.	5.08	12808.	5.34		
	23000	9472.	4.08												
2300	35700	10530.	4.28	11418.	4.63	11928.	4.84	12495.	5.07	13120.	5.31				
	29000	10138.	4.26	11003.	4.62	11501.	4.82	12052.	5.06	12665.	5.30				
	23000	9866.	4.25												
2400	35700	10944.	4.45	11871.	4.81	12404.	5.03	12996.	5.28	13648.	5.53				
	29000	10541.	4.43	11443.	4.81	11963.	5.02	12538.	5.26	13177.	5.52				
	23000	10260.	4.42												
2500	35700	11359.	4.62	12325.	5.00	12880.	5.23	13496.	5.49						
	29000	10943.	4.60	11883.	5.00	12424.	5.21	13024.	5.47						
	23000	10654.	4.59												
2600	35700	11774.	4.79	12779.	5.19	13356.	5.43								
	29000	11345.	4.77	12324.	5.19	12886.	5.41								
	23000	11048.	4.76												
2700	35700	12189.	4.96	13232.	5.38										
	29000	11748.	4.94	12764.	5.38										
	23000	11442.	4.93												
2800	35700	12603.	5.13	13686.	5.56										
	29000	12150.	5.11	13204.	5.56										
	23000	11836.	5.10												
2900	35700	13018.	5.30	14140.	5.75										
	29000	12552.	5.29	13644.	5.75										
	23000	12230.	5.28												
3000	35700	13433.	5.48												
	29000	12954.	5.46												
	23000	12624.	5.45												

NOTE: FUEL VALUES LARGER THAN THE MAXIMUM USABLE FUEL ARE PRESENTED FOR INTERPOLATION PURPOSES.

Figure 7-11 (Sheet 1 of 10)

FLIGHT PLANNING
NORMAL CRUISE THRUST
CRUISE (0.82 MACH)

STANDARD DAY **CRUISE ALTITUDE 33000 FEET**

		TAILWIND						ZERO		HEADWIND					
		100 KT.		50 KT.		25 KT.		WIND		25 KT.		50 KT.		100 KT.	
STAGE LENGTH NM.	T.O. WEIGHT LBS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.
200	35700	1834.	0.68	1898.	0.70	1936.	0.71	1980.	0.72	2030.	0.73	2086.	0.75	2233.	0.78
	29000	1688.	0.67	1753.	0.69	1792.	0.70	1837.	0.71	1888.	0.72	1947.	0.74	2097.	0.77
	23000	1578.	0.65	1644.	0.67	1684.	0.69	1730.	0.70	1781.	0.71	1840.	0.73	1992.	0.76
400	35700	2598.	1.03	2735.	1.08	2814.	1.11	2904.	1.14	3005.	1.17	3119.	1.21	3403.	1.31
	29000	2426.	1.01	2562.	1.06	2641.	1.09	2731.	1.12	2831.	1.16	2944.	1.20	3226.	1.30
	23000	2298.	1.00	2433.	1.05	2511.	1.08	2601.	1.12	2700.	1.15	2813.	1.19	3094.	1.29
600	35700	3363.	1.37	3571.	1.46	3693.	1.50	3829.	1.56	3981.	1.61	4152.	1.68	4572.	1.84
	29000	3165.	1.36	3370.	1.44	3490.	1.49	3624.	1.54	3773.	1.60	3942.	1.67	4356.	1.83
	23000	3018.	1.35	3221.	1.43	3339.	1.48	3472.	1.53	3620.	1.59	3786.	1.66	4196.	1.82
800	35700	4127.	1.72	4408.	1.83	4571.	1.90	4753.	1.97	4956.	2.05	5184.	2.15	5742.	2.37
	29000	3903.	1.70	4178.	1.82	4338.	1.89	4517.	1.96	4716.	2.04	4939.	2.14	5485.	2.36
	23000	3738.	1.69	4010.	1.81	4166.	1.88	4343.	1.95	4539.	2.03	4759.	2.13	5297.	2.35
1000	35700	4891.	2.07	5245.	2.21	5449.	2.30	5677.	2.39	5932.	2.49	6217.	2.61	6911.	2.89
	29000	4641.	2.05	4986.	2.20	5187.	2.28	5410.	2.38	5658.	2.49	5936.	2.60	6615.	2.89
	23000	4458.	2.04	4798.	2.19	4994.	2.28	5213.	2.37	5458.	2.47	5732.	2.60	6399.	2.88
1200	35700	5655.	2.41	6082.	2.59	6328.	2.70	6602.	2.81	6907.	2.93	7249.	3.08	8081.	3.42
	29000	5380.	2.39	5794.	2.58	6035.	2.68	6303.	2.79	6600.	2.93	6934.	3.07	7745.	3.41
	23000	5178.	2.38	5586.	2.57	5822.	2.67	6084.	2.79	6377.	2.91	6705.	3.06	7501.	3.40
1400	35700	6420.	2.76	6918.	2.97	7206.	3.09	7526.	3.23	7882.	3.37	8282.	3.55	9250.	3.95
	29000	6118.	2.74	6603.	2.96	6884.	3.08	7196.	3.21	7543.	3.37	7931.	3.54	8874.	3.94
	23000	5898.	2.73	6375.	2.94	6649.	3.07	6955.	3.20	7296.	3.35	7677.	3.53	8602.	3.93
1600	35700	7184.	3.10	7755.	3.35	8084.	3.49	8451.	3.64	8858.	3.81	9314.	4.02	10420.	4.48
	29000	6857.	3.08	7411.	3.34	7733.	3.48	8089.	3.63	8485.	3.81	8929.	4.00	10004.	4.47
	23000	6619.	3.07	7163.	3.32	7477.	3.47	7826.	3.62	8215.	3.79	8650.	4.00	9704.	4.46
1800	35700	7948.	3.45	8592.	3.72	8963.	3.89	9375.	4.06	9833.	4.25	10347.	4.48	11589.	5.01
	29000	7595.	3.43	8219.	3.72	8581.	3.87	8982.	4.05	9428.	4.25	9926.	4.47	11133.	5.00
	23000	7339.	3.42	7952.	3.70	8304.	3.87	8697.	4.04	9134.	4.24	9623.	4.47		
2000	35700	8712.	3.79	9429.	4.10	9841.	4.29	10299.	4.48	10809.	4.69	11379.	4.95	12759.	5.54
	29000	8334.	3.77	9027.	4.09	9430.	4.27	9875.	4.46	10370.	4.69	10923.	4.94	12263.	5.53
	23000	8059.	3.77	8740.	4.08	9132.	4.26	9568.	4.46						
2200	35700	9477.	4.14	10265.	4.48	10720.	4.68	11224.	4.90	11784.	5.13	12412.	5.42	13929.	6.07
	29000	9072.	4.12	9835.	4.47	10279.	4.67	10768.	4.88	11312.	5.13	11921.	5.40	13392.	6.06
	23000	8779.	4.11	9528.	4.46										
2400	35700	10241.	4.49	11102.	4.86	11598.	5.08	12148.	5.31	12760.	5.57	13445.	5.88		
	29000	9810.	4.47	10644.	4.85	11127.	5.06	11661.	5.30	12255.	5.57	12918.	5.87		
	23000	9499.	4.46												
2500	35700	10623.	4.66	11521.	5.05	12037.	5.28	12610.	5.52	13248.	5.79				
	29000	10180.	4.64	11048.	5.04	11552.	5.26	12108.	5.51	12726.	5.80				
	23000	9859.	4.63												
2600	35700	11005.	4.83	11939.	5.24	12476.	5.48	13073.	5.73						
	29000	10549.	4.81	11452.	5.23	11976.	5.46	12554.	5.72						
	23000	10219.	4.80												
2700	35700	11387.	5.00	12357.	5.43	12916.	5.68	13535.	5.94						
	29000	10918.	4.98	11856.	5.42	12400.	5.66	13001.	5.92						
	23000	10579.	4.98												
2800	35700	11769.	5.18	12776.	5.61	13355.	5.88								
	29000	11287.	5.16	12260.	5.61	12825.	5.86								
	23000	10940.	5.15												
2900	35700	12152.	5.35	13194.	5.80										
	29000	11657.	5.33	12664.	5.80										
	23000	11300.	5.32												
3000	35700	12534.	5.52	13612.	5.99										
	29000	12026.	5.50	13068.	5.99										
	23000	11660.	5.49												
3100	35700	12916.	5.69	14031.	6.18										
	29000	12395.	5.67	13472.	6.18										
	23000	12020.	5.67												
3200	35700	13298.	5.87												
	29000	12764.	5.85												
	23000	12380.	5.84												

NOTE: FUEL VALUES LARGER THAN THE MAXIMUM USABLE FUEL ARE PRESENTED FOR INTERPOLATION PURPOSES.

Figure 7-11 (Sheet 2)

FLIGHT PLANNING
NORMAL CRUISE THRUST
CRUISE (0.82 MACH)

STANDARD DAY **CRUISE ALTITUDE 35000 FEET**

		TAILWIND						ZERO		HEADWIND					
STAGE	T.O.	100 KT.		50 KT.		25 KT.		WIND		25 KT.		50 KT.		100 KT.	
LENGTH NM.	WEIGHT LBS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.
200	35700	1856.	0.68	1915.	0.70	1950.	0.71	1991.	0.72	2037.	0.73	2090.	0.74	2227.	0.78
	29000	1694.	0.67	1755.	0.69	1791.	0.70	1833.	0.71	1881.	0.72	1935.	0.73	2077.	0.77
	23000	1573.	0.66	1635.	0.68	1672.	0.69	1715.	0.70	1763.	0.71	1819.	0.73	1962.	0.76
400	35700	2563.	1.03	2690.	1.08	2764.	1.11	2848.	1.14	2942.	1.18	3049.	1.22	3315.	1.31
	29000	2374.	1.02	2500.	1.07	2573.	1.10	2657.	1.13	2750.	1.17	2856.	1.21	3121.	1.30
	23000	2233.	1.00	2358.	1.06	2431.	1.09	2514.	1.12	2607.	1.16	2712.	1.20	2975.	1.30
600	35700	3271.	1.38	3465.	1.46	3578.	1.51	3705.	1.56	3847.	1.62	4007.	1.69	4402.	1.84
	29000	3054.	1.36	3244.	1.45	3355.	1.50	3480.	1.55	3620.	1.61	3777.	1.68	4165.	1.84
	23000	2893.	1.35	3081.	1.44	3190.	1.49	3313.	1.54	3451.	1.60	3606.	1.67	3989.	1.83
800	35700	3979.	1.73	4241.	1.84	4392.	1.91	4562.	1.99	4752.	2.07	4966.	2.16	5489.	2.38
	29000	3733.	1.71	3989.	1.83	4137.	1.90	4303.	1.97	4489.	2.06	4697.	2.15	5209.	2.37
	23000	3552.	1.70	3804.	1.82	3949.	1.89	4112.	1.96	4294.	2.05	4499.	2.14	5002.	2.37
1000	35700	4686.	2.08	5016.	2.23	5206.	2.31	5420.	2.41	5657.	2.51	5924.	2.63	6576.	2.91
	29000	4413.	2.06	4733.	2.21	4919.	2.30	5127.	2.39	5358.	2.50	5618.	2.62	6253.	2.90
	23000	4212.	2.05	4526.	2.20	4708.	2.29	4911.	2.38	5138.	2.49	5393.	2.61	6015.	2.90
1200	35700	5394.	2.43	5791.	2.61	6021.	2.71	6277.	2.83	6562.	2.96	6883.	3.10	7663.	3.45
	29000	5093.	2.41	5478.	2.60	5701.	2.70	5950.	2.81	6227.	2.95	6539.	3.09	7297.	3.44
	23000	4872.	2.40	5249.	2.59	5467.	2.69	5710.	2.80	5982.	2.94	6286.	3.09	7028.	3.43
1400	35700	6102.	2.77	6566.	2.99	6835.	3.12	7134.	3.25	7467.	3.40	7842.	3.58	8751.	3.98
	29000	5772.	2.76	6222.	2.98	6483.	3.10	6774.	3.23	7097.	3.39	7459.	3.56	8341.	3.97
	23000	5532.	2.74	5972.	2.97	6226.	3.09	6510.	3.23	6826.	3.39	7180.	3.56	8042.	3.97
1600	35700	6809.	3.12	7342.	3.37	7649.	3.52	7991.	3.67	8373.	3.84	8800.	4.05	9838.	4.51
	29000	6452.	3.10	6967.	3.36	7265.	3.50	7597.	3.66	7966.	3.84	8380.	4.04	9385.	4.50
	23000	6191.	3.09	6695.	3.35	6985.	3.49	7309.	3.65	7669.	3.83	8074.	4.03	9055.	4.50
1800	35700	7517.	3.47	8117.	3.75	8463.	3.92	8849.	4.09	9278.	4.29	9759.	4.52	10925.	5.05
	29000	7132.	3.45	7711.	3.74	8047.	3.90	8420.	4.08	8835.	4.29	9301.	4.51	10429.	5.04
	23000	6851.	3.44	7417.	3.73	7744.	3.89	8108.	4.07	8513.	4.28	8967.	4.50	10068.	5.04
2000	35700	8225.	3.82	8892.	4.13	9278.	4.32	9706.	4.51	10183.	4.73	10717.	4.99	12012.	5.58
	29000	7812.	3.80	8456.	4.12	8830.	4.30	9244.	4.50	9705.	4.73	10221.	4.98	11474.	5.57
	23000	7511.	3.79	8140.	4.11	8503.	4.29	8907.	4.49	9357.	4.72	9861.	4.97		
2200	35700	8932.	4.17	9668.	4.51	10092.	4.72	10563.	4.94	11088.	5.18	11676.	5.46	13099.	6.12
	29000	8491.	4.15	9200.	4.50	9612.	4.70	10067.	4.92	10574.	5.18	11142.	5.45	12518.	6.11
	23000	8171.	4.13	8863.	4.49	9262.	4.69	9706.	4.91						
2400	35700	9640.	4.51	10443.	4.89	10906.	5.12	11420.	5.36	11993.	5.62	12635.	5.94	14186.	6.65
	29000	9171.	4.49	9945.	4.89	10394.	5.10	10890.	5.34	11443.	5.62	12063.	5.92	13562.	6.64
	23000	8830.	4.48	9586.	4.88										
2600	35700	10347.	4.86	11218.	5.27	11720.	5.52	12278.	5.78	12898.	6.07	13593.	6.41		
	29000	9851.	4.84	10689.	5.27	11176.	5.50	11714.	5.76	12313.	6.07	12983.	6.39		
	23000	9490.	4.83												
2800	35700	11055.	5.21	11994.	5.66	12534.	5.92	13135.	6.20	13803.	6.51				
	29000	10531.	5.19	11434.	5.65	11958.	5.90	12537.	6.18	13182.	6.51				
	23000	10150.	5.18												
3000	35700	11763.	5.56	12769.	6.04	13349.	6.32								
	29000	11210.	5.54	12178.	6.03	12740.	6.30								
	23000	10810.	5.53												
3100	35700	12117.	5.73	13156.	6.23										
	29000	11550.	5.71	12550.	6.22										
	23000	11139.	5.70												
3200	35700	12470.	5.91	13544.	6.42										
	29000	11890.	5.89	12923.	6.41										
	23000	11469.	5.87												
3300	35700	12824.	6.08	13932.	6.61										
	29000	12230.	6.06	13295.	6.60										
	23000	11799.	6.05												
3400	35700	13178.	6.25												
	29000	12570.	6.23												
	23000	12129.	6.22												

NOTE: FUEL VALUES LARGER THAN THE MAXIMUM USABLE FUEL ARE PRESENTED FOR INTERPOLATION PURPOSES.

Figure 7-11 (Sheet 3)

FLIGHT PLANNING
NORMAL CRUISE THRUST
CRUISE (0.82 MACH)

STANDARD DAY — **CRUISE ALTITUDE 37000 FEET**

STAGE	T.O.	TAILWIND						ZERO WIND		HEADWIND					
		100 KT.		50 KT.		25 KT.				25 KT.		50 KT.		100 KT.	
LENGTH NM.	WEIGHT LBS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.
200	35700	1879.	0.69	1934.	0.70	1966.	0.71	2004.	0.72	2047.	0.73	2096.	0.74	2225.	0.77
	29000	1702.	0.67	1759.	0.69	1792.	0.70	1831.	0.71	1876.	0.72	1927.	0.73	2060.	0.76
	23000	1570.	0.66	1628.	0.68	1662.	0.69	1702.	0.70	1747.	0.71	1799.	0.73	1934.	0.76
400	35700	2538.	1.04	2655.	1.08	2724.	1.11	2802.	1.14	2890.	1.18	2989.	1.22	3239.	1.31
	29000	2329.	1.02	2446.	1.07	2514.	1.10	2591.	1.13	2678.	1.17	2777.	1.21	3025.	1.30
	23000	2176.	1.01	2292.	1.06	2359.	1.09	2436.	1.12	2522.	1.16	2621.	1.20	2866.	1.30
600	35700	3196.	1.39	3377.	1.47	3482.	1.52	3601.	1.57	3733.	1.62	3883.	1.69	4253.	1.85
	29000	2956.	1.37	3133.	1.45	3235.	1.50	3351.	1.56	3481.	1.61	3628.	1.68	3990.	1.84
	23000	2782.	1.36	2955.	1.44	3056.	1.49	3170.	1.55	3298.	1.61	3442.	1.67	3799.	1.84
800	35700	3855.	1.74	4099.	1.85	4240.	1.92	4399.	1.99	4577.	2.07	4776.	2.16	5267.	2.39
	29000	3583.	1.72	3820.	1.84	3957.	1.90	4111.	1.98	4284.	2.06	4478.	2.15	4955.	2.38
	23000	3387.	1.71	3619.	1.83	3753.	1.89	3905.	1.97	4073.	2.05	4264.	2.15	4731.	2.37
1000	35700	4514.	2.08	4821.	2.23	4999.	2.32	5198.	2.41	5420.	2.52	5670.	2.64	6281.	2.92
	29000	4210.	2.07	4507.	2.22	4679.	2.31	4872.	2.40	5086.	2.51	5328.	2.63	5920.	2.92
	23000	3993.	2.06	4283.	2.21	4451.	2.30	4639.	2.40	4849.	2.50	5085.	2.62	5663.	2.91
1200	35700	5172.	2.43	5543.	2.62	5757.	2.72	5996.	2.84	6263.	2.97	6563.	3.11	7295.	3.46
	29000	4837.	2.42	5194.	2.60	5401.	2.71	5632.	2.83	5889.	2.96	6179.	3.10	6885.	3.46
	23000	4598.	2.41	4947.	2.59	5148.	2.70	5373.	2.82	5624.	2.95	5907.	3.10	6595.	3.45
1400	35700	5831.	2.78	6264.	3.00	6515.	3.13	6795.	3.26	7107.	3.41	7457.	3.58	8310.	4.00
	29000	5464.	2.77	5881.	2.98	6122.	3.11	6392.	3.25	6692.	3.40	7029.	3.58	7851.	4.00
	23000	5204.	2.76	5610.	2.98	5845.	3.10	6107.	3.24	6399.	3.40	6728.	3.57	7528.	3.99
1600	35700	6489.	3.13	6986.	3.38	7273.	3.53	7593.	3.69	7950.	3.86	8350.	4.06	9324.	4.54
	29000	6090.	3.12	6568.	3.37	6844.	3.52	7152.	3.67	7494.	3.85	7879.	4.05	8816.	4.53
	23000	5810.	3.11	6274.	3.36	6542.	3.50	6842.	3.67	7175.	3.85	7549.	4.05	8460.	4.52
1800	35700	7148.	3.48	7708.	3.76	8031.	3.93	8392.	4.11	8793.	4.31	9244.	4.53	10338.	5.08
	29000	6717.	3.47	7255.	3.75	7566.	3.92	7912.	4.10	8297.	4.30	8730.	4.52	9781.	5.07
	23000	6415.	3.46	6938.	3.74	7239.	3.90	7576.	4.09	7950.	4.29	8371.	4.52	9392.	5.06
2000	35700	7806.	3.83	8430.	4.15	8790.	4.34	9190.	4.53	9637.	4.75	10137.	5.00	11352.	5.61
	29000	7344.	3.82	7942.	4.13	8287.	4.32	8672.	4.52	9100.	4.75	9580.	5.00	10746.	5.61
	23000	7021.	3.81	7602.	4.13	7937.	4.31	8310.	4.52	8725.	4.74	9192.	4.99		
2200	35700	8465.	4.18	9152.	4.53	9548.	4.74	9989.	4.96	10480.	5.20	11031.	5.48	12366.	6.15
	29000	7971.	4.16	8629.	4.52	9009.	4.72	9432.	4.95	9902.	5.19	10431.	5.47	11711.	6.15
	23000	7626.	4.16	8265.	4.51	8634.	4.71	9044.	4.94	9501.	5.19				
2400	35700	9123.	4.53	9873.	4.91	10306.	5.14	10787.	5.38	11323.	5.65	11924.	5.95	13380.	6.69
	29000	8598.	4.51	9316.	4.90	9731.	5.13	10192.	5.37	10705.	5.64	11281.	5.94	12676.	6.69
	23000	8232.	4.51	8929.	4.89	9331.	5.11								
2600	35700	9782.	4.88	10595.	5.30	11064.	5.54	11586.	5.80	12167.	6.10	12818.	6.42	14394.	7.23
	29000	9225.	4.86	10003.	5.28	10452.	5.53	10952.	5.79	11508.	6.09	12131.	6.42	13642.	7.23
	23000	8838.	4.86	9593.	5.28										
2800	35700	10441.	5.23	11317.	5.68	11823.	5.95	12384.	6.23	13010.	6.54	13711.	6.90		
	29000	9852.	5.21	10690.	5.66	11174.	5.93	11712.	6.22	12310.	6.53	12982.	6.89		
	23000	9443.	5.21												
3000	35700	11099.	5.58	12039.	6.06	12581.	6.35	13183.	6.65	13853.	6.99				
	29000	10478.	5.56	11377.	6.05	11896.	6.34	12472.	6.64	13113.	6.98				
	23000	10049.	5.55												
3200	35700	11758.	5.93	12761.	6.44	13339.	6.75								
	29000	11105.	5.91	12064.	6.43	12618.	6.74								
	23000	10654.	5.90												
3400	35700	12416.	6.28	13482.	6.83										
	29000	11732.	6.26	12751.	6.81										
	23000	11260.	6.25												
3500	35700	12746.	6.45	13843.	7.02										
	29000	12046.	6.44	13095.	7.00										
	23000	11563.	6.43												
3600	35700	13075.	6.63												
	29000	12359.	6.61												
	23000	11866.	6.60												

NOTE: FUEL VALUES LARGER THAN THE MAXIMUM USABLE FUEL ARE PRESENTED FOR INTERPOLATION PURPOSES.

Figure 7-11 (Sheet 4)

FLIGHT PLANNING
NORMAL CRUISE THRUST
CRUISE (0.82 MACH)

STANDARD DAY — **CRUISE ALTITUDE 39000 FEET**

		TAILWIND						ZERO WIND		HEADWIND					
		100 KT.		50 KT.		25 KT.				25 KT.		50 KT.		100 KT.	
STAGE LENGTH NM.	T.O. WEIGHT LBS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.
200	35700	1913.	0.69	1963.	0.70	1992.	0.71	2027.	0.72	2067.	0.73	2113.	0.74	2233.	0.77
	29000	1718.	0.67	1770.	0.69	1801.	0.70	1838.	0.71	1879.	0.72	1927.	0.73	2052.	0.76
	23000	1575.	0.66	1628.	0.68	1660.	0.69	1697.	0.70	1740.	0.71	1788.	0.72	1915.	0.76
400	35700	2529.	1.04	2638.	1.09	2702.	1.11	2775.	1.14	2856.	1.18	2949.	1.21	3183.	1.30
	29000	2298.	1.02	2406.	1.07	2470.	1.10	2542.	1.13	2623.	1.17	2715.	1.21	2946.	1.30
	23000	2132.	1.01	2238.	1.06	2301.	1.09	2372.	1.12	2453.	1.16	2544.	1.20	2773.	1.30
600	35700	3145.	1.39	3314.	1.47	3411.	1.52	3522.	1.57	3646.	1.62	3786.	1.69	4132.	1.84
	29000	2879.	1.37	3043.	1.45	3138.	1.50	3246.	1.56	3366.	1.61	3503.	1.68	3840.	1.84
	23000	2688.	1.36	2849.	1.44	2942.	1.49	3048.	1.55	3166.	1.61	3300.	1.67	3631.	1.83
800	35700	3762.	1.74	3989.	1.85	4121.	1.92	4269.	1.99	4435.	2.07	4622.	2.16	5082.	2.38
	29000	3459.	1.72	3679.	1.84	3806.	1.91	3950.	1.98	4110.	2.06	4290.	2.15	4735.	2.38
	23000	3245.	1.71	3459.	1.83	3583.	1.89	3723.	1.97	3879.	2.06	4055.	2.15	4489.	2.37
1000	35700	4378.	2.09	4664.	2.24	4831.	2.32	5017.	2.42	5225.	2.52	5459.	2.64	6032.	2.92
	29000	4040.	2.07	4315.	2.22	4475.	2.31	4654.	2.40	4853.	2.51	5078.	2.63	5629.	2.91
	23000	3802.	2.06	4070.	2.21	4225.	2.30	4398.	2.40	4593.	2.50	4811.	2.62	5347.	2.91
1200	35700	4994.	2.44	5340.	2.62	5540.	2.73	5764.	2.84	6014.	2.97	6295.	3.11	6981.	3.46
	29000	4620.	2.42	4952.	2.60	5143.	2.71	5358.	2.83	5597.	2.96	5866.	3.10	6523.	3.45
	23000	4359.	2.41	4680.	2.59	4866.	2.70	5073.	2.82	5306.	2.95	5567.	3.10	6205.	3.45
1400	35700	5610.	2.79	6015.	3.00	6250.	3.13	6511.	3.27	6803.	3.42	7131.	3.59	7931.	3.99
	29000	5201.	2.77	5588.	2.99	5812.	3.12	6062.	3.25	6340.	3.41	6654.	3.58	7418.	3.99
	23000	4916.	2.76	5290.	2.98	5507.	3.10	5749.	3.25	6019.	3.40	6323.	3.57	7063.	3.99
1600	35700	6226.	3.14	6691.	3.39	6959.	3.53	7259.	3.69	7593.	3.86	7968.	4.06	8880.	4.53
	29000	5781.	3.12	6224.	3.37	6480.	3.52	6766.	3.68	7084.	3.85	7442.	4.05	8312.	4.53
	23000	5473.	3.11	5901.	3.36	6148.	3.50	6424.	3.67	6733.	3.85	7078.	4.05	7920.	4.53
1800	35700	6843.	3.49	7366.	3.77	7669.	3.94	8006.	4.11	8382.	4.31	8804.	4.54	9830.	5.07
	29000	6362.	3.47	6860.	3.75	7148.	3.92	7470.	4.10	7828.	4.30	8229.	4.53	9206.	5.07
	23000	6030.	3.46	6511.	3.75	6789.	3.91	7099.	4.10	7446.	4.30	7834.	4.53	8778.	5.07
2000	35700	7459.	3.84	8042.	4.15	8379.	4.34	8754.	4.54	9172.	4.76	9641.	5.01	10780.	5.61
	29000	6942.	3.82	7497.	4.14	7817.	4.33	8174.	4.53	8571.	4.75	9017.	5.00	10101.	5.61
	23000	6587.	3.81	7122.	4.13	7431.	4.31	7775.	4.52	8159.	4.75	8590.	5.00	9636.	5.61
2200	35700	8075.	4.19	8717.	4.54	9088.	4.74	9501.	4.96	9961.	5.21	10477.	5.49	11729.	6.15
	29000	7523.	4.17	8133.	4.52	8485.	4.73	8878.	4.95	9315.	5.20	9805.	5.48	10995.	6.15
	23000	7144.	4.16	7732.	4.51	8072.	4.71	8450.	4.94	8872.	5.19	9346.	5.48		
2400	35700	8691.	4.54	9393.	4.92	9798.	5.15	10248.	5.39	10750.	5.66	11313.	5.96	12679.	6.68
	29000	8103.	4.52	8769.	4.90	9154.	5.13	9582.	5.38	10058.	5.65	10593.	5.95	11889.	6.68
	23000	7700.	4.51	8343.	4.90	8713.	5.11	9125.	5.37	9586.	5.64				
2600	35700	9308.	4.89	10068.	5.30	10507.	5.55	10996.	5.81	11540.	6.10	12150.	6.43	13628.	7.22
	29000	8684.	4.87	9405.	5.29	9822.	5.54	10285.	5.80	10802.	6.10	11380.	6.43	12784.	7.22
	23000	8257.	4.86	8953.	5.28	9354.	5.52								
2800	35700	9924.	5.24	10744.	5.69	11217.	5.95	11743.	6.24	12329.	6.55	12986.	6.91	14578.	7.76
	29000	9264.	5.22	10042.	5.67	10490.	5.94	10989.	6.22	11545.	6.54	12168.	6.90	13678.	7.76
	23000	8814.	5.21	9564.	5.66										
3000	35700	10540.	5.59	11419.	6.07	11927.	6.36	12490.	6.66	13118.	7.00	13823.	7.38		
	29000	9845.	5.57	10678.	6.05	11159.	6.34	11693.	6.65	12289.	6.99	12956.	7.38		
	23000	9371.	5.56												
3200	35700	11156.	5.94	12095.	6.45	12636.	6.76	13238.	7.08						
	29000	10425.	5.92	11314.	6.44	11827.	6.75	12397.	7.07						
	23000	9928.	5.91												
3400	35700	11773.	6.29	12770.	6.84	13346.	7.16								
	29000	11006.	6.27	11951.	6.82	12496.	7.15								
	23000	10485.	6.26												
3600	35700	12389.	6.64	13445.	7.22										
	29000	11586.	6.62	12587.	7.20										
	23000	11042.	6.61												
3800	35700	13005.	6.99	14121.	7.60										
	29000	12167.	6.97	13223.	7.59										
	23000	11599.	6.96												
3900	35700	13313.	7.16												
	29000	12457.	7.14												
	23000	11877.	7.13												

NOTE: FUEL VALUES LARGER THAN THE MAXIMUM USABLE FUEL ARE PRESENTED FOR INTERPOLATION PURPOSES.

Figure 7-11 (Sheet 5)

FLIGHT PLANNING
NORMAL CRUISE THRUST
CRUISE (0.82 MACH)

STANDARD DAY **CRUISE ALTITUDE 41000 FEET**

		TAILWIND						ZERO		HEADWIND					
STAGE	T.O.	100 KT.		50 KT.		25 KT.		WIND		25 KT.		50 KT.		100 KT.	
LENGTH NM.	WEIGHT LBS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.
200	35700	1955.	0.69	2000.	0.70	2027.	0.71	2059.	0.72	2096.	0.73	2138.	0.74	2249.	0.76
	29000	1739.	0.67	1788.	0.69	1816.	0.70	1851.	0.70	1889.	0.71	1934.	0.73	2051.	0.75
	23000	1584.	0.66	1633.	0.68	1663.	0.69	1698.	0.70	1738.	0.71	1783.	0.72	1904.	0.75
400	35700	2538.	1.04	2639.	1.09	2698.	1.11	2766.	1.14	2842.	1.17	2928.	1.21	3147.	1.30
	29000	2280.	1.02	2380.	1.07	2438.	1.10	2506.	1.13	2581.	1.16	2667.	1.20	2884.	1.29
	23000	2098.	1.01	2197.	1.06	2255.	1.09	2322.	1.12	2396.	1.15	2481.	1.19	2696.	1.29
600	35700	3120.	1.39	3277.	1.47	3368.	1.52	3472.	1.57	3588.	1.62	3719.	1.68	4044.	1.83
	29000	2820.	1.37	2972.	1.45	3060.	1.50	3161.	1.55	3273.	1.61	3400.	1.68	3716.	1.83
	23000	2612.	1.36	2761.	1.44	2847.	1.49	2945.	1.54	3055.	1.60	3179.	1.67	3488.	1.83
800	35700	3702.	1.74	3915.	1.85	4039.	1.92	4178.	1.99	4334.	2.07	4509.	2.16	4942.	2.37
	29000	3360.	1.72	3564.	1.84	3682.	1.90	3816.	1.98	3965.	2.06	4133.	2.15	4548.	2.37
	23000	3126.	1.71	3324.	1.83	3439.	1.89	3569.	1.97	3714.	2.05	3877.	2.14	4280.	2.37
1000	35700	4284.	2.09	4553.	2.24	4709.	2.32	4884.	2.42	5080.	2.52	5300.	2.63	5840.	2.91
	29000	3900.	2.07	4156.	2.22	4304.	2.31	4471.	2.40	4657.	2.51	4866.	2.62	5380.	2.91
	23000	3640.	2.06	3888.	2.21	4031.	2.30	4192.	2.39	4372.	2.50	4575.	2.62	5072.	2.91
1200	35700	4866.	2.44	5192.	2.62	5380.	2.73	5591.	2.84	5826.	2.97	6090.	3.11	6737.	3.45
	29000	4440.	2.42	4748.	2.61	4926.	2.71	5126.	2.83	5349.	2.95	5599.	3.10	6212.	3.45
	23000	4155.	2.41	4451.	2.60	4623.	2.70	4816.	2.82	5031.	2.95	5273.	3.09	5864.	3.45
1400	35700	5449.	2.79	5830.	3.00	6050.	3.13	6297.	3.26	6572.	3.41	6881.	3.58	7635.	3.99
	29000	4980.	2.77	5340.	2.99	5548.	3.11	5781.	3.25	6040.	3.40	6332.	3.57	7044.	3.99
	23000	4669.	2.76	5015.	2.98	5216.	3.10	5440.	3.24	5689.	3.40	5970.	3.57	6656.	3.99
1600	35700	6031.	3.14	6468.	3.39	6721.	3.53	7003.	3.69	7318.	3.86	7671.	4.06	8533.	4.53
	29000	5520.	3.12	5932.	3.37	6170.	3.52	6436.	3.67	6732.	3.85	7065.	4.05	7877.	4.52
	23000	5183.	3.11	5579.	3.36	5808.	3.51	6063.	3.67	6348.	3.84	6668.	4.04	7448.	4.53
1800	35700	6613.	3.49	7106.	3.77	7391.	3.94	7709.	4.11	8064.	4.31	8462.	4.53	9430.	5.07
	29000	6060.	3.47	6524.	3.76	6792.	3.92	7091.	4.10	7424.	4.30	7798.	4.52	8709.	5.06
	23000	5697.	3.46	6142.	3.75	6400.	3.91	6687.	4.09	7007.	4.29	7366.	4.52	8241.	5.06
2000	35700	7195.	3.84	7744.	4.15	8062.	4.34	8415.	4.54	8810.	4.76	9252.	5.01	10328.	5.60
	29000	6600.	3.82	7116.	4.14	7414.	4.32	7746.	4.52	8116.	4.75	8531.	5.00	9541.	5.60
	23000	6211.	3.81	6706.	4.13	6992.	4.31	7310.	4.52	7665.	4.74	8064.	4.99	9033.	5.60
2200	35700	7777.	4.19	8383.	4.54	8732.	4.74	9122.	4.96	9556.	5.21	10043.	5.48	11226.	6.14
	29000	7140.	4.17	7708.	4.53	8036.	4.72	8401.	4.95	8808.	5.19	9264.	5.47	10373.	6.14
	23000	6726.	4.16	7270.	4.52	7584.	4.72	7934.	4.94	8324.	5.19	8762.	5.47	9825.	6.14
2400	35700	8360.	4.54	9021.	4.92	9403.	5.14	9828.	5.39	10302.	5.65	10833.	5.96	12124.	6.68
	29000	7680.	4.53	8300.	4.91	8658.	5.13	9056.	5.37	9500.	5.64	9997.	5.95	11205.	6.68
	23000	7240.	4.51	7833.	4.90	8176.	5.12	8558.	5.36	8983.	5.64	9460.	5.94		
2600	35700	8942.	4.89	9659.	5.30	10073.	5.55	10534.	5.81	11048.	6.10	11624.	6.43	13021.	7.22
	29000	8221.	4.88	8892.	5.29	9280.	5.53	9711.	5.79	10191.	6.09	10730.	6.42	12038.	7.22
	23000	7754.	4.86	8397.	5.28	8768.	5.52	9181.	5.79	9641.	6.09				
2800	35700	9524.	5.24	10297.	5.69	10744.	5.95	11240.	6.23	11794.	6.55	12414.	6.91	13919.	7.76
	29000	8761.	5.23	9484.	5.68	9902.	5.93	10366.	6.22	10883.	6.54	11463.	6.90	12870.	7.76
	23000	8268.	5.21	8961.	5.67	9360.	5.93								
3000	35700	10106.	5.59	10936.	6.07	11414.	6.35	11947.	6.66	12540.	7.00	13205.	7.38		
	29000	9301.	5.58	10076.	6.06	10524.	6.34	11021.	6.64	11575.	6.99	12196.	7.37		
	23000	8783.	5.56	9524.	6.05										
3200	35700	10688.	5.94	11574.	6.45	12085.	6.76	12653.	7.08	13286.	7.45				
	29000	9841.	5.93	10668.	6.45	11145.	6.74	11676.	7.07	12267.	7.43				
	23000	9297.	5.91												
3400	35700	11271.	6.29	12212.	6.84	12755.	7.16	13359.	7.51						
	29000	10381.	6.28	11260.	6.83	11767.	7.14	12331.	7.49						
	23000	9811.	6.26												
3600	35700	11853.	6.64	12850.	7.22	13426.	7.56								
	29000	10921.	6.63	11852.	7.21	12389.	7.55								
	23000	10325.	6.62												
3800	35700	12435.	6.99	13488.	7.60										
	29000	11461.	6.98	12444.	7.60										
	23000	10839.	6.97												
4000	35700	13017.	7.34	14127.	7.98										
	29000	12001.	7.33	13036.	7.98										
	23000	11354.	7.32												
4200	35700	13599.	7.68												
	29000	12541.	7.68												
	23000	11868.	7.67												

NOTE: FUEL VALUES LARGER THAN THE MAXIMUM USABLE FUEL ARE PRESENTED FOR INTERPOLATION PURPOSES.

Figure 7-11 (Sheet 6)

FLIGHT PLANNING
NORMAL CRUISE THRUST
CRUISE (0.82 MACH)

STANDARD DAY **CRUISE ALTITUDE 43000 FEET**

		TAILWIND						ZERO		HEADWIND					
STAGE	T.O.	100 KT.		50 KT.		25 KT.		WIND		25 KT.		50 KT.		100 KT.	
LENGTH NM.	WEIGHT LBS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.
200	35700	2025.	0.70	2064.	0.71	2087.	0.72	2116.	0.72	2148.	0.73	2185.	0.73	2285.	0.75
	29000	1772.	0.68	1817.	0.69	1844.	0.70	1876.	0.71	1912.	0.72	1954.	0.73	2065.	0.75
	23000	1601.	0.66	1647.	0.68	1675.	0.69	1708.	0.70	1746.	0.71	1789.	0.72	1903.	0.75
400	35700	2579.	1.05	2672.	1.09	2726.	1.12	2788.	1.15	2858.	1.18	2938.	1.21	3140.	1.29
	29000	2276.	1.03	2369.	1.07	2424.	1.10	2487.	1.13	2558.	1.16	2638.	1.20	2842.	1.29
	23000	2076.	1.01	2168.	1.06	2222.	1.09	2285.	1.12	2355.	1.16	2434.	1.20	2636.	1.29
600	35700	3133.	1.40	3279.	1.48	3365.	1.52	3461.	1.57	3569.	1.62	3691.	1.68	3996.	1.83
	29000	2780.	1.38	2922.	1.46	3004.	1.50	3098.	1.56	3203.	1.61	3322.	1.68	3619.	1.83
	23000	2551.	1.36	2689.	1.45	2770.	1.49	2861.	1.55	2963.	1.61	3079.	1.67	3368.	1.83
800	35700	3688.	1.75	3887.	1.86	4003.	1.93	4134.	2.00	4280.	2.07	4444.	2.16	4851.	2.37
	29000	3284.	1.73	3474.	1.84	3585.	1.91	3710.	1.98	3849.	2.06	4006.	2.15	4396.	2.37
	23000	3026.	1.71	3210.	1.83	3317.	1.90	3437.	1.97	3572.	2.05	3724.	2.15	4101.	2.37
1000	35700	4242.	2.10	4495.	2.25	4642.	2.33	4806.	2.42	4990.	2.52	5197.	2.64	5706.	2.91
	29000	3788.	2.08	4027.	2.23	4165.	2.31	4321.	2.41	4495.	2.51	4691.	2.63	5173.	2.91
	23000	3501.	2.07	3731.	2.22	3864.	2.30	4014.	2.40	4181.	2.50	4369.	2.62	4833.	2.91
1200	35700	4797.	2.46	5103.	2.63	5280.	2.73	5479.	2.85	5701.	2.97	5950.	3.11	6562.	3.45
	29000	4292.	2.43	4579.	2.61	4746.	2.72	4932.	2.83	5140.	2.96	5375.	3.10	5950.	3.45
	23000	3976.	2.42	4252.	2.60	4411.	2.71	4590.	2.82	4789.	2.95	5014.	3.10	5565.	3.45
1400	35700	5351.	2.81	5711.	3.02	5919.	3.14	6152.	3.27	6411.	3.42	6703.	3.59	7417.	3.99
	29000	4795.	2.78	5131.	3.00	5326.	3.12	5543.	3.26	5786.	3.41	6059.	3.58	6727.	3.99
	23000	4452.	2.77	4773.	2.98	4958.	3.11	5166.	3.25	5398.	3.40	5659.	3.57	6298.	3.99
1600	35700	5905.	3.16	6318.	3.40	6558.	3.54	6824.	3.69	7122.	3.87	7456.	4.06	8272.	4.53
	29000	5299.	3.13	5684.	3.38	5907.	3.52	6155.	3.68	6432.	3.86	6743.	4.05	7504.	4.53
	23000	4927.	3.12	5293.	3.37	5506.	3.51	5743.	3.67	6007.	3.85	6304.	4.05	7030.	4.53
1800	35700	6460.	3.51	6926.	3.79	7196.	3.94	7497.	4.12	7832.	4.32	8209.	4.54	9128.	5.07
	29000	5803.	3.48	6236.	3.76	6487.	3.93	6766.	4.10	7078.	4.30	7428.	4.53	8281.	5.07
	23000	5402.	3.47	5814.	3.75	6053.	3.92	6319.	4.10	6616.	4.30	6949.	4.53	7762.	5.07
2000	35700	7014.	3.86	7534.	4.17	7835.	4.35	8169.	4.54	8543.	4.76	8962.	5.01	9983.	5.61
	29000	6307.	3.83	6789.	4.15	7067.	4.33	7377.	4.53	7723.	4.75	8112.	5.01	9058.	5.61
	23000	5877.	3.82	6335.	4.14	6600.	4.32	6895.	4.52	7224.	4.75	7594.	5.00	8495.	5.60
2200	35700	7568.	4.21	8142.	4.56	8473.	4.75	8842.	4.97	9253.	5.21	9715.	5.49	10838.	6.15
	29000	6811.	4.18	7341.	4.53	7648.	4.73	7989.	4.95	8369.	5.20	8796.	5.48	9835.	6.15
	23000	6352.	4.17	6856.	4.52	7147.	4.72	7472.	4.95	7833.	5.20	8239.	5.48	9227.	6.14
2400	35700	8123.	4.56	8749.	4.94	9112.	5.15	9515.	5.39	9964.	5.66	10468.	5.96	11694.	6.69
	29000	7315.	4.53	7893.	4.92	8228.	5.14	8600.	5.38	9015.	5.65	9480.	5.96	10612.	6.69
	23000	6827.	4.52	7377.	4.91	7694.	5.13	8048.	5.37	8442.	5.65	8884.	5.95	9960.	6.68
2600	35700	8677.	4.91	9357.	5.32	9750.	5.56	10187.	5.82	10674.	6.11	11221.	6.44	12549.	7.23
	29000	7819.	4.88	8446.	5.30	8809.	5.54	9211.	5.80	9660.	6.10	10165.	6.43	11389.	7.23
	23000	7302.	4.87	7898.	5.29	8241.	5.53	8624.	5.80	9050.	6.09	9529.	6.43		
2800	35700	9231.	5.26	9965.	5.71	10389.	5.96	10860.	6.24	11385.	6.56	11974.	6.91	13404.	7.77
	29000	8323.	5.23	8998.	5.69	9389.	5.94	9822.	6.23	10306.	6.55	10849.	6.91	12166.	7.77
	23000	7777.	5.22	8418.	5.68	8789.	5.93	9201.	6.22						
3000	35700	9786.	5.61	10573.	6.09	11028.	6.37	11533.	6.67	12095.	7.01	12727.	7.39	14260.	8.31
	29000	8826.	5.58	9551.	6.07	9970.	6.35	10434.	6.65	10952.	7.00	11533.	7.38	12943.	8.31
	23000	8252.	5.57	8939.	6.06	9336.	6.34								
3200	35700	10340.	5.96	11180.	6.48	11666.	6.77	12205.	7.09	12806.	7.46	13480.	7.87		
	29000	9330.	5.93	10103.	6.45	10550.	6.75	11045.	7.08	11597.	7.45	12217.	7.86		
	23000	8728.	5.92	9460.	6.44										
3400	35700	10894.	6.31	11788.	6.86	12305.	7.17	12878.	7.52	13516.	7.91				
	29000	9834.	6.29	10655.	6.84	11130.	7.15	11656.	7.50	12243.	7.89				
	23000	9203.	6.27												
3600	35700	11449.	6.66	12396.	7.25	12943.	7.58	13550.	7.94						
	29000	10338.	6.64	11208.	7.22	11711.	7.56	12268.	7.93						
	23000	9678.	6.62												
3800	35700	12003.	7.01	13004.	7.63	13582.	7.98								
	29000	10842.	6.99	11760.	7.61	12291.	7.96								
	23000	10153.	6.97												
4000	35700	12558.	7.37	13611.	8.02										
	29000	11346.	7.34	12313.	7.99										
	23000	10628.	7.32												
4200	35700	13112.	7.72												
	29000	11850.	7.69												
	23000	11103.	7.67												

NOTE: FUEL VALUES LARGER THAN THE MAXIMUM USABLE FUEL ARE PRESENTED FOR INTERPOLATION PURPOSES.

Figure 7-11 (Sheet 7)

FLIGHT PLANNING
NORMAL CRUISE THRUST
CRUISE (0.82 MACH)

STANDARD DAY **CRUISE ALTITUDE 45000 FEET**

		TAILWIND						ZERO WIND		HEADWIND					
		100 KT.		50 KT.		25 KT.				25 KT.		50 KT.		100 KT.	
STAGE LENGTH NM.	T.O. WEIGHT LBS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.
200	35700	2349.	0.72	2380.	0.72	2398.	0.72	2420.	0.72	2447.	0.73	2476.	0.73	2558.	0.74
	29000	1812.	0.68	1853.	0.69	1878.	0.70	1907.	0.71	1941.	0.71	1980.	0.72	2083.	0.74
	23000	1622.	0.67	1665.	0.68	1692.	0.69	1723.	0.70	1758.	0.71	1799.	0.72	1907.	0.74
400	35700	2872.	1.07	2953.	1.11	3000.	1.12	3055.	1.15	3118.	1.18	3187.	1.20	3365.	1.28
	29000	2286.	1.03	2372.	1.08	2423.	1.10	2482.	1.13	2548.	1.16	2623.	1.20	2814.	1.28
	23000	2063.	1.02	2149.	1.06	2199.	1.09	2257.	1.12	2323.	1.16	2397.	1.19	2587.	1.28
600	35700	3396.	1.42	3527.	1.49	3603.	1.53	3690.	1.57	3788.	1.63	3897.	1.68	4172.	1.81
	29000	2759.	1.38	2892.	1.46	2969.	1.51	3057.	1.56	3155.	1.61	3267.	1.67	3545.	1.82
	23000	2503.	1.37	2632.	1.45	2707.	1.49	2792.	1.55	2888.	1.60	2996.	1.67	3266.	1.82
800	35700	3919.	1.77	4100.	1.87	4206.	1.93	4324.	2.00	4459.	2.07	4608.	2.16	4980.	2.35
	29000	3233.	1.73	3411.	1.84	3515.	1.91	3632.	1.98	3762.	2.06	3910.	2.15	4276.	2.36
	23000	2944.	1.72	3115.	1.83	3214.	1.90	3326.	1.97	3453.	2.05	3594.	2.14	3946.	2.36
1000	35700	4442.	2.12	4674.	2.26	4808.	2.34	4959.	2.42	5129.	2.52	5319.	2.63	5787.	2.89
	29000	3707.	2.08	3931.	2.23	4060.	2.31	4206.	2.41	4370.	2.51	4554.	2.62	5007.	2.90
	23000	3385.	2.07	3598.	2.22	3722.	2.30	3861.	2.40	4017.	2.50	4193.	2.62	4626.	2.90
1200	35700	4965.	2.47	5247.	2.64	5411.	2.74	5594.	2.85	5800.	2.97	6029.	3.11	6594.	3.43
	29000	4181.	2.43	4450.	2.61	4606.	2.72	4781.	2.83	4977.	2.96	5197.	3.10	5737.	3.45
	23000	3825.	2.42	4081.	2.60	4229.	2.71	4396.	2.82	4582.	2.95	4792.	3.09	5305.	3.44
1400	35700	5488.	2.82	5821.	3.02	6013.	3.14	6229.	3.27	6470.	3.42	6740.	3.58	7401.	3.97
	29000	4655.	2.79	4970.	3.00	5152.	3.12	5356.	3.26	5584.	3.41	5841.	3.58	6468.	3.99
	23000	4266.	2.77	4564.	2.99	4737.	3.11	4930.	3.25	5147.	3.40	5390.	3.57	5985.	3.98
1600	35700	6011.	3.17	6394.	3.41	6616.	3.55	6864.	3.70	7140.	3.87	7451.	4.06	8208.	4.51
	29000	5128.	3.14	5489.	3.38	5698.	3.53	5931.	3.68	6191.	3.86	6484.	4.05	7199.	4.53
	23000	4707.	3.12	5047.	3.37	5244.	3.51	5465.	3.67	5712.	3.85	5989.	4.04	6665.	4.52
1800	35700	6535.	3.52	6968.	3.79	7218.	3.95	7498.	4.12	7811.	4.31	8161.	4.54	9016.	5.05
	29000	5602.	3.49	6008.	3.76	6243.	3.93	6506.	4.11	6799.	4.31	7128.	4.53	7930.	5.07
	23000	5147.	3.47	5530.	3.75	5752.	3.92	5999.	4.10	6277.	4.30	6587.	4.52	7344.	5.06
2000	35700	7058.	3.87	7542.	4.18	7821.	4.36	8133.	4.55	8481.	4.76	8872.	5.01	9823.	5.59
	29000	6076.	3.84	6528.	4.15	6789.	4.33	7081.	4.53	7406.	4.76	7771.	5.00	8661.	5.61
	23000	5588.	3.82	6013.	4.14	6259.	4.32	6534.	4.52	6842.	4.75	7186.	5.00	8024.	5.60
2200	35700	7581.	4.22	8115.	4.56	8424.	4.76	8768.	4.97	9152.	5.21	9583.	5.49	10630.	6.13
	29000	6550.	4.19	7047.	4.53	7335.	4.74	7655.	4.96	8013.	5.21	8415.	5.48	9392.	6.15
	23000	6029.	4.17	6497.	4.52	6767.	4.72	7068.	4.95	7407.	5.20	7784.	5.47	8704.	6.14
2400	35700	8104.	4.57	8689.	4.94	9026.	5.16	9403.	5.40	9822.	5.66	10293.	5.96	11437.	6.67
	29000	7024.	4.54	7567.	4.92	7881.	5.14	8230.	5.38	8620.	5.66	9058.	5.95	10123.	6.69
	23000	6469.	4.52	6980.	4.91	7274.	5.13	7603.	5.37	7971.	5.65	8383.	5.95	9383.	6.68
2600	35700	8627.	4.92	9262.	5.33	9629.	5.57	10037.	5.82	10493.	6.11	11004.	6.44	12244.	7.20
	29000	7497.	4.89	8086.	5.30	8426.	5.55	8805.	5.81	9228.	6.11	9702.	6.43	10853.	7.23
	23000	6910.	4.87	7463.	5.29	7782.	5.53	8138.	5.80	8536.	6.10	8981.	6.42	10063.	7.22
2800	35700	9151.	5.27	9836.	5.71	10231.	5.97	10672.	6.25	11163.	6.55	11715.	6.91	13052.	7.74
	29000	7971.	5.24	8606.	5.68	8972.	5.95	9380.	6.23	9835.	6.55	10345.	6.90	11584.	7.77
	23000	7351.	5.22	7946.	5.68	8289.	5.93	8672.	6.22	9101.	6.55	9580.	6.90		
3000	35700	9674.	5.62	10409.	6.09	10834.	6.37	11307.	6.67	11834.	7.00	12425.	7.39	13859.	8.28
	29000	8445.	5.59	9125.	6.07	9518.	6.35	9955.	6.66	10442.	7.00	10989.	7.38	12315.	8.31
	23000	7792.	5.57	8429.	6.06	8797.	6.34	9207.	6.65						
3200	35700	10197.	5.97	10983.	6.48	11436.	6.78	11942.	7.10	12504.	7.45	13136.	7.87		
	29000	8919.	5.94	9645.	6.45	10063.	6.76	10530.	7.09	11049.	7.45	11632.	7.85		
	23000	8232.	5.92	8912.	6.44	9304.	6.74								
3400	35700	10720.	6.32	11556.	6.86	12039.	7.18	12577.	7.53	13175.	7.90				
	29000	9393.	6.29	10164.	6.83	10609.	7.16	11104.	7.51	11656.	7.90				
	23000	8673.	6.27	9395.	6.83										
3600	35700	11243.	6.67	12130.	7.24	12642.	7.59	13211.	7.95						
	29000	9866.	6.64	10683.	7.22	11155.	7.56	11679.	7.94						
	23000	9114.	6.62												
3800	35700	11766.	7.02	12703.	7.63	13244.	7.99								
	29000	10340.	6.99	11203.	7.60	11701.	7.97								
	23000	9554.	6.97												
4000	35700	12290.	7.37	13277.	8.01										
	29000	10814.	7.35	11722.	7.99										
	23000	9995.	7.32												
4200	35700	12813.	7.72	13850.	8.40										
	29000	11288.	7.70	12242.	8.37										
	23000	10436.	7.67												
4400	35700	13336.	8.07												
	29000	11762.	8.05												
	23000	10876.	8.02												

NOTE: FUEL VALUES LARGER THAN THE MAXIMUM USABLE FUEL ARE PRESENTED FOR INTERPOLATION PURPOSES.

Figure 7-11 (Sheet 8)

FLIGHT PLANNING
NORMAL CRUISE THRUST
CRUISE (0.82 MACH)

STANDARD DAY **CRUISE ALTITUDE 47000 FEET**

STAGE LENGTH NM.	T.O. WEIGHT LBS.	TAILWIND 100 KT. FUEL LBS.	TAILWIND 100 KT. TIME HRS.	TAILWIND 50 KT. FUEL LBS.	TAILWIND 50 KT. TIME HRS.	TAILWIND 25 KT. FUEL LBS.	TAILWIND 25 KT. TIME HRS.	ZERO WIND FUEL LBS.	ZERO WIND TIME HRS.	HEADWIND 25 KT. FUEL LBS.	HEADWIND 25 KT. TIME HRS.	HEADWIND 50 KT. FUEL LBS.	HEADWIND 50 KT. TIME HRS.	HEADWIND 100 KT. FUEL LBS.	HEADWIND 100 KT. TIME HRS.
400	35700	3417.	1.08	3484.	1.11	3524.	1.13	3573.	1.16	3627.	1.18	3686.	1.20	3845.	1.27
	29000	2324.	1.04	2404.	1.08	2450.	1.11	2505.	1.13	2566.	1.16	2635.	1.19	2812.	1.27
	23000	2063.	1.02	2143.	1.07	2190.	1.09	2245.	1.12	2306.	1.15	2376.	1.19	2555.	1.28
600	35700	3905.	1.43	4019.	1.50	4087.	1.54	4165.	1.58	4253.	1.63	4349.	1.68	4598.	1.81
	29000	2774.	1.39	2897.	1.47	2968.	1.51	3050.	1.56	3142.	1.61	3246.	1.67	3506.	1.81
	23000	2473.	1.37	2593.	1.45	2663.	1.50	2743.	1.55	2832.	1.60	2934.	1.67	3188.	1.82
800	35700	4393.	1.78	4554.	1.88	4649.	1.94	4757.	2.01	4878.	2.08	5012.	2.15	5351.	2.35
	29000	3224.	1.74	3390.	1.85	3486.	1.91	3596.	1.98	3718.	2.06	3857.	2.15	4200.	2.35
	23000	2884.	1.72	3043.	1.83	3136.	1.90	3241.	1.97	3358.	2.05	3491.	2.14	3821.	2.36
1000	35700	4880.	2.13	5089.	2.27	5211.	2.34	5349.	2.43	5504.	2.52	5675.	2.63	6104.	2.89
	29000	3673.	2.09	3883.	2.24	4004.	2.32	4141.	2.41	4295.	2.51	4467.	2.62	4894.	2.89
	23000	3294.	2.07	3493.	2.22	3608.	2.30	3738.	2.40	3884.	2.50	4048.	2.62	4454.	2.90
1200	35700	5368.	2.48	5624.	2.65	5773.	2.75	5942.	2.86	6129.	2.97	6338.	3.10	6857.	3.42
	29000	4123.	2.44	4376.	2.62	4522.	2.72	4687.	2.83	4871.	2.96	5078.	3.10	5588.	3.43
	23000	3705.	2.42	3943.	2.60	4081.	2.71	4236.	2.82	4410.	2.95	4606.	3.09	5087.	3.44
1400	35700	5856.	2.84	6159.	3.03	6336.	3.15	6534.	3.28	6755.	3.42	7001.	3.58	7609.	3.96
	29000	4572.	2.79	4868.	3.00	5040.	3.12	5232.	3.26	5447.	3.40	5689.	3.57	6282.	3.97
	23000	4115.	2.77	4393.	2.99	4554.	3.11	4734.	3.25	4936.	3.40	5163.	3.57	5720.	3.98
1600	35700	6344.	3.19	6694.	3.42	6898.	3.55	7126.	3.70	7380.	3.87	7664.	4.05	8362.	4.50
	29000	5022.	3.14	5361.	3.39	5558.	3.53	5778.	3.68	6024.	3.85	6300.	4.05	6975.	4.51
	23000	4525.	3.12	4843.	3.37	5027.	3.51	5232.	3.67	5462.	3.85	5721.	4.04	6353.	4.52
1800	35700	6832.	3.54	7229.	3.80	7460.	3.96	7718.	4.13	8006.	4.32	8327.	4.53	9115.	5.04
	29000	5471.	3.49	5854.	3.77	6076.	3.93	6324.	4.11	6600.	4.30	6910.	4.52	7669.	5.05
	23000	4936.	3.47	5293.	3.76	5499.	3.92	5730.	4.10	5988.	4.29	6278.	4.52	6986.	5.06
2000	35700	7319.	3.89	7764.	4.19	8022.	4.36	8310.	4.55	8631.	4.77	8990.	5.01	9868.	5.58
	29000	5921.	3.84	6347.	4.16	6594.	4.34	6869.	4.54	7176.	4.75	7521.	5.00	8363.	5.59
	23000	5346.	3.82	5743.	4.14	5972.	4.32	6228.	4.52	6514.	4.74	6835.	5.00	7619.	5.60
2200	35700	7807.	4.24	8299.	4.57	8585.	4.77	8902.	4.98	9257.	5.22	9653.	5.48	10621.	6.12
	29000	6371.	4.20	6840.	4.54	7112.	4.74	7415.	4.96	7753.	5.20	8132.	5.47	9057.	6.13
	23000	5757.	4.17	6193.	4.53	6445.	4.73	6726.	4.95	7040.	5.19	7393.	5.47	8252.	6.14
2400	35700	8295.	4.59	8834.	4.96	9147.	5.17	9495.	5.40	9882.	5.66	10316.	5.96	11374.	6.65
	29000	6820.	4.55	7333.	4.93	7629.	5.14	7960.	5.39	8329.	5.65	8743.	5.95	9751.	6.67
	23000	6167.	4.52	6643.	4.91	6918.	5.13	7224.	5.37	7566.	5.64	7950.	5.95	8885.	6.68
2600	35700	8783.	4.94	9369.	5.34	9709.	5.57	10087.	5.83	10508.	6.11	10979.	6.43	12127.	7.19
	29000	7270.	4.90	7826.	5.31	8147.	5.55	8506.	5.81	8905.	6.10	9353.	6.43	10444.	7.21
	23000	6578.	4.87	7093.	5.29	7390.	5.53	7722.	5.80	8092.	6.09	8508.	6.42	9518.	7.22
2800	35700	9271.	5.29	9904.	5.73	10271.	5.98	10679.	6.25	11133.	6.56	11642.	6.91	12879.	7.73
	29000	7719.	5.25	8319.	5.70	8665.	5.95	9051.	6.24	9482.	6.54	9964.	6.90	11138.	7.75
	23000	6988.	5.22	7543.	5.68	7863.	5.94	8220.	6.22	8618.	6.54	9065.	6.90		
3000	35700	9758.	5.64	10439.	6.11	10834.	6.38	11271.	6.68	11759.	7.01	12306.	7.38	13632.	8.27
	29000	8169.	5.60	8812.	6.08	9183.	6.36	9597.	6.66	10058.	6.99	10575.	7.38	11832.	8.29
	23000	7399.	5.57	7993.	6.06	8336.	6.34	8718.	6.65	9144.	6.99				
3200	35700	10246.	5.99	10974.	6.50	11396.	6.78	11863.	7.10	12384.	7.46	12969.	7.86	14385.	8.81
	29000	8618.	5.95	9305.	6.46	9701.	6.76	10143.	7.09	10634.	7.44	11186.	7.85	12526.	8.83
	23000	7809.	5.93	8443.	6.45	8809.	6.74	9216.	7.08						
3400	35700	10734.	6.34	11509.	6.88	11958.	7.19	12455.	7.53	13009.	7.91	13632.	8.34		
	29000	9068.	6.30	9798.	6.85	10219.	7.16	10688.	7.51	11211.	7.89	11796.	8.33		
	23000	8220.	6.28	8893.	6.83	9281.	7.15								
3600	35700	11222.	6.69	12044.	7.26	12520.	7.59	13048.	7.95	13635.	8.36				
	29000	9518.	6.65	10290.	7.23	10737.	7.57	11234.	7.94	11787.	8.34				
	23000	8630.	6.63	9343.	7.22										
3800	35700	11709.	7.04	12579.	7.65	13082.	7.99								
	29000	9967.	7.00	10783.	7.62	11255.	7.97								
	23000	9040.	6.98												
4000	35700	12197.	7.39	13114.	8.03										
	29000	10417.	7.35	11276.	8.00										
	23000	9451.	7.33												
4200	35700	12685.	7.74	13650.	8.42										
	29000	10866.	7.70	11769.	8.39										
	23000	9861.	7.68												
4400	35700	13173.	8.09												
	29000	11316.	8.05												
	23000	10272.	8.03												

NOTE: FUEL VALUES LARGER THAN THE MAXIMUM USABLE FUEL ARE PRESENTED FOR INTERPOLATION PURPOSES.

Figure 7-11 (Sheet 9)

FLIGHT PLANNING
NORMAL CRUISE THRUST
CRUISE (0.82 MACH)

STANDARD DAY | **CRUISE ALTITUDE 49000 FEET**

		TAILWIND						ZERO WIND		HEADWIND					
STAGE LENGTH NM.	T.O. WEIGHT LBS.	100 KT.		50 KT.		25 KT.				25 KT.		50 KT.		100 KT.	
		FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.
400	35700	4023.	1.10	4082.	1.12	4119.	1.16	4160.	1.18	4200.	1.19	4254.	1.19	4383.	1.27
	29000	2666.	1.06	2735.	1.09	2776.	1.11	2824.	1.14	2878.	1.16	2939.	1.19	3097.	1.26
	23000	2073.	1.02	2148.	1.07	2192.	1.09	2243.	1.12	2300.	1.15	2366.	1.19	2534.	1.27
600	35700	4478.	1.45	4582.	1.51	4644.	1.56	4712.	1.60	4784.	1.64	4873.	1.67	5087.	1.81
	29000	3085.	1.41	3195.	1.48	3260.	1.52	3333.	1.56	3416.	1.61	3510.	1.67	3746.	1.80
	23000	2456.	1.37	2568.	1.45	2633.	1.50	2708.	1.55	2791.	1.60	2886.	1.66	3125.	1.81
800	35700	4934.	1.80	5081.	1.89	5168.	1.96	5264.	2.03	5368.	2.09	5492.	2.15	5791.	2.35
	29000	3505.	1.76	3656.	1.86	3743.	1.92	3843.	1.99	3954.	2.06	4080.	2.14	4394.	2.34
	23000	2840.	1.73	2988.	1.84	3075.	1.90	3173.	1.97	3283.	2.05	3407.	2.14	3717.	2.36
1000	35700	5389.	2.16	5580.	2.28	5693.	2.37	5817.	2.45	5952.	2.54	6111.	2.62	6495.	2.89
	29000	3925.	2.11	4116.	2.25	4227.	2.32	4352.	2.41	4492.	2.51	4651.	2.62	5042.	2.88
	23000	3223.	2.08	3408.	2.22	3516.	2.30	3638.	2.40	3774.	2.50	3928.	2.62	4308.	2.90
1200	35700	5844.	2.51	6079.	2.66	6217.	2.77	6369.	2.88	6536.	2.98	6730.	3.10	7199.	3.43
	29000	4344.	2.46	4576.	2.63	4710.	2.73	4862.	2.84	5031.	2.96	5221.	3.10	5690.	3.42
	23000	3606.	2.43	3829.	2.61	3958.	2.71	4103.	2.82	4265.	2.95	4449.	3.09	4900.	3.44
1400	35700	6300.	2.86	6579.	3.05	6741.	3.17	6922.	3.30	7120.	3.43	7349.	3.58	7903.	3.97
	29000	4764.	2.81	5036.	3.01	5194.	3.13	5371.	3.26	5569.	3.41	5791.	3.57	6338.	3.96
	23000	3989.	2.78	4249.	2.99	4399.	3.11	4568.	3.25	4757.	3.40	4969.	3.57	5491.	3.98
1600	35700	6755.	3.21	7078.	3.43	7266.	3.57	7474.	3.72	7704.	3.88	7968.	4.05	8607.	4.50
	29000	5184.	3.16	5496.	3.40	5678.	3.54	5880.	3.69	6107.	3.86	6362.	4.05	6986.	4.50
	23000	4373.	3.13	4669.	3.37	4841.	3.52	5033.	3.67	5248.	3.85	5490.	4.05	6083.	4.52
1800	35700	7210.	3.56	7577.	3.82	7790.	3.98	8027.	4.15	8288.	4.33	8587.	4.53	9310.	5.04
	29000	5603.	3.51	5957.	3.78	6161.	3.94	6390.	4.11	6645.	4.31	6932.	4.52	7634.	5.04
	23000	4756.	3.48	5089.	3.76	5282.	3.92	5498.	4.10	5739.	4.30	6011.	4.52	6674.	5.06
2000	35700	7665.	3.91	8076.	4.20	8315.	4.38	8579.	4.57	8872.	4.78	9206.	5.01	10014.	5.58
	29000	6023.	3.86	6417.	4.17	6645.	4.34	6899.	4.54	7183.	4.76	7503.	5.00	8282.	5.58
	23000	5139.	3.83	5509.	4.14	5724.	4.32	5963.	4.53	6230.	4.75	6531.	5.00	7266.	5.60
2200	35700	8121.	4.26	8576.	4.59	8839.	4.78	9132.	4.99	9456.	5.23	9825.	5.48	10718.	6.12
	29000	6443.	4.21	6877.	4.55	7128.	4.75	7409.	4.96	7722.	5.21	8073.	5.47	8930.	6.12
	23000	5522.	4.18	5929.	4.53	6165.	4.73	6428.	4.95	6722.	5.20	7052.	5.47	7857.	6.14
2400	35700	8576.	4.61	9075.	4.97	9364.	5.19	9684.	5.42	10040.	5.67	10444.	5.96	11422.	6.66
	29000	6862.	4.56	7337.	4.94	7612.	5.15	7918.	5.39	8260.	5.66	8644.	5.95	9578.	6.66
	23000	5905.	4.53	6350.	4.91	6606.	5.13	6893.	5.38	7213.	5.65	7573.	5.95	8449.	6.68
2600	35700	9031.	4.96	9574.	5.36	9888.	5.59	10237.	5.84	10624.	6.12	11063.	6.44	12126.	7.19
	29000	7282.	4.91	7797.	5.32	8095.	5.55	8427.	5.82	8798.	6.11	9214.	6.43	10226.	7.21
	23000	6289.	4.88	6770.	5.30	7048.	5.54	7358.	5.80	7704.	6.10	8093.	6.43	9040.	7.23
2800	35700	9487.	5.31	10074.	5.74	10413.	5.99	10789.	6.27	11208.	6.57	11682.	6.91	12830.	7.73
	29000	7702.	5.26	8258.	5.71	8579.	5.96	8937.	6.24	9336.	6.56	9785.	6.90	10874.	7.75
	23000	6672.	5.24	7190.	5.68	7489.	5.94	7823.	6.23	8196.	6.55	8614.	6.90	9632.	7.77
3000	35700	9942.	5.66	10573.	6.12	10937.	6.39	11342.	6.69	11793.	7.02	12301.	7.39	13534.	8.27
	29000	8121.	5.61	8718.	6.09	9062.	6.36	9446.	6.67	9874.	7.01	10355.	7.38	11523.	8.29
	23000	7055.	5.59	7610.	6.07	7931.	6.34	8288.	6.65	8687.	7.00	9135.	7.38		
3200	35700	10397.	6.01	11072.	6.51	11461.	6.80	11894.	7.11	12377.	7.47	12920.	7.87	14238.	8.81
	29000	8541.	5.96	9178.	6.47	9546.	6.77	9956.	7.09	10413.	7.46	10925.	7.85	12171.	8.83
	23000	7438.	5.94	8030.	6.45	8372.	6.75	8753.	7.08	9178.	7.45				
3400	35700	10852.	6.36	11571.	6.89	11986.	7.20	12447.	7.54	12961.	7.92	13539.	8.34		
	29000	8961.	6.31	9638.	6.86	10030.	7.17	10465.	7.52	10951.	7.91	11496.	8.33		
	23000	7822.	6.29	8451.	6.84	8814.	7.15	9218.	7.51						
3600	35700	11308.	6.71	12071.	7.28	12510.	7.60	12999.	7.96	13545.	8.36				
	29000	9380.	6.66	10098.	7.24	10513.	7.57	10974.	7.94	11489.	8.35				
	23000	8205.	6.64	8871.	7.22	9255.	7.56								
3800	35700	11763.	7.06	12570.	7.66	13035.	8.00	13551.	8.38						
	29000	9800.	7.01	10558.	7.63	10997.	7.98	11484.	8.37						
	23000	8588.	6.99	9291.	7.60										
4000	35700	12218.	7.41	13069.	8.05										
	29000	10220.	7.36	11019.	8.01										
	23000	8971.	7.34	9711.	7.99										
4200	35700	12673.	7.76	13568.	8.43										
	29000	10639.	7.71	11479.	8.40										
	23000	9354.	7.69												
4400	35700	13129.	8.11												
	29000	11059.	8.06												
	23000	9738.	8.04												

NOTE: FUEL VALUES LARGER THAN THE MAXIMUM USABLE FUEL ARE PRESENTED FOR INTERPOLATION PURPOSES.

Figure 7-11 (Sheet 10)

FLIGHT PLANNING
LONG RANGE CRUISE

STANDARD DAY **CRUISE ALTITUDE 19000 FEET**

FAN SETTING FOR LONG RANGE CRUISE

	TAILWIND			ZERO	HEADWIND		
CRUISE	100 KT.	50 KT.	25 KT.	WIND	25 KT.	50 KT.	100 KT.
WEIGHT LBS.	N1 PCT	N1 PCT	N1 PCT	N1 PCT	N1 PCT	N1 PCT	N1 PCT
35700	68.7	70.2	71.1	72.2	73.6	75.1	76.8
35000	68.2	69.6	70.5	71.5	73.0	74.6	76.8
30000	64.5	65.4	66.0	66.9	68.7	70.7	75.8
25000	60.0	60.9	61.7	62.8	64.6	66.6	73.4
20000	54.8	56.2	57.4	59.1	60.6	62.3	69.6

		TAILWIND						ZERO		HEADWIND					
STAGE	T.O.	100 KT.		50 KT.		25 KT.		WIND		25 KT.		50 KT.		100 KT.	
LENGTH NM.	WEIGHT LBS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.
200	35700	1722.	0.74	1829.	0.79	1896.	0.81	1975.	0.84	2068.	0.86	2177.	0.88	2456.	0.91
	29000	1587.	0.77	1693.	0.83	1760.	0.86	1842.	0.89	1939.	0.92	2054.	0.95	2356.	0.95
	23000	1471.	0.80	1577.	0.87	1645.	0.90	1727.	0.93	1825.	0.98	1942.	1.02	2265.	1.04
400	35700	2495.	1.30	2735.	1.42	2885.	1.48	3062.	1.53	3267.	1.57	3504.	1.60	4094.	1.67
	29000	2254.	1.38	2486.	1.53	2634.	1.61	2812.	1.68	3024.	1.75	3275.	1.82	3924.	1.75
	23000	2056.	1.47	2286.	1.62	2433.	1.70	2610.	1.76	2819.	1.86	3069.	1.98	3757.	2.01
600	35700	3268.	1.86	3642.	2.05	3874.	2.14	4148.	2.22	4465.	2.28	4831.	2.33	5732.	2.42
	29000	2921.	1.99	3279.	2.23	3508.	2.35	3783.	2.47	4110.	2.58	4496.	2.69	5492.	2.56
	23000	2641.	2.14	2996.	2.38	3222.	2.50	3493.	2.59	3812.	2.75	4195.	2.93	5248.	2.98
800	35700	4041.	2.42	4548.	2.68	4863.	2.80	5234.	2.92	5663.	2.99	6158.	3.06	7371.	3.18
	29000	3588.	2.60	4071.	2.93	4381.	3.10	4754.	3.25	5195.	3.41	5718.	3.56	7060.	3.36
	23000	3227.	2.81	3705.	3.13	4011.	3.29	4376.	3.42	4806.	3.64	5322.	3.88	6740.	3.94
1000	35700	4814.	2.98	5454.	3.30	5852.	3.47	6320.	3.61	6862.	3.70	7485.	3.79	9009.	3.93
	29000	4255.	3.21	4864.	3.63	5255.	3.85	5724.	4.04	6281.	4.24	6939.	4.43	8628.	4.17
	23000	3812.	3.48	4414.	3.89	4799.	4.09	5259.	4.25	5800.	4.52	6448.	4.84	8232.	4.91
1200	35700	5587.	3.54	6360.	3.93	6842.	4.13	7406.	4.30	8060.	4.41	8812.	4.52	10647.	4.69
	29000	4922.	3.82	5657.	4.33	6129.	4.59	6695.	4.83	7366.	5.06	8160.	5.31	10196.	4.97
	23000	4397.	4.15	5123.	4.64	5588.	4.88	6142.	5.07	6793.	5.41	7575.	5.79	9724.	5.88
1400	35700	6361.	4.10	7266.	4.56	7831.	4.79	8493.	5.00	9258.	5.12	10139.	5.25	12286.	5.44
	29000	5589.	4.43	6450.	5.03	7002.	5.34	7666.	5.61	8452.	5.89	9381.	6.18	11764.	5.78
	23000	4982.	4.81	5833.	5.40	6377.	5.68	7025.	5.90	7787.	6.30	8702.	6.75	11216.	6.85
1600	35700	7134.	4.66	8172.	5.19	8820.	5.46	9579.	5.69	10457.	5.83	11466.	5.97	13924.	6.20
	29000	6256.	5.05	7243.	5.73	7876.	6.08	8637.	6.40	9537.	6.72	10603.	7.05	13332.	6.58
	23000	5567.	5.48	6542.	6.15	7165.	6.47	7908.	6.73	8781.	7.18	9828.	7.70		
1800	35700	7907.	5.22	9079.	5.82	9809.	6.12	10665.	6.38	11655.	6.54	12792.	6.70	15562.	6.95
	29000	6922.	5.66	8036.	6.43	8750.	6.83	9607.	7.19	10623.	7.55	11824.	7.92	14900.	7.39
	23000	6152.	6.15	7251.	6.90	7954.	7.27	8791.	7.56	9774.	8.07				
2000	35700	8680.	5.79	9985.	6.45	10798.	6.78	11751.	7.08	12853.	7.25	14119.	7.43		
	29000	7589.	6.27	8828.	7.13	9623.	7.58	10578.	7.98	11708.	8.38	13045.	8.79		
	23000	6737.	6.82	7961.	7.66	8742.	8.07	9674.	8.39						
2200	35700	9453.	6.35	10891.	7.08	11787.	7.45	12837.	7.77	14052.	7.96				
	29000	8256.	6.88	9621.	7.83	10497.	8.32	11549.	8.76	12794.	9.21				
	23000	7322.	7.49	8670.	8.41	9531.	8.86								
2400	35700	10226.	6.91	11797.	7.71	12776.	8.11	13924.	8.46						
	29000	8923.	7.49	10414.	8.53	11371.	9.07	12519.	9.55						
	23000	7907.	8.15	9379.	9.17										
2600	35700	10999.	7.47	12703.	8.34	13766.	8.77								
	29000	9590.	8.10	11207.	9.23	12245.	9.82								
	23000	8492.	8.82	10089.	9.92										
2800	35700	11772.	8.03	13610.	8.97										
	29000	10257.	8.71	12000.	9.93										
	23000	9078.	9.49												
3000	35700	12545.	8.59	14516.	9.60										
	29000	10924.	9.32	12793.	10.63										
	23000	9663.	10.16												
3200	35700	13318.	9.15												
	29000	11591.	9.93												
	23000	10248.	10.83												

NOTE: FUEL VALUES LARGER THAN THE MAXIMUM USABLE FUEL ARE PRESENTED FOR INTERPOLATION PURPOSES.

Figure 7-12 (Sheet 1 of 13)

FLIGHT PLANNING
LONG RANGE CRUISE

STANDARD DAY **CRUISE ALTITUDE 23000 FEET**

FAN SETTING FOR LONG RANGE CRUISE

CRUISE WEIGHT LBS.	TAILWIND 100 KT. N1 PCT	TAILWIND 50 KT. N1 PCT	TAILWIND 25 KT. N1 PCT	ZERO WIND N1 PCT	HEADWIND 25 KT. N1 PCT	HEADWIND 50 KT. N1 PCT	HEADWIND 100 KT. N1 PCT
35000	71.6	72.8	73.4	74.2	75.1	75.8	78.4
30000	67.4	68.6	69.5	70.5	71.7	73.5	76.4
25000	62.9	64.2	65.1	66.2	67.6	69.9	74.1
20000	58.0	59.6	60.2	61.2	62.6	65.0	71.5

		TAILWIND						ZERO		HEADWIND					
STAGE	T.O.	100 KT.		50 KT.		25 KT.		WIND		25 KT.		50 KT.		100 KT.	
LENGTH NM.	WEIGHT LBS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.
200	35700	1749.	0.71	1836.	0.75	1890.	0.77	1955.	0.79	2029.	0.81	2116.	0.83	2344.	0.88
	29000	1608.	0.74	1696.	0.78	1751.	0.80	1818.	0.83	1896.	0.86	1989.	0.87	2230.	0.91
	23000	1484.	0.76	1572.	0.82	1627.	0.85	1694.	0.89	1775.	0.92	1873.	0.95	2134.	0.95
400	35700	2468.	1.24	2671.	1.33	2795.	1.38	2942.	1.43	3109.	1.48	3303.	1.52	3792.	1.61
	29000	2228.	1.32	2429.	1.44	2555.	1.50	2705.	1.57	2881.	1.63	3089.	1.64	3603.	1.70
	23000	2018.	1.39	2213.	1.53	2334.	1.62	2480.	1.72	2658.	1.81	2875.	1.87	3445.	1.81
600	35700	3187.	1.76	3507.	1.91	3701.	1.99	3930.	2.06	4188.	2.14	4490.	2.21	5240.	2.34
	29000	2848.	1.91	3162.	2.10	3359.	2.20	3592.	2.30	3865.	2.40	4188.	2.42	4976.	2.48
	23000	2552.	2.02	2854.	2.23	3040.	2.38	3266.	2.55	3542.	2.69	3878.	2.80	4756.	2.67
800	35700	3907.	2.29	4342.	2.49	4606.	2.60	4917.	2.70	5268.	2.81	5677.	2.89	6688.	3.07
	29000	3468.	2.49	3895.	2.76	4162.	2.90	4479.	3.04	4849.	3.17	5287.	3.19	6349.	3.27
	23000	3086.	2.65	3496.	2.94	3747.	3.15	4052.	3.38	4425.	3.57	4880.	3.72	6067.	3.53
1000	35700	4626.	2.82	5178.	3.07	5512.	3.21	5905.	3.33	6348.	3.47	6864.	3.58	8136.	3.80
	29000	4088.	3.08	4627.	3.42	4966.	3.60	5366.	3.77	5833.	3.94	6387.	3.96	7722.	4.06
	23000	3620.	3.28	4137.	3.65	4454.	3.92	4838.	4.21	5309.	4.46	5883.	4.64	7377.	4.39
1200	35700	5346.	3.34	6013.	3.65	6417.	3.82	6892.	3.97	7427.	4.14	8051.	4.27	9584.	4.53
	29000	4708.	3.67	5360.	4.08	5769.	4.30	6253.	4.51	6817.	4.71	7486.	4.73	9095.	4.85
	23000	4154.	3.91	4778.	4.36	5160.	4.68	5623.	5.03	6192.	5.34	6885.	5.57	8688.	5.25
1400	35700	6065.	3.87	6848.	4.23	7323.	4.43	7880.	4.61	8507.	4.80	9237.	4.95	11032.	5.26
	29000	5328.	4.25	6093.	4.74	6573.	5.00	7140.	5.25	7802.	5.48	8585.	5.50	10468.	5.63
	23000	4688.	4.54	5419.	5.07	5867.	5.45	6409.	5.86	7076.	6.22	7888.	6.49	9999.	6.11
1600	35700	6785.	4.40	7684.	4.81	8228.	5.04	8867.	5.24	9587.	5.47	10424.	5.64	12480.	5.99
	29000	5948.	4.84	6826.	5.40	7377.	5.70	8028.	5.98	8786.	6.25	9685.	6.27	11842.	6.42
	23000	5222.	5.17	6061.	5.78	6574.	6.22	7195.	6.69	7959.	7.10	8890.	7.41	11309.	6.97
1800	35700	7504.	4.92	8519.	5.39	9134.	5.65	9855.	5.88	10666.	6.13	11611.	6.33	13927.	6.72
	29000	6569.	5.43	7559.	6.06	8180.	6.40	8915.	6.72	9770.	7.02	10784.	7.04	13215.	7.21
	23000	5756.	5.80	6702.	6.49	7281.	6.98	7981.	7.52	8842.	7.99	9893.	8.33		
2000	35700	8224.	5.45	9354.	5.98	10039.	6.26	10842.	6.51	11746.	6.80	12798.	7.01	15375.	7.45
	29000	7189.	6.01	8292.	6.72	8984.	7.10	9802.	7.45	10754.	7.79	11883.	7.81	14588.	7.99
	23000	6290.	6.43	7343.	7.19	7987.	7.75	8767.	8.35	9726.	8.87				
2200	35700	8943.	5.98	10190.	6.56	10945.	6.87	11830.	7.15	12826.	7.46	13985.	7.70		
	29000	7809.	6.60	9025.	7.38	9787.	7.80	10689.	8.19	11739.	8.56	12983.	8.58		
	23000	6824.	7.07	7985.	7.90	8694.	8.52	9553.	9.18						
2400	35700	9663.	6.50	11025.	7.14	11850.	7.48	12817.	7.79	13905.	8.13				
	29000	8429.	7.18	9758.	8.04	10591.	8.50	11576.	8.93	12723.	9.33				
	23000	7358.	7.70	8626.	8.61	9401.	9.28								
2600	35700	10382.	7.03	11860.	7.72	12755.	8.09	13805.	8.42						
	29000	9049.	7.77	10490.	8.70	11395.	9.20	12463.	9.66						
	23000	7892.	8.32	9267.	9.32										
2800	35700	11102.	7.56	12696.	8.30	13661.	8.70								
	29000	9669.	8.36	11223.	9.36	12198.	9.90								
	23000	8426.	8.96	9908.	10.03										
3000	35700	11821.	8.08	13531.	8.88										
	29000	10289.	8.94	11956.	10.02										
	23000	8960.	9.59	10550.	10.74										
3200	35700	12541.	8.61	14366.	9.46										
	29000	10910.	9.53	12689.	10.68										
	23000	9494.	10.22												
3400	35700	13260.	9.14												
	29000	11530.	10.12												
	23000	10028.	10.85												

NOTE: FUEL VALUES LARGER THAN THE MAXIMUM USABLE FUEL ARE PRESENTED FOR INTERPOLATION PURPOSES.

Figure 7-12 (Sheet 2)

FLIGHT PLANNING
LONG RANGE CRUISE

STANDARD DAY **CRUISE ALTITUDE 27000 FEET**

FAN SETTING FOR LONG RANGE CRUISE

CRUISE WEIGHT LBS.	TAILWIND 100 KT. N1 PCT	TAILWIND 50 KT. N1 PCT	TAILWIND 25 KT. N1 PCT	ZERO WIND N1 PCT	HEADWIND 25 KT. N1 PCT	HEADWIND 50 KT. N1 PCT	HEADWIND 100 KT. N1 PCT
35000	74.4	75.2	75.6	76.1	76.7	77.6	79.8
30000	70.8	71.8	72.6	73.4	74.4	75.4	77.8
25000	66.2	67.5	68.4	69.5	70.7	72.1	75.4
20000	60.7	62.1	63.1	64.3	65.6	67.5	72.6

		TAILWIND						ZERO		HEADWIND					
STAGE	T.O.	100 KT.		50 KT.		25 KT.		WIND		25 KT.		50 KT.		100 KT.	
LENGTH NM.	WEIGHT LBS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.
400	35700	2450.	1.19	2621.	1.27	2726.	1.31	2847.	1.36	2986.	1.41	3149.	1.45	3557.	1.52
	29000	2212.	1.25	2383.	1.35	2489.	1.40	2613.	1.45	2756.	1.50	2923.	1.55	3348.	1.62
	23000	1991.	1.35	2158.	1.47	2264.	1.54	2391.	1.62	2540.	1.69	2721.	1.73	3176.	1.74
600	35700	3113.	1.69	3385.	1.82	3550.	1.89	3741.	1.96	3959.	2.04	4212.	2.10	4843.	2.21
	29000	2790.	1.81	3059.	1.96	3226.	2.04	3420.	2.12	3642.	2.20	3901.	2.28	4556.	2.37
	23000	2477.	1.97	2738.	2.18	2904.	2.29	3102.	2.41	3336.	2.53	3619.	2.58	4318.	2.57
800	35700	3777.	2.19	4148.	2.37	4375.	2.47	4635.	2.57	4932.	2.67	5276.	2.76	6129.	2.89
	29000	3367.	2.36	3735.	2.57	3963.	2.68	4226.	2.79	4528.	2.90	4880.	3.00	5763.	3.13
	23000	2963.	2.59	3318.	2.88	3544.	3.04	3813.	3.20	4131.	3.36	4516.	3.43	5461.	3.40
1000	35700	4440.	2.69	4912.	2.93	5199.	3.05	5528.	3.18	5904.	3.30	6340.	3.41	7415.	3.58
	29000	3945.	2.92	4411.	3.18	4699.	3.32	5033.	3.46	5414.	3.60	5858.	3.73	6970.	3.89
	23000	3449.	3.21	3898.	3.59	4184.	3.78	4524.	3.99	4927.	4.20	5414.	4.29	6603.	4.23
1200	35700	5103.	3.19	5675.	3.48	6024.	3.63	6422.	3.78	6877.	3.94	7404.	4.07	8701.	4.26
	29000	4523.	3.47	5087.	3.80	5436.	3.96	5839.	4.13	6300.	4.30	6837.	4.45	8178.	4.64
	23000	3935.	3.83	4479.	4.29	4824.	4.53	5236.	4.78	5722.	5.03	6311.	5.14	7746.	5.06
1400	35700	5767.	3.68	6438.	4.03	6848.	4.21	7316.	4.39	7849.	4.57	8468.	4.72	9987.	4.95
	29000	5101.	4.02	5764.	4.41	6173.	4.59	6646.	4.79	7186.	5.00	7816.	5.18	9385.	5.40
	23000	4421.	4.45	5059.	4.99	5464.	5.28	5947.	5.57	6518.	5.87	7209.	5.99	8889.	5.89
1600	35700	6430.	4.18	7202.	4.58	7673.	4.79	8209.	4.99	8822.	5.20	9532.	5.38	11273.	5.64
	29000	5678.	4.58	6440.	5.02	6910.	5.23	7453.	5.46	8072.	5.70	8794.	5.90	10592.	6.15
	23000	4906.	5.07	5639.	5.70	6104.	6.02	6658.	6.37	7313.	6.71	8106.	6.85	10031.	6.72
1800	35700	7093.	4.68	7965.	5.14	8497.	5.36	9103.	5.60	9795.	5.83	10596.	6.03	12559.	6.32
	29000	6256.	5.13	7116.	5.63	7647.	5.87	8259.	6.13	8958.	6.40	9773.	6.63	11800.	6.91
	23000	5392.	5.69	6219.	6.40	6744.	6.77	7370.	7.16	8109.	7.54	9004.	7.70		
2000	35700	7756.	5.18	8729.	5.69	9321.	5.94	9997.	6.20	10767.	6.47	11660.	6.69	13844.	7.01
	29000	6834.	5.68	7792.	6.24	8384.	6.51	9066.	6.80	9844.	7.10	10751.	7.35	13007.	7.66
	23000	5878.	6.31	6800.	7.10	7385.	7.52	8081.	7.95	8905.	8.38	9901.	8.55		
2200	35700	8420.	5.68	9492.	6.24	10146.	6.52	10890.	6.81	11740.	7.10	12724.	7.34	15130.	7.69
	29000	7412.	6.24	8468.	6.86	9120.	7.15	9873.	7.47	10730.	7.80	11730.	8.08	14214.	8.42
	23000	6364.	6.93	7380.	7.81	8025.	8.26	8792.	8.74	9700.	9.22				
2400	35700	9083.	6.18	10256.	6.79	10970.	7.10	11784.	7.41	12712.	7.73	13787.	8.00		
	29000	7989.	6.79	9144.	7.47	9857.	7.79	10679.	8.14	11616.	8.50	12709.	8.81		
	23000	6850.	7.55	7960.	8.51	8665.	9.01	9504.	9.53						
2600	35700	9746.	6.68	11019.	7.34	11795.	7.68	12678.	8.02	13685.	8.36				
	29000	8567.	7.35	9820.	8.08	10594.	8.43	11486.	8.81	12502.	9.20				
	23000	7336.	8.18	8540.	9.21	9305.	9.76								
2800	35700	10410.	7.18	11782.	7.90	12619.	8.26	13571.	8.63						
	29000	9145.	7.90	10497.	8.69	11331.	9.07	12293.	9.48						
	23000	7822.	8.80	9121.	9.92										
3000	35700	11073.	7.68	12546.	8.45	13444.	8.84								
	29000	9723.	8.45	11173.	9.30	12068.	9.71								
	23000	8308.	9.42	9701.	10.62										
3200	35700	11736.	8.18	13309.	9.00										
	29000	10300.	9.01	11849.	9.91										
	23000	8794.	10.04	10281.	11.32										
3400	35700	12399.	8.68	14073.	9.55										
	29000	10878.	9.56	12525.	10.53										
	23000	9280.	10.66												
3600	35700	13063.	9.18												
	29000	11456.	10.11												
	23000	9766.	11.28												

NOTE: FUEL VALUES LARGER THAN THE MAXIMUM USABLE FUEL ARE PRESENTED FOR INTERPOLATION PURPOSES.

Figure 7-12 (Sheet 3)

FLIGHT PLANNING
LONG RANGE CRUISE

STANDARD DAY **CRUISE ALTITUDE 31000 FEET**

FAN SETTING FOR LONG RANGE CRUISE

	TAILWIND			ZERO	HEADWIND		
CRUISE WEIGHT LBS.	100 KT. N1 PCT	50 KT. N1 PCT	25 KT. N1 PCT	WIND N1 PCT	25 KT. N1 PCT	50 KT. N1 PCT	100 KT. N1 PCT
35000	76.7	77.3	77.8	78.2	78.9	79.5	81.0
30000	73.8	74.7	75.2	75.8	76.3	77.1	79.0
25000	69.6	70.7	71.3	72.1	72.9	74.0	76.6
20000	64.1	65.4	66.1	67.0	68.5	70.2	73.8

		TAILWIND						ZERO		HEADWIND					
STAGE	T.O.	100 KT.		50 KT.		25 KT.		WIND		25 KT.		50 KT.		100 KT.	
LENGTH NM.	WEIGHT LBS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.
600	35700	3073.	1.61	3306.	1.73	3446.	1.79	3607.	1.86	3790.	1.92	4002.	1.98	4526.	2.10
	29000	2741.	1.71	2970.	1.85	3110.	1.92	3272.	2.00	3458.	2.08	3675.	2.15	4221.	2.26
	23000	2441.	1.86	2666.	2.04	2806.	2.14	2973.	2.24	3169.	2.29	3397.	2.34	3965.	2.44
800	35700	3688.	2.09	4008.	2.25	4200.	2.34	4421.	2.42	4671.	2.52	4960.	2.59	5670.	2.75
	29000	3274.	2.23	3588.	2.42	3778.	2.53	3999.	2.63	4253.	2.74	4548.	2.83	5285.	2.99
	23000	2892.	2.45	3200.	2.69	3391.	2.84	3619.	2.97	3886.	3.04	4197.	3.11	4962.	3.23
1000	35700	4302.	2.56	4710.	2.76	4955.	2.88	5236.	2.99	5552.	3.11	5918.	3.20	6813.	3.40
	29000	3807.	2.75	4205.	3.00	4447.	3.13	4727.	3.26	5047.	3.40	5421.	3.52	6350.	3.71
	23000	3344.	3.04	3735.	3.35	3977.	3.54	4265.	3.71	4603.	3.79	4996.	3.87	5960.	4.02
1200	35700	4917.	3.03	5413.	3.28	5709.	3.42	6050.	3.56	6433.	3.70	6876.	3.81	7957.	4.05
	29000	4339.	3.27	4822.	3.57	5116.	3.73	5454.	3.89	5842.	4.06	6294.	4.20	7414.	4.43
	23000	3795.	3.62	4269.	4.01	4562.	4.24	4911.	4.44	5320.	4.55	5796.	4.64	6958.	4.81
1400	35700	5531.	3.50	6115.	3.80	6464.	3.97	6864.	4.13	7314.	4.30	7835.	4.43	9101.	4.70
	29000	4872.	3.79	5440.	4.14	5785.	4.33	6182.	4.52	6637.	4.72	7167.	4.89	8479.	5.15
	23000	4247.	4.21	4803.	4.67	5147.	4.93	5557.	5.18	6037.	5.30	6595.	5.40	7955.	5.60
1600	35700	6146.	3.98	6817.	4.32	7218.	4.51	7678.	4.70	8195.	4.89	8793.	5.04	10244.	5.35
	29000	5405.	4.31	6057.	4.72	6454.	4.93	6909.	5.15	7432.	5.38	8041.	5.57	9543.	5.87
	23000	4698.	4.80	5338.	5.32	5733.	5.63	6203.	5.91	6754.	6.05	7394.	6.17	8953.	6.39
1800	35700	6760.	4.45	7519.	4.84	7972.	5.06	8492.	5.26	9076.	5.48	9751.	5.65	11388.	6.00
	29000	5938.	4.83	6675.	5.29	7122.	5.54	7637.	5.78	8227.	6.04	8914.	6.26	10608.	6.60
	23000	5150.	5.39	5872.	5.98	6318.	6.33	6849.	6.65	7471.	6.80	8194.	6.93	9950.	7.18
2000	35700	7375.	4.92	8221.	5.36	8727.	5.60	9306.	5.83	9957.	6.08	10709.	6.26	12532.	6.65
	29000	6470.	5.35	7292.	5.86	7791.	6.14	8364.	6.41	9022.	6.70	9787.	6.94	11672.	7.32
	23000	5601.	5.98	6406.	6.64	6903.	7.03	7495.	7.38	8188.	7.55	8993.	7.70	10948.	7.97
2200	35700	7989.	5.40	8924.	5.87	9481.	6.14	10121.	6.40	10838.	6.67	11668.	6.87	13676.	7.30
	29000	7003.	5.87	7910.	6.44	8460.	6.74	9092.	7.04	9817.	7.36	10660.	7.63	12737.	8.04
	23000	6053.	6.56	6941.	7.30	7489.	7.73	8141.	8.12	8905.	8.30	9793.	8.46		
2400	35700	8603.	5.87	9626.	6.39	10236.	6.69	10935.	6.97	11719.	7.26	12626.	7.48	14819.	7.95
	29000	7536.	6.39	8527.	7.01	9129.	7.34	9819.	7.67	10611.	8.02	11533.	8.31	13802.	8.76
	23000	6504.	7.15	7475.	7.95	8074.	8.42	8787.	8.85	9622.	9.05				
2600	35700	9218.	6.34	10328.	6.91	10990.	7.23	11749.	7.54	12600.	7.85	13584.	8.09		
	29000	8069.	6.91	9145.	7.58	9797.	7.94	10547.	8.30	11406.	8.68	12406.	9.00		
	23000	6956.	7.74	8009.	8.61	8660.	9.12	9433.	9.59						
2800	35700	9832.	6.81	11030.	7.43	11745.	7.77	12563.	8.11	13481.	8.45				
	29000	8601.	7.43	9762.	8.16	10466.	8.55	11275.	8.93	12201.	9.34				
	23000	7407.	8.33	8544.	9.27	9245.	9.82								
3000	35700	10447.	7.29	11733.	7.95	12499.	8.32	13377.	8.67						
	29000	9134.	7.95	10379.	8.73	11135.	9.15	12002.	9.56						
	23000	7859.	8.92	9078.	9.93										
3200	35700	11061.	7.76	12435.	8.46	13254.	8.86								
	29000	9667.	8.47	10997.	9.30	11804.	9.75								
	23000	8310.	9.50	9612.	10.59										
3400	35700	11676.	8.23	13137.	8.98										
	29000	10200.	8.99	11614.	9.88										
	23000	8762.	10.09	10146.	11.24										
3600	35700	12290.	8.71	13839.	9.50										
	29000	10732.	9.51	12232.	10.45										
	23000	9213.	10.68												
3800	35700	12905.	9.18	14542.	10.02										
	29000	11265.	10.03	12849.	11.02										
	23000	9665.	11.27												
4000	35700	13519.	9.65												
	29000	11798.	10.55												
	23000	10116.	11.86												

NOTE: FUEL VALUES LARGER THAN THE MAXIMUM USABLE FUEL ARE PRESENTED FOR INTERPOLATION PURPOSES.

Figure 7-12 (Sheet 4)

FLIGHT PLANNING
LONG RANGE CRUISE

STANDARD DAY **CRUISE ALTITUDE 33000 FEET**

FAN SETTING FOR LONG RANGE CRUISE

	TAILWIND			ZERO	HEADWIND		
CRUISE	100 KT.	50 KT.	25 KT.	WIND	25 KT.	50 KT.	100 KT.
WEIGHT LBS.	N1 PCT	N1 PCT	N1 PCT	N1 PCT	N1 PCT	N1 PCT	N1 PCT
35000	77.9	78.4	78.7	79.1	79.7	80.3	81.8
30000	75.1	75.8	76.2	76.7	77.2	77.9	79.7
25000	71.0	71.9	72.5	73.2	73.9	74.9	77.2
20000	65.7	66.8	67.6	68.7	69.8	71.2	74.3

		TAILWIND						ZERO		HEADWIND					
STAGE	T.O.	100 KT.		50 KT.		25 KT.		WIND		25 KT.		50 KT.		100 KT.	
LENGTH NM.	WEIGHT LBS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.
800	35700	3644.	2.04	3943.	2.19	4121.	2.27	4324.	2.36	4555.	2.45	4818.	2.53	5470.	2.70
	29000	3226.	2.18	3517.	2.36	3693.	2.47	3897.	2.56	4131.	2.67	4402.	2.76	5077.	2.89
	23000	2856.	2.38	3142.	2.61	3318.	2.72	3526.	2.82	3765.	2.92	4042.	3.03	4743.	3.17
1000	35700	4236.	2.50	4617.	2.69	4843.	2.80	5102.	2.91	5394.	3.02	5727.	3.12	6550.	3.34
	29000	3737.	2.69	4107.	2.92	4330.	3.06	4589.	3.18	4884.	3.32	5228.	3.42	6078.	3.59
	23000	3291.	2.95	3654.	3.24	3878.	3.38	4140.	3.51	4443.	3.64	4792.	3.78	5676.	3.95
1200	35700	4828.	2.96	5291.	3.20	5566.	3.32	5879.	3.45	6234.	3.59	6637.	3.72	7629.	3.98
	29000	4248.	3.19	4697.	3.48	4968.	3.64	5281.	3.79	5638.	3.96	6053.	4.09	7080.	4.29
	23000	3726.	3.52	4166.	3.88	4437.	4.04	4755.	4.21	5121.	4.36	5543.	4.53	6608.	4.74
1400	35700	5420.	3.42	5965.	3.70	6289.	3.85	6657.	4.00	7073.	4.16	7547.	4.31	8709.	4.62
	29000	4759.	3.70	5286.	4.04	5605.	4.23	5972.	4.41	6392.	4.61	6879.	4.75	8081.	4.99
	23000	4162.	4.09	4678.	4.51	4997.	4.71	5370.	4.90	5799.	5.08	6294.	5.28	7541.	5.52
1600	35700	6012.	3.88	6639.	4.20	7012.	4.38	7435.	4.55	7913.	4.74	8456.	4.90	9789.	5.26
	29000	5270.	4.20	5876.	4.60	6242.	4.82	6664.	5.02	7146.	5.25	7705.	5.42	9082.	5.68
	23000	4597.	4.66	5190.	5.14	5556.	5.37	5985.	5.59	6477.	5.80	7045.	6.03	8473.	6.30
1800	35700	6604.	4.34	7313.	4.71	7734.	4.90	8212.	5.10	8752.	5.31	9366.	5.50	10869.	5.90
	29000	5781.	4.71	6466.	5.15	6879.	5.41	7356.	5.63	7900.	5.90	8530.	6.09	10083.	6.38
	23000	5032.	5.23	5703.	5.78	6115.	6.04	6599.	6.28	7155.	6.52	7796.	6.77	9406.	7.08
2000	35700	7196.	4.80	7988.	5.21	8457.	5.43	8990.	5.65	9592.	5.88	10276.	6.09	11949.	6.54
	29000	6292.	5.22	7056.	5.71	7517.	5.99	8047.	6.25	8654.	6.54	9356.	6.75	11085.	7.08
	23000	5467.	5.80	6215.	6.41	6675.	6.70	7214.	6.97	7833.	7.24	8547.	7.52	10338.	7.86
2200	35700	7788.	5.26	8662.	5.71	9180.	5.95	9768.	6.20	10431.	6.45	11185.	6.69	13029.	7.18
	29000	6803.	5.72	7646.	6.27	8154.	6.58	8739.	6.86	9407.	7.19	10182.	7.42	12086.	7.78
	23000	5902.	6.37	6727.	7.05	7234.	7.36	7829.	7.66	8511.	7.96	9297.	8.27		
2400	35700	8380.	5.72	9336.	6.21	9903.	6.48	10545.	6.75	11271.	7.03	12095.	7.28	14109.	7.82
	29000	7314.	6.23	8235.	6.83	8791.	7.17	9431.	7.48	10161.	7.83	11007.	8.08	13087.	8.47
	23000	6337.	6.94	7239.	7.68	7794.	8.03	8443.	8.36	9189.	8.67				
2600	35700	8972.	6.18	10010.	6.72	10625.	7.00	11323.	7.29	12110.	7.60	13005.	7.87	15189.	8.46
	29000	7825.	6.74	8825.	7.39	9428.	7.76	10122.	8.09	10915.	8.48	11833.	8.75	14088.	9.17
	23000	6773.	7.51	7751.	8.31	8353.	8.69	9058.	9.05						
2800	35700	9564.	6.64	10684.	7.22	11348.	7.53	12100.	7.84	12950.	8.17	13914.	8.47		
	29000	8336.	7.24	9415.	7.95	10066.	8.35	10814.	8.71	11669.	9.12	12659.	9.41		
	23000	7208.	8.08	8263.	8.95	8913.	9.36	9673.	9.74						
3000	35700	10156.	7.10	11358.	7.72	12071.	8.05	12878.	8.39	13789.	8.75				
	29000	8847.	7.75	10005.	8.50	10703.	8.93	11506.	9.32	12423.	9.77				
	23000	7643.	8.65	8776.	9.58	9472.	10.02								
3200	35700	10748.	7.57	12032.	8.23	12794.	8.58	13656.	8.94						
	29000	9358.	8.25	10594.	9.06	11340.	9.52	12198.	9.93						
	23000	8078.	9.22	9288.	10.22										
3400	35700	11340.	8.03	12706.	8.73	13516.	9.10								
	29000	9869.	8.76	11184.	9.62	11977.	10.11								
	23000	8513.	9.79	9800.	10.85										
3600	35700	11932.	8.49	13380.	9.23										
	29000	10380.	9.27	11774.	10.18										
	23000	8949.	10.36	10312.	11.48										
3800	35700	12524.	8.95	14055.	9.73										
	29000	10891.	9.77	12364.	10.74										
	23000	9384.	10.93												
4000	35700	13116.	9.41												
	29000	11402.	10.28												
	23000	9819.	11.50												

NOTE: FUEL VALUES LARGER THAN THE MAXIMUM USABLE FUEL ARE PRESENTED FOR INTERPOLATION PURPOSES.

Figure 7-12 (Sheet 5)

FLIGHT PLANNING
LONG RANGE CRUISE

STANDARD DAY **CRUISE ALTITUDE 35000 FEET**

FAN SETTING FOR LONG RANGE CRUISE

	TAILWIND			ZERO	HEADWIND		
CRUISE	100 KT.	50 KT.	25 KT.	WIND	25 KT.	50 KT.	100 KT.
WEIGHT LBS.	N1 PCT	N1 PCT	N1 PCT	N1 PCT	N1 PCT	N1 PCT	N1 PCT
35000	79.1	79.6	79.9	80.3	80.8	81.4	82.8
30000	76.3	76.9	77.3	77.8	78.3	78.8	80.3
25000	72.3	73.2	73.8	74.4	75.0	75.8	77.7
20000	67.3	68.5	69.2	70.1	71.0	72.2	74.8

		TAILWIND						ZERO		HEADWIND					
STAGE	T.O.	100 KT.		50 KT.		25 KT.		WIND		25 KT.		50 KT.		100 KT.	
LENGTH NM.	WEIGHT LBS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.
800	35700	3608.	2.00	3886.	2.14	4051.	2.21	4239.	2.29	4452.	2.38	4694.	2.48	5297.	2.65
	29000	3186.	2.13	3456.	2.30	3620.	2.39	3809.	2.48	4024.	2.59	4271.	2.68	4890.	2.82
	23000	2821.	2.30	3085.	2.51	3246.	2.62	3434.	2.73	3652.	2.84	3906.	2.93	4546.	3.10
1000	35700	4178.	2.45	4533.	2.63	4744.	2.72	4982.	2.82	5253.	2.94	5559.	3.06	6319.	3.28
	29000	3677.	2.63	4021.	2.85	4229.	2.96	4468.	3.08	4740.	3.21	5053.	3.32	5831.	3.50
	23000	3240.	2.85	3575.	3.11	3778.	3.26	4016.	3.40	4292.	3.54	4613.	3.65	5418.	3.87
1200	35700	4749.	2.89	5180.	3.12	5436.	3.23	5725.	3.35	6053.	3.49	6424.	3.64	7342.	3.90
	29000	4169.	3.12	4585.	3.39	4838.	3.53	5127.	3.67	5457.	3.83	5835.	3.96	6773.	4.18
	23000	3659.	3.40	4064.	3.72	4311.	3.90	4599.	4.07	4933.	4.23	5320.	4.38	6290.	4.63
1400	35700	5320.	3.34	5828.	3.60	6129.	3.74	6469.	3.88	6854.	4.05	7288.	4.22	8364.	4.53
	29000	4660.	3.61	5150.	3.93	5447.	4.09	5787.	4.26	6173.	4.45	6616.	4.61	7715.	4.85
	23000	4077.	3.95	4554.	4.32	4843.	4.54	5181.	4.74	5573.	4.93	6027.	5.10	7162.	5.40
1600	35700	5891.	3.79	6475.	4.09	6821.	4.24	7212.	4.41	7654.	4.60	8153.	4.80	9386.	5.16
	29000	5151.	4.11	5714.	4.47	6056.	4.66	6446.	4.85	6890.	5.07	7398.	5.25	8657.	5.53
	23000	4496.	4.50	5044.	4.93	5376.	5.18	5764.	5.41	6213.	5.63	6734.	5.82	8034.	6.16
1800	35700	6461.	4.24	7122.	4.58	7514.	4.75	7955.	4.94	8455.	5.15	9018.	5.39	10408.	5.78
	29000	5642.	4.60	6279.	5.01	6665.	5.23	7105.	5.44	7606.	5.69	8180.	5.89	9598.	6.21
	23000	4915.	5.04	5534.	5.53	5909.	5.81	6346.	6.08	6853.	6.32	7441.	6.54	8906.	6.92
2000	35700	7032.	4.68	7770.	5.07	8206.	5.26	8698.	5.47	9255.	5.71	9883.	5.97	11431.	6.41
	29000	6133.	5.09	6843.	5.55	7274.	5.79	7764.	6.04	8322.	6.31	8961.	6.54	10540.	6.89
	23000	5334.	5.59	6023.	6.13	6441.	6.45	6929.	6.75	7493.	7.02	8148.	7.26	9778.	7.69
2200	35700	7603.	5.13	8417.	5.56	8899.	5.77	9441.	6.00	10056.	6.26	10747.	6.55	12453.	7.04
	29000	6624.	5.58	7407.	6.10	7882.	6.36	8423.	6.63	9039.	6.93	9743.	7.18	11482.	7.56
	23000	5752.	6.14	6513.	6.74	6974.	7.09	7511.	7.42	8133.	7.72	8855.	7.98	10650.	8.45
2400	35700	8173.	5.58	9064.	6.04	9592.	6.28	10185.	6.53	10856.	6.82	11612.	7.13	13475.	7.67
	29000	7116.	6.08	7972.	6.64	8491.	6.93	9082.	7.22	9755.	7.56	10524.	7.83	12424.	8.24
	23000	6171.	6.69	7003.	7.34	7506.	7.73	8094.	8.09	8773.	8.42	9562.	8.70		
2600	35700	8744.	6.03	9712.	6.53	10284.	6.78	10928.	7.06	11657.	7.37	12477.	7.71	14497.	8.29
	29000	7607.	6.57	8536.	7.18	9100.	7.50	9742.	7.81	10471.	8.18	11306.	8.47	13365.	8.92
	23000	6590.	7.24	7492.	7.95	8039.	8.37	8676.	8.76	9413.	9.11				
2800	35700	9315.	6.47	10359.	7.02	10977.	7.29	11671.	7.59	12457.	7.93	13342.	8.29		
	29000	8098.	7.06	9101.	7.72	9709.	8.06	10401.	8.40	11188.	8.80	12088.	9.11		
	23000	7009.	7.78	7982.	8.55	8572.	9.01	9258.	9.43						
3000	35700	9886.	6.92	11006.	7.51	11669.	7.80	12414.	8.12	13258.	8.48				
	29000	8589.	7.56	9665.	8.26	10318.	8.63	11060.	9.00	11904.	9.42				
	23000	7428.	8.33	8472.	9.16	9104.	9.64								
3200	35700	10456.	7.37	11653.	7.99	12362.	8.31	13158.	8.65						
	29000	9080.	8.05	10230.	8.80	10927.	9.20	11719.	9.59						
	23000	7846.	8.88	8962.	9.76	9637.	10.28								
3400	35700	11027.	7.82	12301.	8.48	13055.	8.81								
	29000	9572.	8.54	10794.	9.35	11536.	9.76								
	23000	8265.	9.43	9451.	10.37										
3600	35700	11598.	8.26	12948.	8.97	13747.	9.32								
	29000	10063.	9.04	11359.	9.89	12144.	10.33								
	23000	8684.	9.98	9941.	10.97										
3800	35700	12168.	8.71	13595.	9.46										
	29000	10554.	9.53	11923.	10.43										
	23000	9103.	10.52												
4000	35700	12739.	9.16	14243.	9.95										
	29000	11045.	10.02	12488.	10.97										
	23000	9522.	11.07												
4200	35700	13310.	9.61												
	29000	11536.	10.51												
	23000	9940.	11.62												

NOTE: FUEL VALUES LARGER THAN THE MAXIMUM USABLE FUEL ARE PRESENTED FOR INTERPOLATION PURPOSES.

Figure 7-12 (Sheet 6)

FLIGHT PLANNING

LONG RANGE CRUISE

STANDARD DAY **CRUISE ALTITUDE 37000 FEET**

FAN SETTING FOR LONG RANGE CRUISE

	TAILWIND			ZERO	HEADWIND		
CRUISE	100 KT.	50 KT.	25 KT.	WIND	25 KT.	50 KT.	100 KT.
WEIGHT LBS.	N1 PCT	N1 PCT	N1 PCT	N1 PCT	N1 PCT	N1 PCT	N1 PCT
35000	80.7	81.2	81.6	82.0	82.5	83.1	84.3
30000	77.9	78.4	78.7	79.1	79.5	80.2	81.6
25000	74.1	74.7	75.1	75.6	76.1	76.9	78.8
20000	69.2	70.2	70.8	71.5	72.2	73.2	75.8

		TAILWIND						ZERO		HEADWIND					
STAGE	T.O.	100 KT.		50 KT.		25 KT.		WIND		25 KT.		50 KT.		100 KT.	
LENGTH NM.	WEIGHT LBS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.
1000	35700	4128.	2.39	4457.	2.57	4652.	2.67	4875.	2.77	5126.	2.88	5413.	2.97	6114.	3.16
	29000	3625.	2.55	3944.	2.76	4135.	2.88	4354.	2.99	4604.	3.10	4891.	3.21	5600.	3.39
	23000	3187.	2.77	3495.	3.02	3684.	3.14	3901.	3.29	4152.	3.43	4445.	3.56	5181.	3.74
1200	35700	4680.	2.82	5080.	3.05	5316.	3.17	5587.	3.29	5891.	3.42	6239.	3.53	7085.	3.76
	29000	4099.	3.03	4486.	3.28	4717.	3.42	4983.	3.56	5285.	3.70	5632.	3.83	6485.	4.04
	23000	3589.	3.30	3962.	3.60	4192.	3.76	4453.	3.94	4758.	4.11	5111.	4.27	5998.	4.47
1400	35700	5232.	3.26	5703.	3.52	5981.	3.67	6300.	3.81	6657.	3.96	7065.	4.09	8056.	4.37
	29000	4573.	3.50	5028.	3.80	5300.	3.97	5612.	4.13	5966.	4.30	6373.	4.44	7371.	4.69
	23000	3991.	3.82	4429.	4.18	4699.	4.37	5006.	4.58	5363.	4.79	5777.	4.97	6814.	5.21
1600	35700	5783.	3.69	6326.	4.00	6646.	4.16	7012.	4.32	7422.	4.50	7891.	4.66	9026.	4.97
	29000	5047.	3.98	5569.	4.33	5882.	4.52	6241.	4.70	6648.	4.90	7114.	5.06	8257.	5.35
	23000	4394.	4.35	4897.	4.77	5207.	4.98	5558.	5.23	5968.	5.46	6443.	5.67	7631.	5.94
1800	35700	6335.	4.12	6948.	4.47	7310.	4.66	7724.	4.84	8187.	5.04	8717.	5.22	9997.	5.57
	29000	5521.	4.45	6111.	4.85	6464.	5.07	6869.	5.27	7329.	5.49	7855.	5.68	9143.	6.00
	23000	4796.	4.88	5364.	5.35	5714.	5.59	6111.	5.87	6573.	6.14	7109.	6.38	8448.	6.68
2000	35700	6887.	4.56	7571.	4.95	7975.	5.16	8437.	5.36	8953.	5.58	9543.	5.78	10968.	6.17
	29000	5995.	4.93	6653.	5.37	7047.	5.62	7498.	5.85	8010.	6.09	8596.	6.30	10029.	6.66
	23000	5198.	5.41	5831.	5.94	6222.	6.20	6664.	6.52	7178.	6.82	7775.	7.08	9264.	7.42
2200	35700	7438.	4.99	8194.	5.42	8640.	5.66	9149.	5.88	9718.	6.13	10369.	6.34	11939.	6.77
	29000	6469.	5.40	7195.	5.89	7629.	6.16	8127.	6.42	8691.	6.69	9337.	6.92	10915.	7.31
	23000	5600.	5.94	6299.	6.52	6729.	6.82	7216.	7.16	7783.	7.49	8441.	7.78	10081.	8.15
2400	35700	7990.	5.42	8817.	5.90	9304.	6.15	9861.	6.40	10483.	6.67	11195.	6.90	12910.	7.37
	29000	6943.	5.88	7737.	6.42	8212.	6.71	8756.	6.99	9372.	7.28	10078.	7.54	11801.	7.96
	23000	6002.	6.47	6766.	7.11	7236.	7.43	7769.	7.81	8388.	8.17	9107.	8.49		
2600	35700	8541.	5.86	9440.	6.37	9969.	6.65	10573.	6.92	11249.	7.21	12021.	7.46	13881.	7.97
	29000	7417.	6.36	8279.	6.94	8794.	7.26	9384.	7.56	10053.	7.88	10819.	8.16	12687.	8.62
	23000	6405.	7.00	7233.	7.69	7744.	8.04	8321.	8.45	8993.	8.85	9773.	9.19		
2800	35700	9093.	6.29	10062.	6.85	10633.	7.15	11286.	7.44	12014.	7.75	12847.	8.03	14852.	8.57
	29000	7890.	6.83	8821.	7.46	9376.	7.81	10013.	8.13	10734.	8.48	11560.	8.77	13572.	9.27
	23000	6807.	7.53	7701.	8.28	8251.	8.65	8874.	9.10	9598.	9.52				
3000	35700	9645.	6.72	10685.	7.32	11298.	7.65	11998.	7.96	12780.	8.29	13673.	8.59		
	29000	8364.	7.31	9363.	7.98	9959.	8.36	10642.	8.71	11415.	9.08	12301.	9.39		
	23000	7209.	8.06	8168.	8.86	8759.	9.27	9426.	9.74						
3200	35700	10196.	7.16	11308.	7.80	11963.	8.14	12710.	8.47	13545.	8.84				
	29000	8838.	7.78	9904.	8.50	10541.	8.91	11270.	9.28	12096.	9.67				
	23000	7611.	8.59	8635.	9.45	9266.	9.88								
3400	35700	10748.	7.59	11931.	8.27	12627.	8.64	13422.	8.99						
	29000	9312.	8.26	10446.	9.03	11124.	9.45	11899.	9.85						
	23000	8013.	9.12	9102.	10.03										
3600	35700	11300.	8.02	12554.	8.75	13292.	9.14								
	29000	9786.	8.73	10988.	9.55	11706.	10.00								
	23000	8416.	9.65	9570.	10.61										
3800	35700	11851.	8.46	13176.	9.23										
	29000	10260.	9.21	11530.	10.07										
	23000	8818.	10.18	10037.	11.20										
4000	35700	12403.	8.89	13799.	9.70										
	29000	10734.	9.69	12072.	10.59										
	23000	9220.	10.70												
4200	35700	12954.	9.32	14422.	10.18										
	29000	11208.	10.16	12614.	11.12										
	23000	9622.	11.23												
4400	35700	13506.	9.76												
	29000	11682.	10.64												
	23000	10025.	11.76												

NOTE: FUEL VALUES LARGER THAN THE MAXIMUM USABLE FUEL ARE PRESENTED FOR INTERPOLATION PURPOSES.

Figure 7-12 (Sheet 7)

FLIGHT PLANNING
LONG RANGE CRUISE

STANDARD DAY **CRUISE ALTITUDE 39000 FEET**

FAN SETTING FOR LONG RANGE CRUISE

	TAILWIND			ZERO	HEADWIND		
CRUISE	100 KT.	50 KT.	25 KT.	WIND	25 KT.	50 KT.	100 KT.
WEIGHT LBS.	N1 PCT	N1 PCT	N1 PCT	N1 PCT	N1 PCT	N1 PCT	N1 PCT
35000	83.1	83.5	83.8	84.1	84.5	84.9	85.6
30000	79.9	80.3	80.6	81.0	81.4	81.9	83.1
25000	75.9	76.5	76.9	77.4	77.9	78.6	80.2
20000	71.2	72.0	72.6	73.2	73.9	74.9	77.0

		TAILWIND						ZERO		HEADWIND					
STAGE	T.O.	100 KT.		50 KT.		25 KT.		WIND		25 KT.		50 KT.		100 KT.	
LENGTH NM.	WEIGHT LBS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.
1000	35700	4103.	2.33	4411.	2.50	4593.	2.58	4798.	2.68	5029.	2.77	5292.	2.86	5932.	3.04
	29000	3586.	2.48	3882.	2.67	4059.	2.77	4261.	2.88	4489.	2.98	4752.	3.08	5393.	3.33
	23000	3143.	2.69	3427.	2.93	3601.	3.05	3802.	3.19	4034.	3.31	4301.	3.42	4967.	3.60
1200	35700	4640.	2.75	5015.	2.95	5236.	3.06	5486.	3.17	5766.	3.29	6084.	3.40	6855.	3.61
	29000	4045.	2.94	4404.	3.17	4619.	3.30	4863.	3.43	5139.	3.55	5456.	3.66	6227.	3.97
	23000	3530.	3.20	3874.	3.50	4085.	3.65	4328.	3.81	4608.	3.96	4931.	4.09	5732.	4.31
1400	35700	5178.	3.17	5620.	3.41	5880.	3.53	6173.	3.67	6502.	3.80	6876.	3.93	7779.	4.18
	29000	4503.	3.40	4925.	3.67	5178.	3.82	5465.	3.97	5788.	4.12	6160.	4.25	7061.	4.61
	23000	3917.	3.71	4321.	4.07	4568.	4.24	4853.	4.44	5182.	4.62	5560.	4.77	6497.	5.02
1600	35700	5715.	3.59	6224.	3.86	6524.	4.01	6861.	4.16	7239.	4.32	7668.	4.47	8702.	4.75
	29000	4962.	3.86	5447.	4.17	5738.	4.34	6067.	4.52	6438.	4.69	6864.	4.84	7896.	5.26
	23000	4304.	4.22	4768.	4.63	5052.	4.83	5379.	5.06	5756.	5.27	6190.	5.44	7262.	5.72
1800	35700	6253.	4.01	6829.	4.32	7167.	4.49	7548.	4.66	7975.	4.84	8460.	5.00	9626.	5.32
	29000	5421.	4.32	5969.	4.68	6297.	4.87	6669.	5.07	7088.	5.26	7568.	5.43	8730.	5.90
	23000	4691.	4.74	5215.	5.20	5536.	5.43	5905.	5.68	6330.	5.92	6819.	6.11	8027.	6.43
2000	35700	6790.	4.43	7433.	4.78	7811.	4.96	8236.	5.16	8712.	5.35	9251.	5.54	10549.	5.89
	29000	5879.	4.78	6491.	5.18	6857.	5.39	7271.	5.62	7737.	5.83	8272.	6.02	9565.	6.55
	23000	5078.	5.25	5662.	5.77	6019.	6.02	6431.	6.31	6904.	6.57	7449.	6.79	8792.	7.14
2200	35700	7328.	4.84	8038.	5.23	8454.	5.44	8923.	5.65	9448.	5.87	10043.	6.07	11473.	6.46
	29000	6338.	5.23	7012.	5.68	7416.	5.92	7873.	6.16	8387.	6.40	8977.	6.61	10399.	7.19
	23000	5465.	5.76	6109.	6.33	6503.	6.62	6956.	6.93	7478.	7.22	8078.	7.46	9557.	7.85
2400	35700	7866.	5.26	8642.	5.69	9098.	5.91	9611.	6.15	10185.	6.38	10835.	6.61	12396.	7.03
	29000	6796.	5.69	7534.	6.18	7976.	6.44	8475.	6.71	9036.	6.97	9681.	7.20	11234.	7.83
	23000	5852.	6.27	6556.	6.90	6987.	7.21	7482.	7.55	8052.	7.87	8708.	8.13	10322.	8.55
2600	35700	8403.	5.68	9247.	6.15	9742.	6.39	10298.	6.64	10921.	6.90	11627.	7.14	13320.	7.60
	29000	7255.	6.15	8056.	6.68	8535.	6.97	9076.	7.26	9686.	7.54	10385.	7.79	12068.	8.48
	23000	6238.	6.78	7003.	7.47	7471.	7.80	8008.	8.18	8626.	8.52	9337.	8.81		
2800	35700	8941.	6.10	9851.	6.60	10385.	6.86	10986.	7.14	11658.	7.42	12419.	7.68	14243.	8.17
	29000	7713.	6.61	8578.	7.18	9095.	7.49	9678.	7.81	10335.	8.11	11089.	8.37	12903.	9.12
	23000	6625.	7.30	7450.	8.04	7954.	8.40	8533.	8.80	9200.	9.17				
3000	35700	9478.	6.52	10456.	7.06	11029.	7.34	11673.	7.64	12394.	7.93	13211.	8.22		
	29000	8172.	7.07	9099.	7.68	9654.	8.01	10280.	8.35	10985.	8.68	11793.	8.96		
	23000	7012.	7.81	7897.	8.60	8438.	8.99	9059.	9.43						
3200	35700	10016.	6.94	11060.	7.52	11673.	7.81	12361.	8.13	13131.	8.45				
	29000	8631.	7.53	9621.	8.19	10214.	8.54	10882.	8.90	11634.	9.25				
	23000	7399.	8.32	8344.	9.17	8922.	9.58	9585.	10.05						
3400	35700	10553.	7.36	11664.	7.97	12316.	8.29	13048.	8.63						
	29000	9089.	7.99	10143.	8.69	10773.	9.06	11484.	9.45						
	23000	7786.	8.83	8792.	9.74	9406.	10.18								
3600	35700	11091.	7.78	12269.	8.43	12960.	8.77	13736.	9.12						
	29000	9548.	8.45	10665.	9.19	11333.	9.59	12086.	10.00						
	23000	8173.	9.34	9239.	10.30										
3800	35700	11628.	8.20	12873.	8.88	13604.	9.24								
	29000	10006.	8.91	11187.	9.69	11892.	10.11								
	23000	8560.	9.86	9686.	10.87										
4000	35700	12166.	8.62	13478.	9.34										
	29000	10465.	9.37	11708.	10.19										
	23000	8947.	10.37	10133.	11.44										
4200	35700	12703.	9.04	14082.	9.80										
	29000	10924.	9.83	12230.	10.69										
	23000	9334.	10.88												
4400	35700	13241.	9.45												
	29000	11382.	10.29												
	23000	9721.	11.39												

NOTE: FUEL VALUES LARGER THAN THE MAXIMUM USABLE FUEL ARE PRESENTED FOR INTERPOLATION PURPOSES.

Figure 7-12 (Sheet 8)

FLIGHT PLANNING

LONG RANGE CRUISE

STANDARD DAY **CRUISE ALTITUDE 41000 FEET**

FAN SETTING FOR LONG RANGE CRUISE

CRUISE WEIGHT LBS.	TAILWIND 100 KT. N1 PCT	TAILWIND 50 KT. N1 PCT	TAILWIND 25 KT. N1 PCT	ZERO WIND N1 PCT	HEADWIND 25 KT. N1 PCT	HEADWIND 50 KT. N1 PCT	HEADWIND 100 KT. N1 PCT
35000	85.2	85.6	85.8	86.1	86.3	86.5	86.8
30000	81.8	82.3	82.6	82.9	83.3	83.7	84.5
25000	77.8	78.4	78.9	79.3	79.7	80.3	81.7
20000	73.2	73.9	74.4	75.0	75.7	76.4	78.4

		TAILWIND						ZERO		HEADWIND					
STAGE	T.O.	100 KT.		50 KT.		25 KT.		WIND		25 KT.		50 KT.		100 KT.	
LENGTH NM.	WEIGHT LBS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.
1200	35700	4617.	2.67	4965.	2.85	5171.	2.94	5400.	3.05	5657.	3.16	5944.	3.28	6648.	3.54
	29000	3997.	2.85	4331.	3.06	4529.	3.18	4754.	3.31	5007.	3.45	5294.	3.59	6010.	3.82
	23000	3479.	3.10	3799.	3.38	3994.	3.52	4217.	3.66	4473.	3.81	4765.	3.94	5493.	4.14
1400	35700	5142.	3.07	5552.	3.28	5795.	3.39	6065.	3.52	6367.	3.65	6703.	3.79	7526.	4.10
	29000	4442.	3.29	4833.	3.54	5067.	3.68	5330.	3.84	5627.	4.00	5964.	4.17	6801.	4.43
	23000	3853.	3.60	4228.	3.93	4457.	4.09	4719.	4.26	5019.	4.43	5361.	4.59	6211.	4.82
1600	35700	5666.	3.48	6139.	3.72	6419.	3.85	6729.	3.99	7076.	4.14	7462.	4.30	8405.	4.66
	29000	4886.	3.73	5336.	4.03	5604.	4.18	5907.	4.36	6247.	4.55	6633.	4.74	7592.	5.05
	23000	4226.	4.09	4657.	4.48	4920.	4.67	5220.	4.86	5565.	5.05	5957.	5.23	6930.	5.50
1800	35700	6191.	3.88	6727.	4.15	7042.	4.30	7393.	4.46	7785.	4.63	8221.	4.81	9284.	5.22
	29000	5330.	4.18	5839.	4.51	6142.	4.69	6483.	4.89	6867.	5.10	7303.	5.32	8382.	5.67
	23000	4599.	4.59	5087.	5.03	5383.	5.24	5722.	5.46	6111.	5.67	6552.	5.88	7648.	6.17
2000	35700	6716.	4.28	7314.	4.59	7666.	4.75	8057.	4.93	8494.	5.12	8980.	5.32	10162.	5.78
	29000	5774.	4.62	6342.	4.99	6679.	5.19	7060.	5.42	7488.	5.65	7972.	5.90	9173.	6.28
	23000	4972.	5.08	5516.	5.57	5846.	5.81	6223.	6.05	6657.	6.29	7148.	6.53	8366.	6.85
2200	35700	7241.	4.68	7901.	5.02	8290.	5.20	8721.	5.40	9203.	5.61	9739.	5.83	11041.	6.34
	29000	6218.	5.06	6845.	5.47	7217.	5.69	7636.	5.94	8108.	6.20	8642.	6.48	9964.	6.90
	23000	5346.	5.58	5945.	6.12	6309.	6.38	6725.	6.65	7202.	6.92	7744.	7.17	9084.	7.53
2400	35700	7765.	5.09	8488.	5.46	8914.	5.66	9385.	5.87	9912.	6.10	10497.	6.34	11920.	6.89
	29000	6662.	5.50	7347.	5.95	7754.	6.19	8212.	6.47	8728.	6.76	9311.	7.05	10754.	7.51
	23000	5719.	6.07	6374.	6.67	6772.	6.95	7226.	7.25	7748.	7.54	8339.	7.82	9802.	8.21
2600	35700	8290.	5.49	9075.	5.89	9538.	6.11	10050.	6.34	10621.	6.59	11256.	6.86	12798.	7.45
	29000	7106.	5.95	7850.	6.43	8292.	6.70	8789.	7.00	9348.	7.31	9981.	7.63	11545.	8.13
	23000	6092.	6.57	6803.	7.21	7235.	7.53	7728.	7.85	8294.	8.16	8935.	8.46	10521.	8.88
2800	35700	8815.	5.89	9662.	6.33	10161.	6.56	10714.	6.81	11330.	7.08	12015.	7.37	13677.	8.01
	29000	7550.	6.39	8353.	6.91	8830.	7.20	9365.	7.52	9969.	7.86	10650.	8.21	12336.	8.74
	23000	6465.	7.06	7232.	7.76	7698.	8.10	8230.	8.44	8840.	8.78	9531.	9.11		
3000	35700	9340.	6.29	10249.	6.76	10785.	7.01	11378.	7.28	12040.	7.57	12774.	7.88	14556.	8.57
	29000	7994.	6.83	8856.	7.40	9367.	7.70	9942.	8.05	10589.	8.41	11320.	8.79	13126.	9.36
	23000	6839.	7.55	7661.	8.31	8162.	8.67	8731.	9.04	9385.	9.40				
3200	35700	9864.	6.70	10836.	7.20	11409.	7.46	12042.	7.75	12749.	8.06	13533.	8.39		
	29000	8438.	7.27	9358.	7.88	9905.	8.20	10518.	8.58	11209.	8.96	11989.	9.36		
	23000	7212.	8.05	8090.	8.86	8625.	9.24	9233.	9.64						
3400	35700	10389.	7.10	11423.	7.63	12033.	7.92	12706.	8.22	13458.	8.55				
	29000	8882.	7.72	9861.	8.36	10442.	8.70	11095.	9.10	11829.	9.51				
	23000	7585.	8.54	8520.	9.40	9088.	9.81								
3600	35700	10914.	7.50	12011.	8.07	12657.	8.37	13370.	8.69						
	29000	9326.	8.16	10364.	8.84	10980.	9.21	11671.	9.63						
	23000	7958.	9.04	8949.	9.95	9551.	10.39								
3800	35700	11439.	7.91	12598.	8.50	13281.	8.82								
	29000	9771.	8.60	10867.	9.32	11517.	9.71								
	23000	8332.	9.53	9378.	10.50										
4000	35700	11963.	8.31	13185.	8.94										
	29000	10215.	9.04	11370.	9.80										
	23000	8705.	10.03	9807.	11.05										
4200	35700	12488.	8.71	13772.	9.37										
	29000	10659.	9.49	11872.	10.28										
	23000	9078.	10.52												
4400	35700	13013.	9.11	14359.	9.81										
	29000	11103.	9.93	12375.	10.77										
	23000	9451.	11.02												
4600	35700	13537.	9.52												
	29000	11547.	10.37												
	23000	9824.	11.51												

NOTE: FUEL VALUES LARGER THAN THE MAXIMUM USABLE FUEL ARE PRESENTED FOR INTERPOLATION PURPOSES.

Figure 7-12 (Sheet 9)

FLIGHT PLANNING
LONG RANGE CRUISE

STANDARD DAY **CRUISE ALTITUDE 43000 FEET**

FAN SETTING FOR LONG RANGE CRUISE

	TAILWIND			ZERO	HEADWIND		
CRUISE	100 KT.	50 KT.	25 KT.	WIND	25 KT.	50 KT.	100 KT.
WEIGHT LBS.	N1 PCT	N1 PCT	N1 PCT	N1 PCT	N1 PCT	N1 PCT	N1 PCT
35000	87.4	87.5	87.7	87.7	87.8	87.9	87.9
30000	84.0	84.3	84.6	84.8	85.0	85.3	85.8
25000	79.9	80.4	80.8	81.1	81.5	82.0	83.1
20000	75.2	75.8	76.3	76.8	77.3	78.0	79.8

		TAILWIND						ZERO		HEADWIND					
STAGE	T.O.	100 KT.		50 KT.		25 KT.		WIND		25 KT.		50 KT.		100 KT.	
LENGTH NM.	WEIGHT LBS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.
1200	35700	4620.	2.61	4941.	2.79	5131.	2.88	5342.	2.98	5578.	3.09	5847.	3.21	6494.	3.53
	29000	3963.	2.78	4274.	2.99	4458.	3.10	4667.	3.21	4903.	3.34	5170.	3.46	5825.	3.68
	23000	3441.	3.01	3739.	3.26	3918.	3.40	4122.	3.54	4357.	3.67	4624.	3.79	5284.	4.00
1400	35700	5130.	3.00	5510.	3.21	5734.	3.32	5983.	3.44	6261.	3.57	6576.	3.71	7334.	4.09
	29000	4393.	3.21	4760.	3.46	4977.	3.59	5221.	3.72	5498.	3.87	5811.	4.01	6576.	4.27
	23000	3802.	3.49	4152.	3.79	4362.	3.94	4601.	4.11	4876.	4.27	5189.	4.40	5960.	4.65
1600	35700	5641.	3.39	6079.	3.63	6338.	3.76	6624.	3.89	6944.	4.04	7306.	4.20	8175.	4.65
	29000	4824.	3.64	5246.	3.92	5495.	4.07	5776.	4.23	6093.	4.40	6452.	4.57	7327.	4.86
	23000	4163.	3.96	4565.	4.31	4807.	4.49	5081.	4.68	5396.	4.86	5755.	5.02	6635.	5.30
1800	35700	6152.	3.78	6648.	4.06	6941.	4.20	7265.	4.35	7626.	4.52	8036.	4.70	9015.	5.21
	29000	5255.	4.07	5732.	4.39	6013.	4.56	6330.	4.74	6688.	4.93	7092.	5.12	8078.	5.45
	23000	4524.	4.44	4978.	4.83	5251.	5.04	5560.	5.26	5915.	5.46	6320.	5.64	7310.	5.95
2000	35700	6663.	4.17	7217.	4.48	7545.	4.64	7906.	4.81	8309.	5.00	8765.	5.20	9856.	5.76
	29000	5686.	4.50	6217.	4.86	6531.	5.05	6884.	5.25	7283.	5.46	7733.	5.67	8829.	6.04
	23000	4885.	4.92	5391.	5.36	5695.	5.59	6039.	5.83	6434.	6.06	6885.	6.26	7986.	6.60
2200	35700	7174.	4.56	7786.	4.90	8148.	5.07	8547.	5.26	8991.	5.47	9495.	5.70	10696.	6.32
	29000	6116.	4.93	6703.	5.33	7049.	5.54	7438.	5.75	7878.	5.99	8374.	6.22	9580.	6.63
	23000	5246.	5.39	5804.	5.88	6139.	6.13	6518.	6.40	6954.	6.65	7450.	6.87	8661.	7.25
2400	35700	7685.	4.95	8355.	5.32	8752.	5.51	9188.	5.72	9674.	5.95	10225.	6.19	11537.	6.88
	29000	6547.	5.36	7189.	5.79	7567.	6.02	7993.	6.26	8473.	6.53	9015.	6.78	10332.	7.22
	23000	5607.	5.87	6217.	6.40	6584.	6.68	6998.	6.98	7473.	7.25	8015.	7.49	9336.	7.90
2600	35700	8196.	5.34	8924.	5.74	9355.	5.95	9829.	6.18	10357.	6.42	10954.	6.69	12377.	7.44
	29000	6978.	5.79	7674.	6.26	8085.	6.51	8547.	6.77	9068.	7.06	9656.	7.33	11083.	7.80
	23000	5968.	6.35	6630.	6.93	7028.	7.23	7477.	7.55	7993.	7.85	8580.	8.11	10012.	8.56
2800	35700	8706.	5.73	9493.	6.17	9959.	6.39	10470.	6.63	11039.	6.90	11684.	7.19	13218.	8.00
	29000	7408.	6.22	8160.	6.73	8603.	7.00	9101.	7.28	9663.	7.59	10297.	7.88	11834.	8.39
	23000	6329.	6.82	7043.	7.45	7472.	7.78	7956.	8.12	8512.	8.45	9145.	8.72		
3000	35700	9217.	6.12	10062.	6.59	10562.	6.83	11111.	7.09	11722.	7.38	12414.	7.69	14058.	8.55
	29000	7839.	6.65	8646.	7.20	9121.	7.49	9655.	7.78	10258.	8.12	10937.	8.43	12585.	8.98
	23000	6690.	7.30	7456.	7.97	7916.	8.32	8435.	8.70	9032.	9.04				
3200	35700	9728.	6.51	10631.	7.01	11165.	7.27	11752.	7.55	12404.	7.85	13143.	8.18		
	29000	8270.	7.07	9132.	7.66	9639.	7.97	10210.	8.29	10853.	8.65	11578.	8.99		
	23000	7051.	7.78	7869.	8.50	8360.	8.87	8915.	9.27	9551.	9.64				
3400	35700	10239.	6.90	11201.	7.43	11769.	7.71	12393.	8.00	13087.	8.33				
	29000	8700.	7.50	9617.	8.13	10157.	8.46	10764.	8.80	11448.	9.18				
	23000	7412.	8.25	8283.	9.02	8805.	9.42	9394.	9.84						
3600	35700	10750.	7.29	11770.	7.86	12372.	8.15	13034.	8.46						
	29000	9131.	7.93	10103.	8.60	10675.	8.95	11318.	9.31						
	23000	7773.	8.73	8696.	9.54	9249.	9.97								
3800	35700	11261.	7.68	12339.	8.28	12976.	8.58	13675.	8.92						
	29000	9562.	8.36	10589.	9.07	11193.	9.43	11872.	9.82						
	23000	8134.	9.21	9109.	10.07										
4000	35700	11772.	8.07	12908.	8.70	13579.	9.02								
	29000	9992.	8.79	11075.	9.53	11711.	9.92								
	23000	8495.	9.68	9522.	10.59										
4200	35700	12282.	8.46	13477.	9.12										
	29000	10423.	9.22	11560.	10.00										
	23000	8856.	10.16	9935.	11.11										
4400	35700	12793.	8.85	14046.	9.55										
	29000	10854.	9.65	12046.	10.47										
	23000	9217.	10.64												
4600	35700	13304.	9.24												
	29000	11284.	10.08												
	23000	9578.	11.12												

NOTE: FUEL VALUES LARGER THAN THE MAXIMUM USABLE FUEL ARE PRESENTED FOR INTERPOLATION PURPOSES.

Figure 7-12 (Sheet 10)

FLIGHT PLANNING
LONG RANGE CRUISE

STANDARD DAY **CRUISE ALTITUDE 45000 FEET**

FAN SETTING FOR LONG RANGE CRUISE

	TAILWIND			ZERO	HEADWIND		
CRUISE	100 KT.	50 KT.	25 KT.	WIND	25 KT.	50 KT.	100 KT.
WEIGHT LBS.	N1 PCT	N1 PCT	N1 PCT	N1 PCT	N1 PCT	N1 PCT	N1 PCT
35000	89.4	89.4	89.4	89.4	89.2	89.1	88.7
30000	86.0	86.3	86.4	86.6	86.7	86.8	87.2
25000	81.9	82.3	82.6	83.0	83.3	83.7	84.7
20000	77.0	77.7	78.1	78.5	79.1	79.8	81.4

		TAILWIND						ZERO		HEADWIND					
STAGE	T.O.	100 KT.		50 KT.		25 KT.		WIND		25 KT.		50 KT.		100 KT.	
LENGTH NM.	WEIGHT LBS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.
1200	35700	4857.	2.54	5146.	2.72	5314.	2.82	5503.	2.93	5717.	3.05	5955.	3.19	6540.	3.52
	29000	3947.	2.71	4239.	2.90	4410.	3.00	4603.	3.11	4821.	3.21	5066.	3.31	5661.	3.53
	23000	3406.	2.93	3685.	3.15	3849.	3.28	4039.	3.40	4254.	3.52	4498.	3.64	5097.	3.90
1400	35700	5346.	2.92	5690.	3.13	5889.	3.25	6114.	3.38	6366.	3.52	6647.	3.69	7335.	4.08
	29000	4367.	3.12	4710.	3.35	4911.	3.47	5139.	3.59	5394.	3.71	5681.	3.84	6376.	4.09
	23000	3755.	3.39	4082.	3.65	4276.	3.81	4498.	3.95	4749.	4.09	5035.	4.23	5733.	4.54
1600	35700	5835.	3.30	6233.	3.54	6465.	3.67	6724.	3.82	7015.	3.99	7339.	4.18	8129.	4.64
	29000	4787.	3.54	5182.	3.80	5413.	3.93	5674.	4.08	5967.	4.22	6296.	4.36	7091.	4.65
	23000	4104.	3.85	4480.	4.16	4702.	4.33	4956.	4.50	5245.	4.66	5572.	4.82	6370.	5.17
1800	35700	6324.	3.68	6777.	3.95	7041.	4.10	7335.	4.27	7664.	4.46	8032.	4.68	8924.	5.20
	29000	5206.	3.95	5653.	4.25	5915.	4.40	6210.	4.57	6540.	4.72	6911.	4.88	7806.	5.21
	23000	4453.	4.31	4878.	4.66	5128.	4.86	5415.	5.05	5740.	5.22	6109.	5.41	7006.	5.81
2000	35700	6813.	4.06	7321.	4.36	7616.	4.53	7945.	4.72	8314.	4.93	8724.	5.17	9718.	5.76
	29000	5626.	4.37	6125.	4.69	6417.	4.87	6745.	5.05	7113.	5.22	7527.	5.40	8521.	5.77
	23000	4802.	4.77	5276.	5.16	5555.	5.39	5874.	5.59	6236.	5.79	6646.	6.00	7643.	6.45
2200	35700	7302.	4.44	7865.	4.77	8192.	4.96	8556.	5.16	8963.	5.40	9416.	5.67	10513.	6.32
	29000	6046.	4.78	6597.	5.14	6919.	5.34	7281.	5.54	7687.	5.73	8142.	5.93	9235.	6.33
	23000	5151.	5.24	5674.	5.66	5981.	5.91	6333.	6.14	6732.	6.36	7183.	6.59	8279.	7.08
2400	35700	7791.	4.83	8408.	5.18	8767.	5.38	9166.	5.61	9612.	5.87	10109.	6.17	11308.	6.88
	29000	6466.	5.20	7068.	5.59	7420.	5.81	7816.	6.03	8260.	6.23	8757.	6.45	9950.	6.89
	23000	5500.	5.70	6071.	6.16	6408.	6.44	6792.	6.69	7227.	6.93	7720.	7.18	8916.	7.72
2600	35700	8280.	5.21	8952.	5.60	9343.	5.81	9777.	6.06	10261.	6.34	10801.	6.66	12102.	7.44
	29000	6886.	5.61	7540.	6.04	7922.	6.27	8352.	6.51	8833.	6.74	9372.	6.97	10665.	7.44
	23000	5849.	6.16	6469.	6.67	6834.	6.96	7251.	7.24	7723.	7.50	8258.	7.77	9552.	8.35
2800	35700	8769.	5.59	9496.	6.01	9919.	6.24	10387.	6.50	10911.	6.81	11493.	7.16	12897.	8.00
	29000	7306.	6.02	8012.	6.49	8424.	6.74	8887.	7.00	9406.	7.24	9987.	7.49	11380.	8.00
	23000	6199.	6.62	6867.	7.17	7260.	7.49	7710.	7.79	8218.	8.07	8795.	8.36	10188.	8.99
3000	35700	9258.	5.97	10040.	6.42	10494.	6.66	10998.	6.95	11560.	7.28	12185.	7.65	13691.	8.56
	29000	7726.	6.44	8483.	6.94	8926.	7.21	9423.	7.49	9979.	7.75	10602.	8.02	12094.	8.56
	23000	6548.	7.08	7265.	7.67	7687.	8.02	8168.	8.33	8714.	8.63	9332.	8.95		
3200	35700	9747.	6.35	10583.	6.83	11070.	7.09	11608.	7.40	12209.	7.75	12878.	8.15	14486.	9.12
	29000	8146.	6.85	8955.	7.39	9428.	7.68	9958.	7.97	10552.	8.25	11217.	8.54	12809.	9.12
	23000	6897.	7.54	7663.	8.17	8113.	8.54	8627.	8.88	9210.	9.20				
3400	35700	10236.	6.73	11127.	7.24	11645.	7.52	12219.	7.85	12858.	8.22	13570.	8.64		
	29000	8566.	7.27	9427.	7.84	9929.	8.14	10494.	8.46	11125.	8.75	11832.	9.06		
	23000	7246.	8.01	8061.	8.67	8539.	9.07	9086.	9.43						
3600	35700	10725.	7.11	11671.	7.65	12221.	7.95	12829.	8.29	13507.	8.69				
	29000	8985.	7.68	9898.	8.29	10431.	8.61	11029.	8.95	11698.	9.26				
	23000	7595.	8.47	8458.	9.18	8966.	9.60	9545.	9.98						
3800	35700	11214.	7.49	12215.	8.06	12797.	8.37	13440.	8.74						
	29000	9405.	8.10	10370.	8.74	10933.	9.08	11565.	9.43						
	23000	7944.	8.93	8856.	9.68	9392.	10.12								
4000	35700	11703.	7.87	12758.	8.47	13372.	8.80								
	29000	9825.	8.51	10842.	9.19	11435.	9.55								
	23000	8293.	9.39	9254.	10.18										
4200	35700	12192.	8.25	13302.	8.88										
	29000	10245.	8.93	11313.	9.63										
	23000	8642.	9.85	9652.	10.68										
4400	35700	12681.	8.63	13846.	9.29										
	29000	10665.	9.34	11785.	10.08										
	23000	8991.	10.31	10050.	11.19										
4600	35700	13170.	9.01												
	29000	11085.	9.75												
	23000	9340.	10.77												

NOTE: FUEL VALUES LARGER THAN THE MAXIMUM USABLE FUEL ARE PRESENTED
FOR INTERPOLATION PURPOSES.

Figure 7-12 (Sheet 11)

FLIGHT PLANNING
LONG RANGE CRUISE

STANDARD DAY **CRUISE ALTITUDE 47000 FEET**

FAN SETTING FOR LONG RANGE CRUISE

CRUISE WEIGHT LBS.	TAILWIND 100 KT. N1 PCT	TAILWIND 50 KT. N1 PCT	TAILWIND 25 KT. N1 PCT	ZERO WIND N1 PCT	HEADWIND 25 KT. N1 PCT	HEADWIND 50 KT. N1 PCT	HEADWIND 100 KT. N1 PCT
30000	88.1	88.1	88.1	88.1	88.1	88.1	88.1
28000	86.6	86.8	86.9	87.0	87.0	87.1	87.4
26000	84.9	85.3	85.5	85.7	85.8	86.1	86.5
24000	83.1	83.6	83.9	84.2	84.4	84.8	85.4
22000	81.2	81.7	82.1	82.5	82.9	83.3	84.1
20000	79.1	79.8	80.2	80.6	81.1	81.6	82.6

STAGE LENGTH NM.	T.O. WEIGHT LBS.	TAILWIND 100 KT. FUEL LBS.	TAILWIND 100 KT. TIME HRS.	TAILWIND 50 KT. FUEL LBS.	TAILWIND 50 KT. TIME HRS.	TAILWIND 25 KT. FUEL LBS.	TAILWIND 25 KT. TIME HRS.	ZERO WIND FUEL LBS.	ZERO WIND TIME HRS.	HEADWIND 25 KT. FUEL LBS.	HEADWIND 25 KT. TIME HRS.	HEADWIND 50 KT. FUEL LBS.	HEADWIND 50 KT. TIME HRS.	HEADWIND 100 KT. FUEL LBS.	HEADWIND 100 KT. TIME HRS.
1400	35700	5754.	2.88	6059.	3.11	6238.	3.23	6440.	3.37	6665.	3.52	6920.	3.68	7545.	4.07
	29000	4372.	3.02	4686.	3.23	4873.	3.34	5079.	3.47	5311.	3.60	5574.	3.73	6211.	4.08
	23000	3723.	3.28	4025.	3.53	4205.	3.66	4409.	3.80	4638.	3.95	4898.	4.12	5541.	4.42
1600	35700	6213.	3.25	6570.	3.51	6777.	3.66	7012.	3.81	7272.	3.98	7567.	4.17	8288.	4.63
	29000	4782.	3.41	5144.	3.66	5359.	3.79	5595.	3.93	5862.	4.08	6163.	4.24	6892.	4.63
	23000	4061.	3.72	4408.	4.01	4614.	4.16	4849.	4.32	5111.	4.50	5409.	4.69	6143.	5.03
1800	35700	6673.	3.63	7080.	3.92	7317.	4.08	7583.	4.25	7879.	4.45	8214.	4.67	9031.	5.19
	29000	5192.	3.81	5601.	4.09	5845.	4.23	6112.	4.39	6412.	4.57	6753.	4.74	7573.	5.19
	23000	4400.	4.16	4792.	4.49	5024.	4.66	5289.	4.84	5584.	5.04	5920.	5.27	6745.	5.65
2000	35700	7133.	4.00	7590.	4.32	7856.	4.50	8155.	4.70	8486.	4.92	8861.	5.16	9774.	5.75
	29000	5602.	4.21	6059.	4.51	6331.	4.68	6629.	4.86	6963.	5.05	7342.	5.24	8254.	5.75
	23000	4738.	4.61	5175.	4.98	5434.	5.17	5729.	5.37	6057.	5.59	6430.	5.84	7347.	6.27
2200	35700	7592.	4.38	8100.	4.73	8395.	4.93	8726.	5.14	9094.	5.39	9508.	5.66	10517.	6.31
	29000	6013.	4.60	6517.	4.94	6817.	5.12	7145.	5.32	7514.	5.54	7932.	5.75	8935.	6.31
	23000	5077.	5.05	5559.	5.46	5844.	5.67	6169.	5.89	6531.	6.14	6941.	6.41	7949.	6.88
2400	35700	8052.	4.75	8611.	5.13	8935.	5.35	9298.	5.59	9701.	5.86	10156.	6.15	11260.	6.87
	29000	6423.	5.00	6975.	5.37	7303.	5.57	7662.	5.79	8065.	6.03	8522.	6.25	9616.	6.87
	23000	5415.	5.50	5942.	5.94	6254.	6.17	6609.	6.41	7004.	6.68	7452.	6.99	8551.	7.50
2600	35700	8512.	5.12	9121.	5.53	9474.	5.77	9869.	6.03	10308.	6.33	10803.	6.65	12003.	7.43
	29000	6833.	5.39	7433.	5.80	7789.	6.01	8178.	6.25	8616.	6.51	9111.	6.76	10297.	7.42
	23000	5754.	5.94	6326.	6.43	6664.	6.67	7049.	6.94	7477.	7.23	7962.	7.56	9153.	8.12
2800	35700	8971.	5.50	9631.	5.94	10013.	6.20	10441.	6.48	10915.	6.79	11450.	7.14	12746.	7.98
	29000	7243.	5.79	7890.	6.23	8276.	6.46	8695.	6.72	9167.	7.00	9701.	7.26	10979.	7.98
	23000	6092.	6.38	6709.	6.91	7074.	7.18	7488.	7.46	7950.	7.78	8473.	8.13	9755.	8.73
3000	35700	9431.	5.87	10142.	6.34	10553.	6.62	11012.	6.92	11522.	7.26	12097.	7.64	13489.	8.54
	29000	7653.	6.18	8348.	6.65	8762.	6.91	9211.	7.18	9718.	7.48	10290.	7.77	11660.	8.54
	23000	6431.	6.83	7092.	7.39	7484.	7.68	7928.	7.98	8423.	8.33	8984.	8.71	10357.	9.35
3200	35700	9891.	6.25	10652.	6.75	11092.	7.04	11584.	7.37	12129.	7.73	12744.	8.13	14233.	9.10
	29000	8064.	6.58	8806.	7.08	9248.	7.35	9728.	7.65	10269.	7.97	10880.	8.27	12341.	9.10
	23000	6769.	7.27	7476.	7.87	7894.	8.18	8368.	8.51	8896.	8.87	9495.	9.28		
3400	35700	10350.	6.62	11162.	7.15	11631.	7.47	12156.	7.81	12736.	8.20	13392.	8.63		
	29000	8474.	6.97	9264.	7.51	9734.	7.80	10245.	8.11	10819.	8.45	11469.	8.78		
	23000	7108.	7.71	7859.	8.36	8304.	8.68	8808.	9.03	9369.	9.42				
3600	35700	10810.	7.00	11672.	7.56	12170.	7.89	12727.	8.26	13343.	8.67				
	29000	8884.	7.37	9721.	7.94	10220.	8.24	10761.	8.58	11370.	8.94				
	23000	7446.	8.16	8243.	8.84	8714.	9.19	9248.	9.56						
3800	35700	11270.	7.37	12183.	7.96	12710.	8.31	13299.	8.70						
	29000	9294.	7.77	10179.	8.37	10706.	8.69	11278.	9.04						
	23000	7785.	8.60	8626.	9.32	9124.	9.69								
4000	35700	11729.	7.75	12693.	8.36	13249.	8.74								
	29000	9704.	8.16	10637.	8.80	11192.	9.13								
	23000	8123.	9.04	9010.	9.80										
4200	35700	12189.	8.12	13203.	8.77										
	29000	10115.	8.56	11095.	9.22										
	23000	8462.	9.49	9393.	10.29										
4400	35700	12649.	8.50	13713.	9.17										
	29000	10525.	8.95	11552.	9.65										
	23000	8800.	9.93	9777.	10.77										
4600	35700	13108.	8.87												
	29000	10935.	9.35												
	23000	9139.	10.37												

NOTE: FUEL VALUES LARGER THAN THE MAXIMUM USABLE FUEL ARE PRESENTED FOR INTERPOLATION PURPOSES.

Figure 7-12 (Sheet 12)

FLIGHT PLANNING
LONG RANGE CRUISE

STANDARD DAY **CRUISE ALTITUDE 49000 FEET**

FAN SETTING FOR LONG RANGE CRUISE

	TAILWIND			ZERO	HEADWIND		
CRUISE	100 KT.	50 KT.	25 KT.	WIND	25 KT.	50 KT.	100 KT.
WEIGHT LBS.	N1 PCT	N1 PCT	N1 PCT	N1 PCT	N1 PCT	N1 PCT	N1 PCT
26000	87.0	87.1	87.2	87.2	87.2	87.3	87.5
24000	85.2	85.5	85.7	85.9	86.1	86.2	86.5
22000	83.3	83.7	84.0	84.2	84.6	84.9	85.3
20000	81.2	81.7	82.0	82.4	82.8	83.2	83.9

		TAILWIND						ZERO		HEADWIND					
STAGE	T.O.	100 KT.		50 KT.		25 KT.		WIND		25 KT.		50 KT.		100 KT.	
LENGTH NM.	WEIGHT LBS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.	FUEL LBS.	TIME HRS.
1400	35700	6202.	2.92	6484.	3.14	6653.	3.24	6841.	3.39	7041.	3.54	7278.	3.70	7847.	4.09
	29000	4651.	2.91	4929.	3.12	5093.	3.25	5276.	3.38	5483.	3.53	5717.	3.68	6289.	4.06
	23000	3697.	3.19	3977.	3.43	4147.	3.56	4333.	3.70	4547.	3.84	4789.	3.98	5382.	4.25
1600	35700	6634.	3.29	6962.	3.54	7158.	3.66	7376.	3.83	7610.	4.00	7882.	4.19	8541.	4.64
	29000	5038.	3.30	5360.	3.55	5550.	3.69	5763.	3.84	6001.	4.00	6271.	4.17	6928.	4.62
	23000	4026.	3.62	4347.	3.90	4542.	4.04	4756.	4.21	5001.	4.37	5277.	4.53	5954.	4.84
1800	35700	7066.	3.66	7441.	3.94	7663.	4.09	7910.	4.27	8178.	4.47	8487.	4.68	9236.	5.19
	29000	5426.	3.69	5792.	3.97	6008.	4.13	6249.	4.30	6519.	4.48	6824.	4.67	7567.	5.18
	23000	4354.	4.04	4717.	4.37	4937.	4.53	5178.	4.72	5454.	4.90	5766.	5.08	6527.	5.43
2000	35700	7497.	4.03	7919.	4.34	8168.	4.51	8445.	4.71	8747.	4.93	9092.	5.17	9930.	5.75
	29000	5813.	4.08	6223.	4.40	6465.	4.57	6735.	4.76	7037.	4.96	7378.	5.17	8205.	5.73
	23000	4682.	4.47	5086.	4.84	5332.	5.02	5600.	5.23	5907.	5.43	6254.	5.64	7099.	6.01
2200	35700	7929.	4.39	8398.	4.74	8673.	4.93	8979.	5.15	9315.	5.40	9697.	5.66	10624.	6.30
	29000	6200.	4.47	6654.	4.82	6922.	5.01	7221.	5.22	7554.	5.44	7932.	5.67	8844.	6.29
	23000	5010.	4.90	5456.	5.31	5727.	5.50	6022.	5.73	6360.	5.97	6742.	6.19	7671.	6.60
2400	35700	8361.	4.76	8877.	5.14	9179.	5.35	9514.	5.59	9883.	5.86	10302.	6.15	11319.	6.85
	29000	6587.	4.86	7086.	5.24	7380.	5.45	7707.	5.68	8072.	5.92	8486.	6.17	9483.	6.85
	23000	5338.	5.33	5826.	5.77	6122.	5.99	6444.	6.24	6814.	6.50	7230.	6.74	8243.	7.19
2600	35700	8793.	5.13	9355.	5.54	9684.	5.77	10049.	6.03	10452.	6.32	10907.	6.64	12013.	7.40
	29000	6974.	5.25	7517.	5.67	7837.	5.90	8194.	6.14	8590.	6.40	9039.	6.66	10122.	7.41
	23000	5666.	5.76	6196.	6.24	6517.	6.48	6866.	6.75	7267.	7.03	7718.	7.29	8816.	7.78
2800	35700	9224.	5.50	9834.	5.94	10189.	6.19	10583.	6.47	11020.	6.79	11512.	7.13	12707.	7.95
	29000	7361.	5.64	7948.	6.09	8294.	6.34	8680.	6.60	9108.	6.88	9593.	7.16	10760.	7.97
	23000	5994.	6.19	6565.	6.71	6912.	6.96	7288.	7.26	7720.	7.56	8207.	7.84	9388.	8.37
3000	35700	9656.	5.87	10312.	6.34	10694.	6.62	11118.	6.91	11589.	7.25	12117.	7.62	13402.	8.51
	29000	7748.	6.03	8380.	6.51	8752.	6.78	9166.	7.06	9626.	7.35	10147.	7.66	11399.	8.52
	23000	6322.	6.61	6935.	7.18	7307.	7.45	7711.	7.77	8174.	8.09	8695.	8.39	9960.	8.96
3200	35700	10088.	6.23	10791.	6.74	11199.	7.04	11652.	7.36	12157.	7.72	12722.	8.11	14096.	9.06
	29000	8135.	6.42	8811.	6.94	9209.	7.22	9652.	7.52	10144.	7.83	10701.	8.16	12038.	9.08
	23000	6650.	7.04	7305.	7.64	7702.	7.94	8133.	8.28	8627.	8.62	9183.	8.94		
3400	35700	10519.	6.60	11270.	7.14	11704.	7.46	12187.	7.80	12725.	8.18	13327.	8.60		
	29000	8522.	6.81	9242.	7.36	9667.	7.66	10138.	7.98	10662.	8.31	11254.	8.66		
	23000	6978.	7.47	7674.	8.11	8097.	8.42	8555.	8.79	9080.	9.15				
3600	35700	10951.	6.97	11748.	7.54	12210.	7.88	12722.	8.24	13294.	8.64				
	29000	8909.	7.20	9674.	7.79	10124.	8.10	10625.	8.44	11180.	8.79				
	23000	7306.	7.90	8044.	8.58	8492.	8.91	8977.	9.29	9533.	9.68				
3800	35700	11383.	7.34	12227.	7.94	12715.	8.30	13256.	8.68						
	29000	9297.	7.59	10105.	8.21	10581.	8.54	11111.	8.90						
	23000	7634.	8.33	8414.	9.05	8887.	9.40	9399.	9.80						
4000	35700	11815.	7.71	12706.	8.34	13220.	8.72								
	29000	9684.	7.98	10536.	8.63	11039.	8.98								
	23000	7963.	8.76	8784.	9.51	9282.	9.88								
4200	35700	12246.	8.07	13184.	8.74										
	29000	10071.	8.37	10968.	9.06										
	23000	8291.	9.18	9153.	9.98										
4400	35700	12678.	8.44	13663.	9.14										
	29000	10458.	8.76	11399.	9.48										
	23000	8619.	9.61	9523.	10.45										
4600	35700	13110.	8.81												
	29000	10845.	9.15												
	23000	8947.	10.04												

NOTE: FUEL VALUES LARGER THAN THE MAXIMUM USABLE FUEL ARE PRESENTED FOR INTERPOLATION PURPOSES.

Figure 7-12 (Sheet 13)

CLIMB

Multiengine climb performance is presented in tabulated form on the following pages.

This performance is based on maximum continuous climb thrust setting on both engines, gear and flaps up, speed brakes retracted and anti-ice systems OFF. The performance is also presented for anti-ice systems ON.

The time, distance, fuel, and rate-of-climb used to any given altitude is based on the climb starting at sea level. If the climb is initiated at some other altitude, it is necessary to go into the data twice, once at the initial altitude and once at the final altitude. The difference in time, distance, and fuel between these two altitudes provides the proper values for the climb. The data allow for fuel burn-off in the climb; therefore, the weight presented is at the start of the climb.

The climb data for the conditions requiring a step climb are based on climbing direct to the highest obtainable altitude as shown in the step climb weight table, cruising at that altitude until the desired weight is achieved, and then climbing to the desired altitude or the next step altitude per the step climb table.

CRUISE CLIMB
300 KIAS/0.80 INDICATED MACH

TIME, DISTANCE, FUEL, AND RATE OF CLIMB — **ANTI-ICE SYSTEMS OFF**

T.O. WEIGHT	35700	34000	32000	30000	28000	26000	35700	34000	32000	30000	28000	26000	35700	34000	32000	30000	28000	26000
PRESSURE ALTITUDE	5000 FEET ISA = 5°C = 41°F						10000 FEET ISA = - 5°C = 23°F						15000 FEET ISA = -15°C = 6°F					
ISA +20°C MIN	3	3	3	2	2	2	8	7	6	6	5	5	15	14	12	11	10	9
NM	12	11	10	9	8	8	37	34	31	28	25	23	85	77	68	61	54	49
LB	169	157	144	131	120	109	432	397	361	328	297	268	838	759	678	606	543	486
R/C	1765	1910	2090	2293	2522	2781	812	894	1001	1118	1247	1393	575	656	759	872	996	1135
ISA +10°C MIN	2	2	2	2	2	2	5	5	5	4	4	4	10	9	8	7	7	6
NM	9	8	8	7	6	6	26	24	22	20	18	16	51	47	43	39	35	32
LB	139	129	119	109	100	92	331	308	282	258	236	215	570	526	480	436	397	360
R/C	2341	2514	2734	2982	3260	3577	1314	1424	1564	1720	1894	2092	1146	1257	1400	1557	1732	1930
ISA MIN	2	2	2	2	2	2	4	4	4	3	3	3	7	7	6	6	5	5
NM	7	6	6	5	5	4	19	18	16	15	14	12	36	33	31	28	25	23
LB	117	110	102	94	86	79	269	252	232	214	196	179	442	411	378	347	317	289
R/C	3005	3211	3478	3777	4114	4497	1869	2007	2186	2384	2608	2862	1741	1884	2067	2271	2499	2758
ISA -10°C MIN	2	2	2	2	2	2	4	4	4	3	3	3	7	6	6	6	5	5
NM	7	6	6	5	5	4	18	17	16	14	13	12	34	32	29	27	24	22
LB	112	105	97	90	83	76	257	240	222	204	187	171	422	393	361	331	303	276
R/C	3063	3274	3546	3850	4194	4584	1914	2056	2239	2443	2673	2933	1773	1919	2106	2315	2548	2812
PRESSURE ALTITUDE	17000 FEET ISA = -19°C = - 2°F						19000 FEET ISA = -23°C = - 9°F						21000 FEET ISA = -27°C = -16°F					
ISA +20°C MIN	19	17	15	13	12	11	22	20	18	16	14	13	26	23	21	18	16	14
NM	109	97	86	76	68	60	134	119	105	93	82	73	161	143	125	110	97	86
LB	1018	916	814	725	646	577	1203	1077	952	845	751	668	1392	1242	1093	967	857	761
R/C	558	637	738	849	972	1109	527	605	705	814	935	1071	505	583	681	790	910	1044
ISA +10°C MIN	11	11	10	9	8	7	13	12	11	10	9	8	15	14	13	11	10	9
NM	63	58	52	47	43	39	75	68	62	56	51	46	87	80	72	65	59	53
LB	666	614	558	507	460	417	762	702	637	578	524	473	858	789	715	648	586	530
R/C	1139	1250	1392	1549	1724	1922	1117	1227	1369	1526	1701	1898	1117	1228	1371	1530	1706	1905
ISA MIN	8	8	7	7	6	6	9	9	8	7	7	6	10	10	9	8	8	7
NM	43	40	37	33	31	28	50	47	43	39	36	32	58	54	49	45	41	37
LB	509	474	435	399	364	332	575	535	491	449	411	374	642	597	547	500	457	416
R/C	1766	1911	2097	2303	2534	2796	1787	1934	2123	2332	2567	2833	1725	1870	2056	2263	2495	2757
ISA -10°C MIN	8	8	7	6	6	5	9	9	8	7	7	6	10	10	9	8	7	7
NM	41	38	35	32	29	27	48	45	41	38	34	31	56	52	47	43	39	36
LB	486	452	415	380	348	317	549	511	468	429	392	357	613	569	522	477	435	396
R/C	1797	1945	2135	2345	2582	2849	1820	1969	2163	2377	2617	2889	1755	1903	2094	2306	2542	2810
PRESSURE ALTITUDE	23000 FEET ISA = -31°C = -23°F						25000 FEET ISA = -35°C = -30°F						27000 FEET ISA = -38°C = -37°F					
ISA +20°C MIN	30	27	24	21	18	16	34	30	27	23	21	18	39	35	30	26	23	21
NM	189	167	146	128	113	100	220	194	169	148	130	114	259	227	196	171	150	131
LB	1580	1405	1233	1087	962	852	1777	1575	1378	1212	1069	945	2015	1776	1545	1352	1189	1049
R/C	516	594	694	803	925	1062	468	544	641	749	868	1001	347	417	507	607	717	839
ISA +10°C MIN	17	15	14	13	12	10	19	17	16	14	13	12	21	19	17	16	14	13
NM	99	91	82	74	67	60	113	103	93	84	76	68	130	118	106	96	86	77
LB	953	875	792	717	648	585	1052	965	872	788	712	642	1163	1064	960	866	781	704
R/C	1131	1245	1390	1551	1730	1932	1015	1124	1264	1417	1589	1781	851	953	1083	1227	1386	1565
ISA MIN	12	11	10	9	8	8	13	12	11	10	9	8	14	13	12	11	10	9
NM	66	61	56	51	46	42	75	69	63	58	52	47	84	78	71	65	59	53
LB	709	658	603	551	503	457	777	721	660	603	550	500	849	787	719	657	598	543
R/C	1714	1860	2047	2255	2487	2750	1643	1786	1970	2175	2403	2662	1486	1622	1798	1993	2210	2455
ISA -10°C MIN	11	11	10	9	8	8	13	12	11	10	9	8	14	13	12	11	10	9
NM	64	59	54	49	45	40	72	67	61	55	50	46	81	75	68	62	56	51
LB	676	628	575	525	479	436	741	688	629	575	524	476	810	750	686	626	570	518
R/C	1741	1890	2081	2294	2531	2800	1671	1818	2007	2216	2450	2715	1510	1651	1831	2030	2253	2504
PRESSURE ALTITUDE	29000 FEET ISA = -42°C = -44°F						31000 FEET ISA = -46°C = -52°F						33000 FEET ISA = -50°C = -59°F					
ISA +20°C MIN	46	40	35	30	26	23	54	47	40	34	30	26	60	51	43	37	32	28
NM	312	270	231	200	174	152	378	322	272	232	201	174	428	361	303	257	221	191
LB	2311	2018	1740	1514	1325	1163	2669	2299	1960	1691	1470	1285	2920	2498	2117	1817	1574	1371
R/C	277	344	430	525	630	747	227	294	381	477	585	706	381	476	602	743	901	1078
ISA +10°C MIN	23	21	19	17	16	14	26	24	21	19	17	15	28	25	23	20	18	17
NM	149	136	122	109	98	88	170	154	138	123	110	99	187	169	150	134	120	107
LB	1286	1173	1056	950	855	769	1412	1285	1153	1035	930	834	1508	1369	1225	1098	985	883
R/C	759	858	983	1122	1275	1447	756	859	991	1136	1297	1479	1062	1208	1396	1603	1833	2091
ISA MIN	16	14	13	12	11	10	17	16	14	13	12	11	18	17	15	14	13	12
NM	95	88	80	73	66	60	106	98	89	81	73	66	115	106	96	87	79	71
LB	924	856	781	713	649	589	999	924	842	767	698	633	1057	977	890	810	736	667
R/C	1389	1523	1694	1884	2095	2334	1453	1595	1777	1979	2205	2460	1947	2143	2395	2675	2986	3337
ISA -10°C MIN	15	14	13	12	11	10	17	15	14	13	12	11	18	16	15	14	12	11
NM	91	84	77	70	63	57	102	94	85	77	70	63	110	102	92	84	76	68
LB	881	816	744	679	618	560	952	881	803	731	664	602	1008	931	848	771	701	635
R/C	1409	1546	1721	1915	2132	2376	1468	1612	1799	2005	2235	2496	1943	2142	2397	2679	2994	3349

Figure 7-13 (Sheet 1 of 2)

CLIMB

Multiengine climb performance is presented in tabulated form on the following pages.

This performance is based on maximum continuous climb thrust setting on both engines, gear and flaps up, speed brakes retracted and anti-ice systems OFF. The performance is also presented for anti-ice systems ON.

The time, distance, fuel, and rate-of-climb used to any given altitude is based on the climb starting at sea level. If the climb is initiated at some other altitude, it is necessary to go into the data twice, once at the initial altitude and once at the final altitude. The difference in time, distance, and fuel between these two altitudes provides the proper values for the climb. The data allow for fuel burn-off in the climb; therefore, the weight presented is at the start of the climb.

The climb data for the conditions requiring a step climb are based on climbing direct to the highest obtainable altitude as shown in the step climb weight table, cruising at that altitude until the desired weight is achieved, and then climbing to the desired altitude or the next step altitude per the step climb table.

CRUISE CLIMB

300 KIAS/0.80 INDICATED MACH

TIME, DISTANCE, FUEL, AND RATE OF CLIMB — **ANTI-ICE SYSTEMS OFF**

T.O. WEIGHT	35700	34000	32000	30000	28000	26000	35700	34000	32000	30000	28000	26000	35700	34000	32000	30000	28000	26000
PRESSURE ALTITUDE	5000 FEET ISA = 5°C = 41°F						10000 FEET ISA = - 5°C = 23°F						15000 FEET ISA = -15°C = 6°F					
ISA +20°C MIN	3	3	3	2	2	2	8	7	6	6	5	5	15	14	12	11	10	9
NM	12	11	10	9	8	8	37	34	31	28	25	23	85	77	68	61	54	49
LB	169	157	144	131	120	109	432	397	361	328	297	268	838	759	678	606	543	486
R/C	1765	1910	2090	2293	2522	2781	812	894	1001	1118	1247	1393	575	656	759	872	996	1135
ISA +10°C MIN	2	2	2	2	2	2	5	5	5	4	4	4	10	9	8	7	7	6
NM	9	8	8	7	6	6	26	24	22	20	18	16	51	47	43	39	35	32
LB	139	129	119	109	100	92	331	308	282	258	236	215	570	526	480	436	397	360
R/C	2341	2514	2734	2982	3260	3577	1314	1424	1564	1720	1894	2092	1146	1257	1400	1557	1732	1930
ISA MIN	2	2	2	2	2	2	4	4	4	3	3	3	7	7	6	6	5	5
NM	7	6	6	5	5	4	19	18	16	15	14	12	36	33	31	28	25	23
LB	117	110	102	94	86	79	269	252	232	214	196	179	442	411	378	347	317	289
R/C	3005	3211	3478	3777	4114	4497	1869	2007	2186	2384	2608	2862	1741	1884	2067	2271	2499	2758
ISA -10°C MIN	2	2	2	2	2	2	4	4	4	3	3	3	7	6	6	6	5	5
NM	7	6	6	5	5	4	18	17	16	14	13	12	34	32	29	27	24	22
LB	112	105	97	90	83	76	257	240	222	204	187	171	422	393	361	331	303	276
R/C	3063	3274	3546	3850	4194	4584	1914	2056	2239	2443	2673	2933	1773	1919	2106	2315	2548	2812
PRESSURE ALTITUDE	17000 FEET ISA = -19°C = - 2°F						19000 FEET ISA = -23°C = - 9°F						21000 FEET ISA = -27°C = -16°F					
ISA +20°C MIN	19	17	15	13	12	11	22	20	18	16	14	13	26	23	21	18	16	14
NM	109	97	86	76	68	60	134	119	105	93	82	73	161	143	125	110	97	86
LB	1018	916	814	725	646	577	1203	1077	952	845	751	668	1392	1242	1093	967	857	761
R/C	558	637	738	849	972	1109	527	605	705	814	935	1071	505	583	681	790	910	1044
ISA +10°C MIN	11	11	10	9	8	7	13	12	11	10	9	8	15	14	13	11	10	9
NM	63	58	52	47	43	39	75	68	62	56	51	46	87	80	72	65	59	53
LB	666	614	558	507	460	417	762	702	637	578	524	473	858	789	715	648	586	530
R/C	1139	1250	1392	1549	1724	1922	1117	1227	1369	1526	1701	1898	1117	1228	1371	1530	1706	1905
ISA MIN	8	8	7	7	6	6	9	9	8	7	7	6	10	10	9	8	8	7
NM	43	40	37	33	31	28	50	47	43	39	36	32	58	54	49	45	41	37
LB	509	474	435	399	364	332	575	535	491	449	411	374	642	597	547	500	457	416
R/C	1766	1911	2097	2303	2534	2796	1787	1934	2123	2332	2567	2833	1725	1870	2056	2263	2495	2757
ISA -10°C MIN	8	8	7	6	6	5	9	9	8	7	7	6	10	10	9	8	7	7
NM	41	38	35	32	29	27	48	45	41	38	34	31	56	52	47	43	39	36
LB	486	452	415	380	348	317	549	511	468	429	392	357	613	569	522	477	435	396
R/C	1797	1945	2135	2345	2582	2849	1820	1969	2163	2377	2617	2889	1755	1903	2094	2306	2542	2810
PRESSURE ALTITUDE	23000 FEET ISA = -31°C = -23°F						25000 FEET ISA = -35°C = -30°F						27000 FEET ISA = -38°C = -37°F					
ISA +20°C MIN	30	27	24	21	18	16	34	30	27	23	21	18	39	35	30	26	23	21
NM	189	167	146	128	113	100	220	194	169	148	130	114	259	227	196	171	150	131
LB	1580	1405	1233	1087	962	852	1777	1575	1378	1212	1069	945	2015	1776	1545	1352	1189	1049
R/C	516	594	694	803	925	1062	468	544	641	749	868	1001	347	417	507	607	717	839
ISA +10°C MIN	17	15	14	13	12	10	19	17	16	14	13	12	21	19	17	16	14	13
NM	99	91	82	74	67	60	113	103	93	84	76	68	130	118	106	96	86	77
LB	953	875	792	717	648	585	1052	965	872	788	712	642	1163	1064	960	866	781	704
R/C	1131	1245	1390	1551	1730	1932	1015	1124	1264	1417	1589	1781	851	953	1083	1227	1386	1565
ISA MIN	12	11	10	9	8	8	13	12	11	10	9	8	14	13	12	11	10	9
NM	66	61	56	51	46	42	75	69	63	58	52	47	84	78	71	65	59	53
LB	709	658	603	551	503	457	777	721	660	603	550	500	849	787	719	657	598	543
R/C	1714	1860	2047	2255	2487	2750	1643	1786	1970	2175	2403	2662	1486	1622	1798	1993	2210	2455
ISA -10°C MIN	11	11	10	9	8	8	13	12	11	10	9	8	14	13	12	11	10	9
NM	64	59	54	49	45	40	72	67	61	55	50	46	81	75	68	62	56	51
LB	676	628	575	525	479	436	741	688	629	575	524	476	810	750	686	626	570	518
R/C	1741	1890	2081	2294	2531	2800	1671	1818	2007	2216	2450	2715	1510	1651	1831	2030	2253	2504
PRESSURE ALTITUDE	29000 FEET ISA = -42°C = -44°F						31000 FEET ISA = -46°C = -52°F						33000 FEET ISA = -50°C = -59°F					
ISA +20°C MIN	46	40	35	30	26	23	54	47	40	34	30	26	60	51	43	37	32	28
NM	312	270	231	200	174	152	378	322	272	232	201	174	428	361	303	257	221	191
LB	2311	2018	1740	1514	1325	1163	2669	2299	1960	1691	1470	1285	2920	2498	2117	1817	1574	1371
R/C	277	344	430	525	630	747	227	294	381	477	585	706	381	476	602	743	901	1078
ISA +10°C MIN	23	21	19	17	16	14	26	24	21	19	17	15	28	25	23	20	18	17
NM	149	136	122	109	98	88	170	154	138	123	110	99	187	169	150	134	120	107
LB	1286	1173	1056	950	855	769	1412	1285	1153	1035	930	834	1508	1369	1225	1098	985	883
R/C	759	858	983	1122	1275	1447	756	859	991	1136	1297	1479	1062	1208	1396	1603	1833	2091
ISA MIN	16	14	13	12	11	10	17	16	14	13	12	11	18	17	15	14	13	12
NM	95	88	80	73	66	60	106	98	89	81	73	66	115	106	96	87	79	71
LB	924	856	781	713	649	589	999	924	842	767	698	633	1057	977	890	810	736	667
R/C	1389	1523	1694	1884	2095	2334	1453	1595	1777	1979	2205	2460	1947	2143	2395	2675	2986	3337
ISA -10°C MIN	15	14	13	12	11	10	17	15	14	13	12	11	18	16	15	14	12	11
NM	91	84	77	70	63	57	102	94	85	77	70	63	110	102	92	84	76	68
LB	881	816	744	679	618	560	952	881	803	731	664	602	1008	931	848	771	701	635
R/C	1409	1546	1721	1915	2132	2376	1468	1612	1799	2005	2235	2496	1943	2142	2397	2679	2994	3349

Figure 7-13 (Sheet 1 of 2)

CLIMB

Multiengine climb performance is presented in tabulated form on the following pages.

This performance is based on maximum continuous climb thrust setting on both engines, gear and flaps up, speed brakes retracted and anti-ice systems OFF. The performance is also presented for anti-ice systems ON.

The time, distance, fuel, and rate-of-climb used to any given altitude is based on the climb starting at sea level. If the climb is initiated at some other altitude, it is necessary to go into the data twice, once at the initial altitude and once at the final altitude. The difference in time, distance, and fuel between these two altitudes provides the proper values for the climb. The data allow for fuel burn-off in the climb; therefore, the weight presented is at the start of the climb.

The climb data for the conditions requiring a step climb are based on climbing direct to the highest obtainable altitude as shown in the step climb weight table, cruising at that altitude until the desired weight is achieved, and then climbing to the desired altitude or the next step altitude per the step climb table.

CRUISE CLIMB

300 KIAS/0.80 INDICATED MACH

TIME,DISTANCE,FUEL, AND RATE OF CLIMB **ANTI-ICE SYSTEMS OFF**

T.O. WEIGHT	35700	34000	32000	30000	28000	26000	35700	34000	32000	30000	28000	26000	35700	34000	32000	30000	28000	26000
PRESSURE ALTITUDE	5000 FEET ISA = 5°C = 41°F						10000 FEET ISA = - 5°C = 23°F						15000 FEET ISA = -15°C = 6°F					
MIN	3	3	3	2	2	2	7	6	6	5	5	4	11	10	9	9	8	7
ISA NM	12	11	10	9	8	8	33	31	28	25	23	21	61	56	51	46	42	38
+20°C LB	169	157	144	131	120	109	392	362	330	301	273	248	657	605	549	498	451	408
R/C	1767	1909	2092	2295	2523	2781	1135	1235	1362	1502	1660	1838	1117	1225	1363	1516	1687	1879
MIN	2	2	2	2	2	2	5	5	5	4	4	4	8	8	7	6	6	5
ISA NM	9	8	8	7	6	6	24	22	20	19	17	15	43	40	36	33	30	27
+10°C LB	139	129	119	109	100	92	313	292	268	246	225	205	505	470	430	394	359	327
R/C	2341	2513	2735	2982	3261	3577	1594	1717	1876	2053	2251	2476	1678	1816	1993	2190	2411	2661
MIN	2	2	2	2	2	2	4	4	4	3	3	3	6	6	6	5	5	4
ISA NM	7	6	6	5	5	4	18	17	16	14	13	12	32	30	27	25	23	21
LB	117	110	102	94	86	79	263	246	227	209	192	175	415	387	357	328	301	275
R/C	3008	3214	3482	3780	4117	4501	2038	2184	2374	2585	2823	3094	2323	2495	2717	2963	3242	3556
MIN	2	2	2	2	2	2	4	4	4	3	3	3	6	6	5	5	5	4
ISA NM	7	6	6	5	5	4	18	16	15	14	13	12	31	29	26	24	22	20
-10°C LB	112	105	97	90	83	76	251	235	217	200	183	168	396	370	341	313	287	262
R/C	3066	3277	3550	3854	4198	4589	2087	2237	2432	2649	2893	3171	2367	2543	2769	3021	3305	3627
PRESSURE ALTITUDE	17000 FEET ISA = -19°C = - 2°F						19000 FEET ISA = -23°C = - 9°F						21000 FEET ISA = -27°C = -16°F					
MIN	13	12	11	10	9	8	16	14	13	12	11	10	19	17	15	14	12	11
ISA NM	74	68	61	55	50	45	90	82	74	67	60	54	111	101	90	81	73	65
+20°C LB	766	704	637	577	522	471	891	816	737	666	601	541	1044	952	855	769	691	621
R/C	969	1070	1199	1341	1500	1678	780	872	990	1119	1263	1424	595	678	784	901	1031	1176
MIN	9	9	8	7	7	6	11	10	9	9	8	7	12	12	11	10	9	8
ISA NM	51	47	43	39	36	32	60	56	51	46	42	38	71	65	59	54	49	44
+10°C LB	580	539	493	451	411	374	660	612	560	511	465	423	746	691	630	575	523	475
R/C	1543	1675	1844	2031	2241	2479	1400	1524	1685	1863	2062	2287	1243	1363	1515	1684	1871	2084
MIN	7	7	6	6	5	5	8	8	7	7	6	6	9	9	8	7	7	6
ISA NM	38	35	32	29	27	25	44	41	37	34	31	29	51	47	43	40	36	33
LB	472	441	406	373	342	312	532	496	456	419	384	350	594	554	510	468	428	390
R/C	2201	2368	2582	2821	3089	3394	2024	2183	2387	2614	2870	3159	1851	2002	2197	2413	2656	2931
MIN	7	7	6	6	5	5	8	8	7	6	6	6	9	9	8	7	7	6
ISA NM	36	34	31	28	26	24	42	39	36	33	30	27	49	45	42	38	35	32
-10°C LB	450	421	387	356	326	298	507	473	435	400	366	334	567	528	486	446	408	372
R/C	2246	2416	2636	2880	3154	3466	2063	2226	2435	2667	2929	3225	1882	2037	2236	2457	2705	2985
PRESSURE ALTITUDE	23000 FEET ISA = -31°C = -23°F						25000 FEET ISA = -35°C = -30°F						27000 FEET ISA = -38°C = -37°F					
MIN	22	20	18	16	15	13	27	24	21	19	17	15	32	28	25	22	19	17
ISA NM	138	124	110	98	88	78	169	151	133	118	104	93	210	185	161	142	125	110
+20°C LB	1223	1107	988	884	792	709	1425	1280	1135	1009	900	802	1672	1487	1305	1153	1021	907
R/C	512	592	694	806	930	1069	454	532	632	740	860	994	331	404	495	596	707	830
MIN	14	13	12	11	10	9	16	15	13	12	11	10	18	17	15	14	13	11
ISA NM	83	76	69	63	57	51	96	89	80	73	66	59	113	104	94	85	76	69
+10°C LB	837	774	705	642	583	528	937	864	785	713	647	585	1049	964	873	791	716	647
R/C	1138	1253	1400	1562	1743	1946	1007	1116	1256	1410	1581	1774	843	946	1076	1220	1379	1558
MIN	10	10	9	8	8	7	12	11	10	9	8	8	13	12	11	10	9	9
ISA NM	59	54	50	46	42	38	67	62	57	52	48	43	77	71	65	59	54	49
LB	660	614	564	517	473	431	728	677	621	569	520	474	800	743	681	623	569	518
R/C	1729	1876	2064	2273	2507	2772	1637	1781	1965	2169	2398	2656	1479	1616	1792	1986	2204	2449
MIN	10	10	9	8	7	7	11	11	10	9	8	8	13	12	11	10	9	8
ISA NM	56	52	48	44	40	36	65	60	55	50	46	41	74	68	63	57	52	47
-10°C LB	629	586	538	493	451	411	694	646	592	542	495	451	763	708	649	593	541	493
R/C	1756	1906	2098	2312	2551	2822	1666	1811	1999	2208	2442	2706	1502	1645	1825	2025	2247	2499
PRESSURE ALTITUDE	29000 FEET ISA = -42°C = -44°F						31000 FEET ISA = -46°C = -52°F						33000 FEET ISA = -50°C = -59°F					
MIN	39	34	29	26	22	20	48	41	35	30	26	23	54	46	38	33	28	25
ISA NM	266	230	197	171	149	131	337	285	239	205	177	154	390	326	271	230	197	171
+20°C LB	1985	1738	1506	1318	1159	1023	2369	2033	1734	1499	1307	1146	2637	2242	1896	1629	1413	1234
R/C	261	330	417	513	619	737	210	279	367	465	573	694	358	454	581	724	883	1061
MIN	21	19	17	16	14	13	24	22	19	18	16	14	26	24	21	19	17	15
ISA NM	134	122	109	98	88	79	157	142	127	113	102	91	175	158	140	125	112	100
+10°C LB	1177	1077	972	878	793	714	1314	1197	1076	968	871	783	1416	1286	1152	1034	929	833
R/C	712	809	932	1068	1218	1386	675	775	902	1042	1197	1372	995	1140	1324	1529	1752	2005
MIN	14	13	12	11	10	9	16	15	14	12	11	10	17	16	15	13	12	11
ISA NM	88	81	74	68	61	56	100	92	84	76	69	63	110	101	92	83	76	68
LB	879	815	745	681	621	564	960	888	811	739	673	611	1022	945	861	784	713	646
R/C	1292	1421	1586	1769	1973	2202	1268	1401	1572	1760	1971	2208	1773	1961	2202	2469	2766	3102
MIN	14	13	12	11	10	9	16	15	13	12	11	10	17	16	14	13	12	11
ISA NM	85	78	71	65	59	53	96	89	81	73	67	60	106	97	88	80	73	66
-10°C LB	837	776	710	648	591	537	915	846	772	704	640	581	975	900	820	747	679	615
R/C	1310	1442	1612	1799	2008	2243	1278	1414	1588	1781	1996	2239	1770	1961	2205	2475	2776	3115

Figure 7-13 (Sheet 1 of 2)

CRUISE CLIMB

300 KIAS/0.80 INDICATED MACH

TIME, DISTANCE, FUEL, AND RATE OF CLIMB — ANTI-ICE SYSTEMS OFF

PRESSURE ALTITUDE 35000 FEET — ISA = -54°C = -66°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +20°C	MIN	65	55	46	40	34	30
	NM	465	392	327	277	238	205
	LB	3105	2648	2237	1915	1655	1439
	R/C	449	549	684	836	1007	1199
ISA +10°C	MIN	30	27	24	22	19	17
	NM	202	182	162	144	128	114
	LB	1590	1441	1287	1152	1032	924
	R/C	1075	1228	1424	1642	1883	2154
ISA	MIN	19	18	16	15	13	12
	NM	123	113	103	93	84	76
	LB	1110	1025	932	848	770	697
	R/C	1772	1966	2215	2492	2800	3148
ISA -10°C	MIN	19	17	16	14	13	12
	NM	119	109	99	90	81	73
	LB	1060	978	889	808	733	664
	R/C	1763	1960	2212	2492	2804	3155

PRESSURE ALTITUDE 37000 FEET — ISA = -57°C = -70°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +20°C	MIN	70	59	50	42	36	32
	NM	507	425	353	298	255	220
	LB	3299	2803	2358	2013	1735	1506
	R/C	350	448	578	726	894	1082
ISA +10°C	MIN	32	29	26	23	21	18
	NM	218	196	174	154	137	122
	LB	1678	1516	1352	1208	1080	966
	R/C	874	1033	1223	1430	1662	1921
ISA	MIN	20	19	17	16	14	13
	NM	133	122	110	100	90	81
	LB	1168	1076	977	888	805	728
	R/C	1461	1659	1899	2158	2448	2773
ISA -10°C	MIN	20	19	17	15	14	13
	NM	128	118	106	96	87	78
	LB	1115	1027	932	846	767	694
	R/C	1450	1650	1894	2156	2450	2779

PRESSURE ALTITUDE 39000 FEET — ISA = -57°C = -70°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +20°C	MIN	* 101	* 68	55	46	39	34
	NM	763	492	397	330	279	239
	LB	4397	3085	2541	2146	1837	1587
	R/C	100	135	264	397	545	712
ISA +10°C	MIN	35	32	28	25	22	20
	NM	244	217	190	168	149	132
	LB	1803	1616	1432	1274	1136	1013
	R/C	463	609	794	990	1193	1421
ISA	MIN	22	20	18	17	15	14
	NM	146	133	120	108	97	88
	LB	1239	1137	1030	933	844	763
	R/C	998	1181	1410	1658	1916	2205
ISA -10°C	MIN	22	20	18	16	15	13
	NM	141	129	116	104	94	85
	LB	1185	1087	983	890	805	727
	R/C	978	1162	1395	1647	1907	2200

PRESSURE ALTITUDE 41000 FEET — ISA = -57°C = -70°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +20°C	MIN	* 210	* 164	* 107	* 56	45	38
	NM	1670	1297	830	405	323	269
	LB	7941	6229	4228	2431	2005	1703
	R/C	101	100	100	120	270	425
ISA +10°C	MIN	44	37	32	27	24	21
	NM	312	259	219	189	165	145
	LB	2096	1797	1553	1364	1206	1070
	R/C	114	257	437	630	839	1053
ISA	MIN	25	22	20	18	16	15
	NM	167	150	133	119	107	96
	LB	1340	1218	1095	986	889	801
	R/C	616	796	1021	1262	1526	1803
ISA -10°C	MIN	25	22	20	18	16	15
	NM	162	146	129	115	103	92
	LB	1286	1167	1047	942	849	764
	R/C	588	770	998	1243	1509	1789

PRESSURE ALTITUDE 43000 FEET — ISA = -57°C = -70°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +20°C	MIN	* 316	* 270	* 213	* 154	* 90	* 46
	NM	2548	2176	1710	1226	702	333
	LB	11060	9349	7349	5341	3340	1922
	R/C	102	100	100	100	100	163
ISA +10°C	MIN	* 149	* 99	41	32	27	24
	NM	1183	774	292	228	191	164
	LB	5518	3819	1838	1514	1306	1144
	R/C	100	100	102	291	494	715
ISA	MIN	30	26	23	20	18	16
	NM	207	178	153	134	119	105
	LB	1519	1341	1183	1054	943	845
	R/C	260	431	652	891	1148	1428
ISA -10°C	MIN	31	26	23	20	18	16
	NM	206	174	149	130	115	102
	LB	1476	1293	1135	1008	901	807
	R/C	221	395	619	860	1119	1403

PRESSURE ALTITUDE 45000 FEET — ISA = -57°C = -70°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +20°C	MIN	* 428	* 382	* 325	* 267	* 203	* 137
	NM	3481	3111	2645	2163	1640	1091
	LB	14052	12345	10346	8346	6346	4348
	R/C	101	100	100	100	100	101
ISA +10°C	MIN	* 262	* 212	* 153	* 88	35	28
	NM	2120	1712	1222	687	251	197
	LB	8853	7156	5146	3143	1515	1259
	R/C	101	101	100	100	146	360
ISA	MIN	* 90	* 41	28	23	20	18
	NM	701	291	190	158	136	118
	LB	3500	1799	1333	1150	1012	898
	R/C	100	100	292	521	775	1049
ISA -10°C	MIN	* 103	* 51	28	23	20	18
	NM	784	367	189	155	132	115
	LB	3751	2051	1292	1105	969	859
	R/C	100	100	259	490	749	1026

PRESSURE ALTITUDE 47000 FEET — ISA = -57°C = -70°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +20°C	MIN	* 548	* 504	* 446	* 388	* 324	* 257
	NM	4478	4113	3647	3165	2642	2089
	LB	16926	15235	13234	11234	9235	7225
	R/C	100	101	101	101	101	100
ISA +10°C	MIN	* 375	* 325	* 266	* 201	* 134	* 62
	NM	3059	2651	2164	1630	1077	482
	LB	11876	10178	8178	6178	4172	2169
	R/C	101	101	101	101	100	100
ISA	MIN	* 202	* 152	* 88	31	24	20
	NM	1619	1210	685	216	166	138
	LB	6832	5134	3126	1363	1122	970
	R/C	100	101	100	133	372	640
ISA -10°C	MIN	* 218	* 166	* 100	* 33	24	20
	NM	1711	1295	770	228	164	135
	LB	7068	5373	3369	1368	1083	930
	R/C	100	101	100	100	339	609

PRESSURE ALTITUDE 49000 FEET — ISA = -57°C = -70°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +20°C	MIN	----	----	* 554	* 496	* 432	* 365
	NM	----	----	4565	4083	3560	3011
	LB	----	----	15729	13729	11728	9729
	R/C	----	----	101	101	101	101
ISA +10°C	MIN	* 492	* 442	* 384	* 319	* 252	* 180
	NM	4041	3630	3143	2610	2058	1464
	LB	14739	13033	11033	9033	7034	5031
	R/C	102	101	101	101	101	101
ISA	MIN	* 320	* 270	* 206	* 140	* 68	26
	NM	2584	2176	1653	1112	527	181
	LB	10012	8318	6317	4312	2309	1110
	R/C	100	101	101	100	100	220
ISA -10°C	MIN	* 339	* 287	* 221	* 153	* 79	26
	NM	2679	2262	1739	1196	604	181
	LB	10210	8512	6512	4512	2506	1078
	R/C	100	101	101	101	100	188

PRESSURE ALTITUDE 51000 FEET — ISA = -57°C = -70°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +20°C	MIN	----	----	----	* 597	* 534	* 467
	NM	----	----	----	4951	4431	3882
	LB	----	----	----	15864	13871	11871
	R/C	----	----	----	100	101	101
ISA +10°C	MIN	----	* 561	* 502	* 437	* 371	* 299
	NM	----	4618	4130	3597	3046	2451
	LB	----	15640	13638	11640	9640	7638
	R/C	----	101	101	101	101	101
ISA	MIN	* 442	* 392	* 328	* 262	* 191	* 116
	NM	3594	3184	2662	2122	1539	925
	LB	13032	11334	9335	7333	5335	3333
	R/C	100	101	101	101	101	101
ISA -10°C	MIN	* 465	* 413	* 347	* 280	* 205	* 128
	NM	3695	3278	2754	2212	1621	1004
	LB	13203	11504	9505	7505	5504	3502
	R/C	101	101	101	101	101	100

* INDICATES STEP CLIMB REQUIRED

NOTE: STEP CLIMB DATA INCLUDES TIME, DISTANCE AND FUEL USED IN CRUISE PORTION, BASED ON MAXIMUM CRUISE THRUST.

CRUISE CLIMB SPEED - KIAS

PRESSURE ALTTITUDE-FEET											
0	5000	10000	15000	20000	25000	30000	35000	40000	45000	50000	51000
270	270	300	300	300	300	300	272	242	216	192	188

WIND EFFECT ON CLIMB DISTANCE - NM
(SUBTRACT FOR HEADWIND, ADD FOR TAILWIND)

CLIMB TIME (MIN)	WIND 25KTS	50KTS	100KTS
5	2	4	8
10	4	8	16
15	6	12	25
20	8	16	33
25	10	20	41
30	12	25	50

NOTE: FOR CLIMB CONDITIONS REQUIRING A STEP CLIMB, THE FOLLOWING TABLE GIVES THE WEIGHT AT THE END OF STEP CRUISE AT THE STEP ALTITUDE, REQUIRED TO CONTINUE CLIMB.

STEP CLIMB ALT IN FEET	TEMPERATURE ISA -10°C	ISA + 0°C	ISA +10°C	ISA +20°C
37000	----	----	----	31633
39000	----	----	----	28088
41000	----	----	30469	24952
43000	32224	32486	27112	21908
45000	28865	29119	24061	19000
47000	25697	25904	21169	16475
49000	22673	22851	18540	14317

Figure 7-13 (Sheet 2)

CRUISE CLIMB

300 KIAS/0.80 INDICATED MACH

TIME,DISTANCE,FUEL, AND RATE OF CLIMB **ANTI-ICE SYSTEMS ON**

T.O. WEIGHT	35700	34000	32000	30000	28000	26000	35700	34000	32000	30000	28000	26000	35700	34000	32000	30000	28000	26000
PRESSURE ALTITUDE	5000 FEET ISA = 5°C = 41°F						10000 FEET ISA = - 5°C = 23°F						15000 FEET ISA = -15°C = 6°F					
ISA +10°C MIN	2	2	2	2	2	2	5	5	5	4	4	4	9	9	8	7	7	6
NM	9	8	8	7	6	6	25	23	21	19	17	16	48	44	40	37	33	30
LB	146	136	125	115	106	96	341	317	291	267	244	222	575	531	485	442	402	364
R/C	2321	2492	2713	2959	3236	3550	1529	1656	1819	2000	2203	2433	1130	1239	1379	1534	1707	1902
ISA MIN	2	2	2	2	2	2	4	4	4	3	3	3	7	6	6	5	5	5
NM	7	6	6	5	5	4	18	17	16	14	13	12	34	32	29	27	24	22
LB	123	115	106	98	90	83	279	261	241	222	203	186	449	419	385	353	323	295
R/C	2984	3189	3455	3752	4087	4468	2161	2321	2528	2758	3016	3310	1722	1863	2044	2245	2471	2726
ISA -10°C MIN	2	2	2	2	2	2	4	4	4	3	3	3	7	6	6	5	5	5
NM	7	6	6	5	5	4	18	16	15	14	13	11	33	30	28	25	23	21
LB	117	110	102	94	86	79	266	249	229	211	194	177	428	399	367	337	308	281
R/C	3042	3251	3522	3825	4166	4555	2207	2370	2581	2817	3081	3382	1752	1896	2081	2286	2517	2778
PRESSURE ALTITUDE	17000 FEET ISA = -19°C = - 2°F						19000 FEET ISA = -23°C = - 9°F						21000 FEET ISA = -27°C = -16°F					
ISA +10°C MIN	11	10	9	8	8	7	13	12	11	10	9	8	15	13	12	11	10	9
NM	60	55	50	45	41	37	72	66	60	54	49	44	84	77	70	63	57	51
LB	677	625	569	517	470	425	780	719	653	593	537	486	882	812	736	667	604	546
R/C	1119	1228	1369	1524	1697	1893	1101	1210	1351	1506	1679	1874	1098	1209	1351	1508	1683	1880
ISA MIN	8	7	7	6	6	5	9	9	8	7	7	6	10	10	9	8	7	7
NM	41	38	35	32	29	27	49	45	41	38	34	31	56	52	48	44	40	36
LB	520	485	445	408	373	340	591	550	504	462	422	384	661	615	563	516	471	429
R/C	1747	1891	2075	2280	2509	2769	1768	1913	2100	2308	2541	2805	1707	1851	2036	2241	2471	2731
ISA -10°C MIN	8	7	7	6	6	5	9	8	8	7	7	6	10	9	9	8	7	7
NM	40	37	34	31	28	26	47	43	40	36	33	30	54	50	46	42	38	35
LB	496	462	424	389	356	324	563	524	480	440	402	366	630	586	537	491	448	408
R/C	1777	1924	2112	2321	2555	2821	1799	1948	2139	2352	2590	2860	1736	1883	2072	2282	2518	2784
PRESSURE ALTITUDE	23000 FEET ISA = -31°C = -23°F						25000 FEET ISA = -35°C = -30°F						27000 FEET ISA = -38°C = -37°F					
ISA +10°C MIN	16	15	14	12	11	10	18	17	15	14	13	11	21	19	17	15	14	13
NM	97	89	80	72	65	59	111	101	91	82	74	67	128	116	105	94	85	76
LB	983	903	818	741	670	605	1089	999	903	817	738	665	1208	1106	998	900	812	731
R/C	1114	1227	1371	1530	1708	1908	1000	1108	1246	1399	1569	1760	832	933	1062	1203	1361	1538
ISA MIN	11	11	10	9	8	8	13	12	11	10	9	8	14	13	12	11	10	9
NM	65	60	55	50	45	41	73	68	62	56	51	46	83	77	70	64	58	52
LB	732	680	623	569	520	473	804	747	683	624	569	518	881	816	746	681	621	564
R/C	1696	1841	2027	2233	2464	2725	1625	1767	1950	2153	2380	2636	1467	1604	1779	1972	2186	2431
ISA -10°C MIN	11	10	10	9	8	7	12	12	11	10	9	8	14	13	12	11	10	9
NM	62	58	53	48	44	40	70	65	60	54	49	45	80	74	67	61	56	50
LB	697	648	593	542	495	450	766	711	650	594	542	492	839	777	710	648	591	536
R/C	1723	1871	2061	2272	2508	2775	1652	1798	1985	2193	2425	2688	1491	1630	1809	2007	2228	2477
PRESSURE ALTITUDE	29000 FEET ISA = -42°C = -44°F						31000 FEET ISA = -46°C = -52°F						33000 FEET ISA = -50°C = -59°F					
ISA +10°C MIN	23	21	19	17	15	14	26	24	21	19	17	15	28	25	23	20	18	16
NM	148	134	120	108	97	87	169	153	136	122	109	98	185	167	149	133	119	106
LB	1341	1223	1100	990	891	801	1476	1342	1204	1081	971	871	1576	1431	1280	1148	1029	922
R/C	741	838	963	1099	1251	1420	798	907	1047	1201	1372	1565	1045	1190	1376	1582	1809	2065
ISA MIN	15	14	13	12	11	10	17	16	14	13	12	11	18	17	15	14	13	11
NM	94	87	79	72	65	59	105	96	88	80	72	65	113	104	95	86	78	70
LB	961	889	812	740	674	612	1039	961	876	798	726	658	1100	1016	925	842	765	694
R/C	1373	1505	1677	1864	2075	2311	1544	1695	1889	2103	2344	2615	1927	2122	2372	2649	2959	3308
ISA -10°C MIN	15	14	13	12	11	10	17	15	14	13	12	11	18	16	15	14	12	11
NM	90	83	76	69	62	57	101	93	84	77	69	63	109	101	91	83	75	68
LB	915	847	773	705	641	582	990	915	834	760	691	626	1048	968	881	802	728	660
R/C	1390	1526	1700	1893	2108	2350	1554	1708	1906	2125	2370	2647	1921	2117	2370	2651	2963	3316
PRESSURE ALTITUDE	35000 FEET ISA = -54°C = -66°F						37000 FEET ISA = -57°C = -70°F						39000 FEET ISA = -57°C = -70°F					
ISA +10°C MIN	30	27	24	22	19	17	32	29	26	23	21	18	36	32	28	25	22	20
NM	200	181	160	143	127	113	217	195	173	153	136	121	247	218	191	168	149	132
LB	1664	1508	1347	1205	1079	966	1760	1590	1416	1265	1131	1011	1909	1706	1508	1340	1194	1064
R/C	1062	1214	1409	1625	1864	2133	851	1008	1195	1401	1629	1886	373	515	693	881	1076	1295
ISA MIN	19	18	16	15	13	12	20	19	17	15	14	13	22	20	18	17	15	14
NM	122	112	102	92	83	75	132	121	109	99	89	80	145	132	119	107	97	87
LB	1156	1067	971	883	801	726	1217	1121	1019	925	839	759	1294	1188	1075	973	881	796
R/C	1756	1948	2197	2472	2779	3124	1455	1651	1890	2149	2438	2763	978	1159	1387	1632	1888	2176
ISA -10°C MIN	19	17	16	14	13	12	20	18	17	15	14	13	22	20	18	16	15	13
NM	118	108	98	89	80	72	127	117	106	95	86	78	141	128	115	104	93	84
LB	1103	1017	925	841	763	691	1162	1070	971	882	799	723	1237	1134	1026	928	840	758
R/C	1744	1942	2189	2469	2779	3130	1435	1634	1877	2138	2429	2757	966	1150	1381	1632	1890	2182
PRESSURE ALTITUDE	41000 FEET ISA = -57°C = -70°F																	
ISA +10°C MIN	----	----	33	28	25	22												
NM	----	----	229	195	169	148												
LB	----	----	1680	1459	1283	1135												
R/C	----	----	269	450	646	844												
ISA MIN	25	23	20	18	16	15												
NM	168	150	133	119	106	95												
LB	1411	1280	1148	1034	931	838												
R/C	523	698	916	1151	1406	1672												
ISA -10°C MIN	25	22	20	18	16	14												
NM	162	145	129	115	103	92												
LB	1345	1220	1094	985	887	798												
R/C	581	760	986	1230	1496	1773												

WIND EFFECT ON CLIMB DISTANCE - NM
(SUBTRACT FOR HEADWIND, ADD FOR TAILWIND)

CLIMB TIME (MIN)	WIND 25KTS	50KTS	100KTS
5	2	4	8
10	4	8	16
15	6	12	25
20	8	16	33
25	10	20	41
30	12	25	50

CRUISE CLIMB SPEED - KIAS

PRESSURE ALTITUDE-FEET									
0	5000	10000	15000	20000	25000	30000	35000	40000	41000
270	270	300	300	300	300	300	272	242	237

Figure 7-14

CRUISE CLIMB

270 KIAS/0.78 INDICATED MACH

TIME, DISTANCE, FUEL, AND RATE OF CLIMB | **ANTI-ICE SYSTEMS OFF**

T.O. WEIGHT	35700	34000	32000	30000	28000	26000	35700	34000	32000	30000	28000	26000	35700	34000	32000	30000	28000	26000
PRESSURE ALTITUDE	5000 FEET ISA = 5°C = 41°F						10000 FEET ISA = - 5°C = 23°F						15000 FEET ISA = -15°C = 6°F					
MIN	3	3	3	2	2	2	6	6	5	5	4	4	9	8	8	7	6	6
ISA NM	12	11	10	9	8	8	28	26	23	21	19	17	44	41	37	34	30	28
+20°C LB	169	157	144	131	120	109	351	325	297	271	246	223	522	483	440	401	365	331
R/C	1767	1909	2092	2295	2523	2781	1756	1900	2084	2290	2519	2780	1537	1672	1846	2039	2255	2499
MIN	2	2	2	2	2	2	5	4	4	4	4	3	7	6	6	6	5	5
ISA NM	9	8	8	7	6	6	20	19	17	16	14	13	33	30	28	25	23	21
+10°C LB	139	129	119	109	100	92	285	265	244	224	205	186	424	395	363	332	304	277
R/C	2341	2513	2735	2982	3261	3577	2263	2433	2653	2898	3173	3486	2084	2248	2461	2697	2961	3262
MIN	2	2	2	2	2	2	4	4	3	3	3	3	6	5	5	5	4	4
ISA NM	7	6	6	5	5	4	16	15	13	12	11	10	25	24	22	20	18	17
LB	117	110	102	94	86	79	240	225	207	191	175	160	359	336	310	285	262	239
R/C	3008	3214	3482	3780	4117	4501	2753	2950	3204	3487	3806	4170	2685	2881	3135	3418	3737	4099
MIN	2	2	2	2	2	2	4	4	3	3	3	3	6	5	5	4	4	4
ISA NM	7	6	6	5	5	4	15	14	13	12	11	10	24	23	21	19	17	16
-10°C LB	112	105	97	90	83	76	230	215	198	183	168	154	343	321	296	272	250	228
R/C	3066	3277	3550	3854	4198	4589	2812	3013	3273	3563	3889	4260	2737	2938	3198	3487	3812	4182
PRESSURE ALTITUDE	17000 FEET ISA = -19°C = - 2°F						19000 FEET ISA = -23°C = - 9°F						21000 FEET ISA = -27°C = -16°F					
MIN	10	10	9	8	7	7	12	11	10	9	8	8	14	13	12	11	10	9
ISA NM	52	48	44	40	36	33	62	57	52	47	42	38	73	67	61	55	50	45
+20°C LB	597	552	503	457	415	376	679	626	569	517	469	425	770	709	643	583	528	477
R/C	1380	1509	1675	1857	2062	2292	1204	1326	1481	1653	1844	2059	1020	1134	1279	1439	1617	1817
MIN	8	7	7	6	6	5	9	8	8	7	7	6	10	9	9	8	7	7
ISA NM	38	36	33	30	27	25	45	42	38	35	32	29	52	48	44	40	37	33
+10°C LB	483	449	412	378	345	314	544	506	464	424	387	353	609	565	518	473	431	392
R/C	1945	2104	2309	2537	2792	3081	1799	1952	2149	2368	2612	2889	1636	1783	1972	2181	2414	2678
MIN	6	6	6	5	5	4	7	7	6	6	5	5	8	8	7	6	6	5
ISA NM	30	28	25	23	21	19	35	32	30	27	25	23	40	37	34	31	29	26
LB	408	381	352	323	296	271	459	428	394	362	332	303	511	476	439	403	369	337
R/C	2508	2697	2941	3213	3518	3865	2354	2538	2774	3036	3331	3666	2210	2387	2616	2871	3157	3480
MIN	6	6	5	5	5	4	7	7	6	6	5	5	8	7	7	6	6	5
ISA NM	29	27	24	22	20	19	33	31	28	26	24	22	38	36	33	30	27	25
-10°C LB	390	364	336	309	283	259	438	409	376	346	317	290	487	455	418	384	352	321
R/C	2557	2751	3001	3279	3591	3946	2399	2587	2828	3097	3398	3740	2249	2430	2664	2924	3216	3546
PRESSURE ALTITUDE	23000 FEET ISA = -31°C = -23°F						25000 FEET ISA = -35°C = -30°F						27000 FEET ISA = -38°C = -37°F					
MIN	16	15	13	12	11	10	18	17	15	14	12	11	21	19	17	15	14	12
ISA NM	87	80	72	65	58	52	102	93	84	75	67	61	120	109	97	87	78	70
+20°C LB	870	798	721	652	589	532	975	891	804	725	653	588	1091	994	893	803	722	648
R/C	915	1025	1165	1319	1489	1681	854	962	1099	1249	1416	1603	734	837	968	1112	1271	1449
MIN	12	11	10	9	8	8	13	12	11	10	9	8	15	13	12	11	10	9
ISA NM	61	56	51	47	42	38	70	65	59	53	48	44	81	74	67	61	55	50
+10°C LB	677	628	574	524	477	433	749	693	633	577	525	476	827	764	695	633	575	521
R/C	1469	1609	1789	1987	2208	2458	1357	1493	1667	1858	2072	2313	1216	1346	1512	1696	1901	2130
MIN	9	8	8	7	7	6	10	9	9	8	7	7	11	10	10	9	8	7
ISA NM	46	43	39	36	33	30	52	48	44	41	37	34	59	55	50	46	42	38
LB	564	526	483	444	406	370	619	576	529	485	444	405	676	629	577	529	483	440
R/C	2081	2254	2476	2723	2999	3313	1979	2148	2366	2607	2877	3183	1827	1990	2201	2433	2694	2987
MIN	9	8	8	7	7	6	10	9	8	8	7	7	11	10	9	9	8	7
ISA NM	44	41	38	34	31	28	50	47	43	39	36	32	57	53	48	44	40	36
-10°C LB	538	501	461	423	387	353	590	549	505	462	423	385	644	599	550	504	460	419
R/C	2121	2298	2526	2779	3062	3382	2018	2192	2415	2662	2939	3252	1859	2027	2242	2480	2747	3048
PRESSURE ALTITUDE	29000 FEET ISA = -42°C = -44°F						31000 FEET ISA = -46°C = -52°F						33000 FEET ISA = -50°C = -59°F					
MIN	24	22	19	17	15	14	27	25	22	19	17	16	32	28	25	22	20	17
ISA NM	142	128	114	101	90	80	169	151	133	118	104	93	205	180	157	138	121	107
+20°C LB	1223	1108	991	887	795	713	1376	1239	1101	981	876	782	1565	1395	1228	1088	966	859
R/C	618	716	841	978	1129	1298	516	610	730	861	1005	1166	386	475	587	710	845	996
MIN	16	15	14	12	11	10	18	17	15	14	13	11	21	19	17	15	14	13
ISA NM	93	86	77	70	63	57	108	98	89	80	72	65	125	113	102	91	82	74
+10°C LB	911	839	762	692	627	568	1002	921	834	755	683	617	1103	1009	911	823	743	669
R/C	1077	1201	1361	1536	1731	1950	963	1084	1237	1407	1594	1805	845	961	1109	1272	1452	1653
MIN	12	11	10	10	9	8	14	13	12	11	10	9	15	14	13	12	11	10
ISA NM	67	62	57	52	47	43	77	71	65	59	53	48	87	80	73	66	60	54
LB	738	685	628	574	524	477	803	744	681	622	567	515	871	806	736	671	611	555
R/C	1634	1790	1989	2210	2457	2735	1490	1640	1833	2046	2282	2549	1406	1552	1741	1950	2183	2444
MIN	12	11	10	9	9	8	13	12	11	10	9	9	15	14	12	11	10	9
ISA NM	65	60	55	50	45	41	74	68	62	56	51	46	84	77	70	63	58	52
-10°C LB	703	653	598	547	499	454	764	709	648	592	539	490	830	768	701	639	581	528
R/C	1661	1822	2027	2253	2506	2791	1513	1667	1865	2083	2326	2599	1423	1575	1769	1983	2222	2490

Figure 7-15 (Sheet 1 of 2)

CRUISE CLIMB

270 KIAS/0.78 INDICATED MACH

TIME, DISTANCE, FUEL, AND RATE OF CLIMB — **ANTI-ICE SYSTEMS OFF**

T.O. WEIGHT		35700	34000	32000	30000	28000	26000	35700	34000	32000	30000	28000	26000	35700	34000	32000	30000	28000	26000
PRESSURE ALTITUDE		35000 FEET ISA = -54°C = -66°F						37000 FEET ISA = -57°C = -70°F						39000 FEET ISA = -57°C = -70°F					
ISA +20°C	MIN	37	33	28	25	22	19	43	37	32	27	24	21	* 76	* 45	37	31	27	23
	NM	245	213	183	159	139	122	290	246	208	179	155	136	560	308	247	207	177	152
	LB	1769	1557	1357	1193	1054	933	1978	1715	1477	1288	1131	997	3145	1981	1646	1408	1222	1069
	R/C	382	484	614	757	915	1090	338	460	616	787	976	1185	100	146	288	443	613	801
ISA +10°C	MIN	23	21	19	17	15	14	25	23	20	18	16	15	28	25	22	20	18	16
	NM	142	128	115	103	92	82	159	143	127	113	101	90	182	162	142	126	111	99
	LB	1200	1094	984	886	798	717	1290	1171	1049	942	846	759	1404	1264	1124	1004	898	803
	R/C	914	1050	1224	1413	1623	1858	915	1075	1280	1503	1750	2025	518	665	850	1052	1274	1519
ISA	MIN	16	15	14	13	11	10	18	16	15	14	12	11	19	18	16	15	13	12
	NM	97	89	81	73	66	60	107	98	89	80	73	65	120	109	98	88	80	72
	LB	937	866	789	718	653	592	997	919	836	759	689	624	1066	979	887	803	727	657
	R/C	1456	1624	1838	2073	2335	2629	1473	1668	1914	2186	2487	2824	1029	1207	1433	1680	1951	2255
ISA -10°C	MIN	16	15	14	12	11	10	17	16	15	13	12	11	19	18	16	14	13	12
	NM	94	86	78	71	64	58	104	95	86	77	70	63	116	106	95	85	77	69
	LB	893	824	751	683	621	563	951	876	796	723	656	593	1018	934	845	765	692	625
	R/C	1463	1635	1853	2094	2361	2660	1460	1657	1908	2182	2487	2827	1011	1192	1420	1670	1945	2252
PRESSURE ALTITUDE		41000 FEET ISA = -57°C = -70°F						43000 FEET ISA = -57°C = -70°F						45000 FEET ISA = -57°C = -70°F					
ISA +20°C	MIN	* 197	* 141	* 81	39	31	27	* 305	* 259	* 200	* 129	* 64	33	* 416	* 374	* 314	* 255	* 189	* 110
	NM	1551	1100	612	269	214	178	2420	2067	1585	1017	477	230	3304	2990	2508	2039	1503	863
	LB	7062	5087	3072	1647	1367	1170	10256	8557	6557	4309	2296	1348	13316	11616	9616	7617	5616	3382
	R/C	100	100	100	155	317	496	100	100	100	100	100	210	100	100	100	100	100	100
ISA +10°C	MIN	35	30	25	22	20	17	* 125	* 75	33	27	23	20	* 252	* 201	* 129	* 63	29	23
	NM	235	197	167	144	126	111	979	565	222	177	149	128	2005	1591	1015	476	195	156
	LB	1636	1417	1232	1086	963	856	4570	2866	1450	1215	1053	924	8268	6564	4282	2278	1218	1024
	R/C	175	324	501	694	904	1136	100	101	165	356	558	778	101	101	100	100	216	426
ISA	MIN	22	20	18	16	14	13	27	23	20	18	16	14	* 81	32	25	21	18	16
	NM	139	125	111	99	88	79	176	150	129	113	100	89	620	217	163	135	116	101
	LB	1161	1056	949	855	771	694	1325	1170	1032	920	823	737	3109	1441	1170	1009	888	788
	R/C	656	837	1055	1292	1551	1838	288	464	685	921	1170	1444	100	105	323	556	811	1075
ISA -10°C	MIN	22	20	18	16	14	13	27	23	20	18	16	14	* 94	* 41	25	21	18	16
	NM	135	121	107	96	85	76	174	147	126	110	97	86	705	286	161	132	113	98
	LB	1112	1009	906	816	735	661	1281	1124	988	878	785	703	3379	1674	1130	968	850	752
	R/C	631	817	1039	1279	1541	1832	258	438	662	902	1154	1432	100	100	287	527	781	1049
PRESSURE ALTITUDE		47000 FEET ISA = -57°C = -70°F						49000 FEET ISA = -57°C = -70°F						51000 FEET ISA = -57°C = -70°F					
ISA +20°C	MIN	* 525	* 489	* 430	* 374	* 309	* 241	* 621	* 592	* 533	* 482	* 417	* 351	* 703	* 684	* 625	* 581	* 516	* 454
	NM	4162	3908	3428	2999	2464	1928	4905	4723	4244	3867	3333	2828	5516	5427	4950	4644	4112	3659
	LB	16175	14476	12476	10476	8476	6476	18656	16956	14956	12956	10956	8956	20793	19093	17093	15093	13093	11093
	R/C	100	100	100	100	100	100	101	101	101	101	101	101	100	100	100	100	100	100
ISA +10°C	MIN	* 368	* 317	* 257	* 192	* 112	* 39	* 481	* 430	* 374	* 308	* 240	* 167	* 593	* 542	* 492	* 426	* 361	* 288
	NM	2935	2525	2061	1523	881	281	3828	3416	2993	2456	1924	1327	4695	4286	3925	3388	2897	2300
	LB	11378	9684	7685	5685	3429	1424	14200	12498	10498	8498	6500	4499	16840	15140	13140	11140	9140	7140
	R/C	100	101	101	101	100	100	100	100	100	100	100	100	100	100	100	100	100	100
ISA	MIN	* 199	* 139	* 73	27	22	18	* 316	* 267	* 202	* 124	* 51	23	* 434	* 388	* 323	* 257	* 185	* 97
	NM	1566	1086	554	184	143	119	2489	2121	1594	971	382	155	3405	3079	2552	2046	1462	759
	LB	6591	4606	2592	1189	988	855	9764	8064	6064	3789	1777	974	12744	11037	9037	7037	5038	2782
	R/C	100	100	100	185	432	700	100	100	100	101	100	281	102	100	100	100	100	100
ISA -10°C	MIN	* 214	* 162	* 84	28	22	18	* 335	* 282	* 217	* 137	* 61	23	* 456	* 404	* 342	* 274	* 199	* 108
	NM	1651	1233	633	185	140	116	2580	2163	1676	1053	455	154	3505	3088	2644	2134	1542	835
	LB	6807	5108	2821	1161	951	819	9950	8250	6250	3985	1972	942	12903	11202	9202	7202	5203	2952
	R/C	100	100	100	150	401	673	100	101	101	101	100	250	101	101	101	101	101	100

* INDICATES STEP CLIMB REQUIRED
NOTE: STEP CLIMB DATA INCLUDES TIME, DISTANCE AND FUEL USED IN CRUISE PORTION, BASED ON MAXIMUM CRUISE THRUST.

NOTE: FOR CLIMB CONDITIONS REQUIRING A STEP CLIMB, THE FOLLOWING TABLE GIVES THE WEIGHT AT THE END OF STEP CRUISE AT THE STEP ALTITUDE, REQUIRED TO CONTINUE CLIMB.

STEP CLIMB ALT IN FEET	TEMPERATURE ISA -10°C	ISA + 0°C	ISA +10°C	ISA +20°C
37000	----	----	----	32892
39000	----	----	----	29244
41000	----	----	31424	25989
43000	32589	32877	27979	22874
45000	29423	29662	24803	20214
47000	26231	26436	22163	18122
49000	23230	23407	19909	16335

CRUISE CLIMB SPEED - KIAS

PRESSURE ALTTITUDE-FEET												
0	5000	10000	15000	20000	25000	30000	35000	40000	45000	50000	51000
270	270	270	270	270	270	270	265	236	210	187	182

WIND EFFECT ON CLIMB DISTANCE - NM
(SUBTRACT FOR HEADWIND, ADD FOR TAILWIND)

CLIMB TIME (MIN)	WIND 25KTS	50KTS	100KTS
5	2	4	8
10	4	8	16
15	6	12	25
20	8	16	33
25	10	20	41
30	12	25	50

Figure 7-15 (Sheet 2)

CRUISE CLIMB

270 KIAS/0.78 INDICATED MACH

TIME, DISTANCE, FUEL, AND RATE OF CLIMB

ANTI-ICE SYSTEMS ON

PRESSURE ALTITUDE 5000 FEET — ISA = 5°C = 41°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +10°C	MIN	2	2	2	2	2	2
	NM	9	8	8	7	6	6
	LB	146	136	125	115	106	96
	R/C	2321	2493	2713	2959	3236	3550
ISA	MIN	2	2	2	2	2	2
	NM	7	6	6	5	5	4
	LB	123	115	106	98	90	83
	R/C	2984	3189	3455	3752	4087	4468
ISA -10°C	MIN	2	2	2	2	2	2
	NM	7	6	6	5	5	4
	LB	117	110	102	94	86	79
	R/C	3042	3251	3522	3825	4166	4555

PRESSURE ALTITUDE 10000 FEET — ISA = - 5°C = 23°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +10°C	MIN	5	4	4	4	4	3
	NM	21	19	18	16	15	13
	LB	300	280	257	236	216	196
	R/C	2246	2416	2635	2878	3152	3463
ISA	MIN	4	4	3	3	3	3
	NM	16	15	14	12	11	10
	LB	252	236	217	200	184	168
	R/C	2739	2934	3187	3470	3788	4149
ISA -10°C	MIN	4	4	3	3	3	3
	NM	15	14	13	12	11	10
	LB	240	225	208	191	176	161
	R/C	2792	2992	3250	3539	3863	4232

PRESSURE ALTITUDE 15000 FEET — ISA = -15°C = 6°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +10°C	MIN	7	7	6	6	5	5
	NM	33	31	28	26	23	21
	LB	447	416	382	350	320	292
	R/C	2071	2235	2446	2681	2944	3243
ISA	MIN	6	5	5	5	4	4
	NM	25	24	22	20	18	17
	LB	377	352	325	299	274	251
	R/C	2663	2859	3111	3392	3709	4069
ISA -10°C	MIN	6	5	5	4	4	4
	NM	25	23	21	19	18	16
	LB	360	336	310	285	262	239
	R/C	2721	2921	3179	3467	3791	4159

PRESSURE ALTITUDE 17000 FEET — ISA = -19°C = - 2°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +10°C	MIN	8	7	7	6	6	5
	NM	39	36	33	30	27	25
	LB	509	474	435	398	363	331
	R/C	1935	2093	2298	2524	2778	3066
ISA	MIN	6	6	6	5	5	4
	NM	30	28	26	23	21	20
	LB	428	400	369	339	311	284
	R/C	2492	2681	2924	3195	3499	3844
ISA -10°C	MIN	6	6	5	5	5	4
	NM	29	27	25	23	21	19
	LB	408	381	352	323	296	271
	R/C	2540	2732	2981	3258	3568	3921

PRESSURE ALTITUDE 19000 FEET — ISA = -23°C = - 9°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +10°C	MIN	9	8	8	7	7	6
	NM	45	42	38	35	32	29
	LB	574	534	489	447	408	371
	R/C	1785	1937	2133	2350	2594	2869
ISA	MIN	7	7	6	6	5	5
	NM	35	32	30	27	25	23
	LB	481	449	414	380	349	318
	R/C	2345	2527	2763	3025	3318	3652
ISA -10°C	MIN	7	7	6	6	5	5
	NM	33	31	29	26	24	22
	LB	459	428	394	362	332	303
	R/C	2384	2570	2811	3078	3378	3718

PRESSURE ALTITUDE 21000 FEET — ISA = -27°C = -16°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +10°C	MIN	10	10	9	8	7	7
	NM	53	49	45	41	37	33
	LB	643	597	546	499	455	414
	R/C	1615	1761	1948	2155	2386	2648
ISA	MIN	8	8	7	7	6	6
	NM	40	37	34	31	29	26
	LB	536	500	460	423	387	353
	R/C	2197	2374	2601	2855	3139	3460
ISA -10°C	MIN	8	7	7	6	6	5
	NM	39	36	33	30	28	25
	LB	511	477	438	403	369	336
	R/C	2233	2414	2647	2905	3195	3524

PRESSURE ALTITUDE 23000 FEET — ISA = -31°C = -23°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +10°C	MIN	12	11	10	9	8	8
	NM	61	57	52	47	43	39
	LB	715	663	606	553	504	457
	R/C	1454	1593	1772	1969	2189	2437
ISA	MIN	9	9	8	7	7	6
	NM	46	43	39	36	33	30
	LB	592	552	508	466	426	389
	R/C	2066	2238	2459	2704	2980	3291
ISA -10°C	MIN	9	8	8	7	7	6
	NM	44	41	38	35	32	29
	LB	564	526	483	443	406	370
	R/C	2105	2281	2508	2759	3041	3360

PRESSURE ALTITUDE 25000 FEET — ISA = -35°C = -30°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +10°C	MIN	13	12	11	10	9	8
	NM	71	65	59	54	49	44
	LB	792	733	668	609	554	503
	R/C	1343	1478	1650	1841	2053	2292
ISA	MIN	10	9	9	8	7	7
	NM	53	49	45	41	37	34
	LB	650	606	556	510	466	425
	R/C	1965	2134	2350	2590	2859	3163
ISA -10°C	MIN	10	9	9	8	7	7
	NM	51	47	43	39	36	32
	LB	619	577	529	485	444	404
	R/C	2004	2176	2398	2644	2920	3231

PRESSURE ALTITUDE 27000 FEET — ISA = -38°C = -37°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +10°C	MIN	15	14	12	11	10	9
	NM	81	75	68	62	56	50
	LB	874	807	735	668	607	550
	R/C	1204	1333	1499	1681	1884	2113
ISA	MIN	11	10	10	9	8	7
	NM	60	55	51	46	42	38
	LB	711	661	607	556	508	462
	R/C	1812	1975	2183	2415	2674	2966
ISA -10°C	MIN	11	10	9	9	8	7
	NM	57	53	49	44	40	37
	LB	677	629	577	529	483	440
	R/C	1844	2011	2225	2462	2727	3027

PRESSURE ALTITUDE 29000 FEET — ISA = -42°C = -44°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +10°C	MIN	16	15	14	13	11	10
	NM	94	86	78	71	64	57
	LB	964	888	806	732	663	600
	R/C	1062	1186	1345	1519	1712	1929
ISA	MIN	12	11	11	10	9	8
	NM	68	63	57	52	48	43
	LB	776	721	660	604	551	501
	R/C	1621	1776	1974	2194	2439	2716
ISA -10°C	MIN	12	11	10	10	9	8
	NM	65	60	55	50	46	41
	LB	739	686	628	574	524	477
	R/C	1646	1804	2008	2233	2484	2767

PRESSURE ALTITUDE 31000 FEET — ISA = -46°C = -52°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +10°C	MIN	18	17	15	14	13	11
	NM	109	99	90	81	73	65
	LB	1062	975	883	799	723	653
	R/C	952	1072	1224	1393	1579	1788
ISA	MIN	14	13	12	11	10	9
	NM	77	71	65	59	54	49
	LB	845	784	716	654	596	542
	R/C	1476	1626	1818	2029	2265	2530
ISA -10°C	MIN	13	12	11	10	10	9
	NM	74	69	62	57	52	47
	LB	804	745	681	622	567	515
	R/C	1498	1652	1848	2065	2307	2578

PRESSURE ALTITUDE 33000 FEET — ISA = -50°C = -59°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +10°C	MIN	21	19	17	15	14	13
	NM	126	115	103	92	83	74
	LB	1170	1070	965	872	786	709
	R/C	835	950	1097	1258	1437	1637
ISA	MIN	15	14	13	12	11	10
	NM	87	81	73	67	60	55
	LB	918	849	775	707	643	584
	R/C	1392	1539	1728	1935	2167	2427
ISA -10°C	MIN	15	14	13	11	10	10
	NM	84	78	70	64	58	52
	LB	873	808	737	672	611	555
	R/C	1409	1559	1753	1966	2202	2469

PRESSURE ALTITUDE 35000 FEET — ISA = -54°C = -66°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +10°C	MIN	23	21	19	17	15	14
	NM	143	130	116	103	93	83
	LB	1273	1161	1043	939	845	760
	R/C	906	1041	1213	1402	1611	1844
ISA	MIN	16	15	14	13	12	10
	NM	98	90	82	74	67	60
	LB	988	912	831	756	687	623
	R/C	1443	1611	1823	2058	2318	2611
ISA -10°C	MIN	16	15	14	12	11	10
	NM	94	87	79	71	64	58
	LB	940	868	790	719	653	592
	R/C	1446	1616	1834	2073	2338	2635

PRESSURE ALTITUDE 37000 FEET — ISA = -57°C = -70°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +10°C	MIN	25	23	20	18	16	15
	NM	160	144	128	114	102	91
	LB	1372	1245	1114	1000	898	805
	R/C	884	1043	1245	1466	1709	1980
ISA	MIN	18	16	15	14	12	11
	NM	108	99	90	81	73	66
	LB	1052	969	881	800	726	657
	R/C	1463	1657	1903	2173	2473	2808
ISA -10°C	MIN	18	16	15	13	12	11
	NM	104	96	86	78	70	63
	LB	1003	923	839	761	690	625
	R/C	1450	1645	1892	2167	2470	2809

PRESSURE ALTITUDE 39000 FEET — ISA = -57°C = -70°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +10°C	MIN	29	26	23	20	18	16
	NM	187	166	145	128	113	100
	LB	1509	1354	1201	1071	957	855
	R/C	412	553	730	924	1136	1370
ISA	MIN	20	18	16	15	13	12
	NM	121	110	99	89	80	72
	LB	1127	1034	936	848	767	693
	R/C	1010	1187	1411	1656	1926	2226
ISA -10°C	MIN	19	18	16	14	13	12
	NM	117	107	96	86	77	69
	LB	1075	985	891	807	730	659
	R/C	1003	1182	1410	1658	1932	2237

PRESSURE ALTITUDE 41000 FEET — ISA = -57°C = -70°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +10°C	MIN	----	33	27	23	20	18
	NM	----	220	179	152	132	115
	LB	----	1600	1355	1180	1040	921
	R/C	----	148	314	493	689	903
ISA	MIN	22	20	18	16	15	13
	NM	142	127	113	100	90	80
	LB	1236	1121	1006	906	816	734
	R/C	563	739	950	1179	1430	1708
ISA -10°C	MIN	22	20	18	16	14	13
	NM	137	122	108	96	86	77
	LB	1176	1067	957	861	775	698
	R/C	622	806	1026	1265	1525	1814

WIND EFFECT ON CLIMB DISTANCE - NM
(SUBTRACT FOR HEADWIND, ADD FOR TAILWIND)

CLIMB TIME (MIN)	WIND 25KTS	50KTS	100KTS
5	2	4	8
10	4	8	16
15	6	12	25
20	8	16	33
25	10	20	41
30	12	25	50

CRUISE CLIMB SPEED - KIAS

PRESSURE ALTTITUDE-FEET									
0	5000	10000	15000	20000	25000	30000	35000	40000	41000
270	270	270	270	270	270	270	265	236	230

Figure 7-16

CRUISE CLIMB

300 KIAS/0.80 INDICATED MACH

TIME, DISTANCE, FUEL, AND RATE OF CLIMB **ANTI-ICE SYSTEMS OFF**

T.O. WEIGHT	35700	34000	32000	30000	28000	26000	35700	34000	32000	30000	28000	26000	35700	34000	32000	30000	28000	26000
PRESSURE ALTITUDE	35000 FEET ISA = -54°C = -66°F						37000 FEET ISA = -57°C = -70°F						39000 FEET ISA = -57°C = -70°F					
MIN	65	55	46	40	34	30	70	59	50	42	36	32	* 101	* 68	55	46	39	34
ISA NM	465	392	327	277	238	205	507	425	353	298	255	220	763	492	397	330	279	239
+20°C LB	3105	2648	2237	1915	1655	1439	3299	2803	2358	2013	1735	1506	4397	3085	2541	2146	1837	1587
R/C	449	549	684	836	1007	1199	350	448	578	726	894	1082	100	135	264	397	545	712
MIN	30	27	24	22	19	17	32	29	26	23	21	18	35	32	28	25	22	20
ISA NM	202	182	162	144	128	114	218	196	174	154	137	122	244	217	190	168	149	132
+10°C LB	1590	1441	1287	1152	1032	924	1678	1516	1352	1208	1080	966	1803	1616	1432	1274	1136	1013
R/C	1075	1228	1424	1642	1883	2154	874	1033	1223	1430	1662	1921	463	609	794	990	1193	1421
MIN	19	18	16	15	13	12	20	19	17	16	14	13	22	20	18	17	15	14
ISA NM	123	113	103	93	84	76	133	122	110	100	90	81	146	133	120	108	97	88
LB	1110	1025	932	848	770	697	1168	1076	977	888	805	728	1239	1137	1030	933	844	763
R/C	1772	1966	2215	2492	2800	3148	1461	1659	1899	2158	2448	2773	998	1181	1410	1658	1916	2205
MIN	19	17	16	14	13	12	20	19	17	15	14	13	22	20	18	16	15	13
ISA NM	119	109	99	90	81	73	128	118	106	96	87	78	141	129	116	104	94	85
-10°C LB	1060	978	889	808	733	664	1115	1027	932	846	767	694	1185	1087	983	890	805	727
R/C	1763	1960	2212	2492	2804	3155	1450	1650	1894	2156	2450	2779	978	1162	1395	1647	1907	2200
PRESSURE ALTITUDE	41000 FEET ISA = -57°C = -70°F						43000 FEET ISA = -57°C = -70°F						45000 FEET ISA = -57°C = -70°F					
MIN	* 210	* 164	* 107	* 56	45	38	* 316	* 270	* 213	* 154	* 90	* 46	* 428	* 382	* 325	* 267	* 203	* 137
ISA NM	1670	1297	830	405	323	269	2548	2176	1710	1226	702	333	3481	3111	2645	2163	1640	1091
+20°C LB	7941	6229	4228	2431	2005	1703	11060	9349	7349	5341	3340	1922	14052	12345	10346	8346	6346	4348
R/C	101	100	100	120	270	425	102	100	100	100	100	163	101	100	100	100	100	101
MIN	44	37	32	27	24	21	* 149	* 99	41	32	27	24	* 262	* 212	* 153	* 88	35	28
ISA NM	312	259	219	189	165	145	1183	774	292	228	191	164	2120	1712	1222	687	251	197
+10°C LB	2096	1797	1553	1364	1206	1070	5518	3819	1838	1514	1306	1144	8853	7156	5146	3143	1515	1259
R/C	114	257	437	630	839	1053	100	100	102	291	494	715	101	101	100	100	146	360
MIN	25	22	20	18	16	15	30	26	23	20	18	16	* 90	* 41	28	23	20	18
ISA NM	167	150	133	119	107	96	207	178	153	134	119	105	701	291	190	158	136	118
LB	1340	1218	1095	986	889	801	1519	1341	1183	1054	943	845	3500	1799	1333	1150	1012	898
R/C	616	796	1021	1262	1526	1803	260	431	652	891	1148	1428	100	100	292	521	775	1049
MIN	25	22	20	18	16	15	31	26	23	20	18	16	* 103	* 51	28	23	20	18
ISA NM	162	146	129	115	103	92	206	174	149	130	115	102	784	367	189	155	132	115
-10°C LB	1286	1167	1047	942	849	764	1476	1293	1135	1008	901	807	3751	2051	1292	1105	969	859
R/C	588	770	998	1243	1509	1789	221	395	619	860	1119	1403	100	100	259	490	749	1026
PRESSURE ALTITUDE	47000 FEET ISA = -57°C = -70°F						49000 FEET ISA = -57°C = -70°F						51000 FEET ISA = -57°C = -70°F					
MIN	* 548	* 504	* 446	* 388	* 324	* 257	----	----	* 554	* 496	* 432	* 365	----	----	----	* 597	* 534	* 467
ISA NM	4478	4113	3647	3165	2642	2089	----	----	4565	4083	3560	3011	----	----	----	4951	4431	3882
+20°C LB	16926	15235	13234	11234	9235	7225	----	----	15729	13729	11728	9729	----	----	----	15864	13871	11871
R/C	100	101	101	101	101	100	----	----	101	101	101	101	----	----	----	100	101	101
MIN	* 375	* 325	* 266	* 201	* 134	* 62	* 492	* 442	* 384	* 319	* 252	* 180	----	* 561	* 502	* 437	* 371	* 299
ISA NM	3059	2651	2164	1630	1077	482	4041	3630	3143	2610	2058	1464	----	4618	4130	3597	3046	2451
+10°C LB	11876	10178	8178	6178	4172	2169	14739	13033	11033	9033	7034	5031	----	15640	13638	11640	9640	7638
R/C	101	101	101	101	100	100	102	101	101	101	101	101	----	101	101	101	101	101
MIN	* 202	* 152	* 88	31	24	20	* 320	* 270	* 206	* 140	* 68	26	* 442	* 392	* 328	* 262	* 191	* 116
ISA NM	1619	1210	685	216	166	138	2584	2176	1653	1112	527	181	3594	3184	2662	2122	1539	925
LB	6832	5134	3126	1363	1122	970	10012	8318	6317	4312	2309	1110	13032	11334	9335	7333	5335	3333
R/C	100	101	100	133	372	640	100	101	101	100	100	220	100	101	101	101	101	101
MIN	* 218	* 166	* 100	* 33	24	20	* 339	* 287	* 221	* 153	* 79	26	* 465	* 413	* 347	* 280	* 205	* 128
ISA NM	1711	1295	770	228	164	135	2679	2262	1739	1196	604	181	3695	3278	2754	2212	1621	1004
-10°C LB	7068	5373	3369	1368	1083	930	10210	8512	6512	4512	2506	1078	13203	11504	9505	7505	5504	3502
R/C	100	101	100	100	339	609	100	101	101	101	100	188	101	101	101	101	101	100

* INDICATES STEP CLIMB REQUIRED
NOTE: STEP CLIMB DATA INCLUDES TIME, DISTANCE AND FUEL USED IN CRUISE PORTION, BASED ON MAXIMUM CRUISE THRUST.

CRUISE CLIMB SPEED - KIAS

PRESSURE ALTTITUDE-FEET											
0	5000	10000	15000	20000	25000	30000	35000	40000	45000	50000	51000
270	270	300	300	300	300	300	272	242	216	192	188

WIND EFFECT ON CLIMB DISTANCE - NM
(SUBTRACT FOR HEADWIND, ADD FOR TAILWIND)

CLIMB TIME (MIN)	WIND 25KTS	50KTS	100KTS
5	2	4	8
10	4	8	16
15	6	12	25
20	8	16	33
25	10	20	41
30	12	25	50

NOTE: FOR CLIMB CONDITIONS REQUIRING A STEP CLIMB, THE FOLLOWING TABLE GIVES THE WEIGHT AT THE END OF STEP CRUISE AT THE STEP ALTITUDE, REQUIRED TO CONTINUE CLIMB.

STEP CLIMB ALT IN FEET	TEMPERATURE ISA -10°C	ISA + 0°C	ISA +10°C	ISA +20°C
37000	----	----	----	31633
39000	----	----	----	28088
41000	----	----	30469	24952
43000	32224	32486	27112	21908
45000	28865	29119	24061	19000
47000	25697	25904	21169	16475
49000	22673	22851	18540	14317

Figure 7-13 (Sheet 2)

CRUISE CLIMB

300 KIAS/0.80 INDICATED MACH

TIME, DISTANCE, FUEL, AND RATE OF CLIMB

ANTI-ICE SYSTEMS ON

PRESSURE ALTITUDE 5000 FEET — ISA = 5°C = 41°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +10°C	MIN	3	3	3	3	2	2
	NM	12	11	10	9	8	7
	LB	173	161	147	134	122	111
	R/C	1758	1902	2084	2289	2517	2776
ISA	MIN	2	2	2	2	2	2
	NM	9	8	8	7	6	6
	LB	141	132	121	111	102	93
	R/C	2312	2484	2705	2952	3229	3545
ISA -10°C	MIN	2	2	2	2	2	2
	NM	9	8	7	7	6	5
	LB	135	126	116	107	98	89
	R/C	2363	2539	2765	3018	3301	3624

PRESSURE ALTITUDE 10000 FEET — ISA = - 5°C = 23°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +10°C	MIN	8	7	6	6	5	5
	NM	37	34	31	28	25	23
	LB	450	413	375	340	308	278
	R/C	758	840	945	1058	1185	1328
ISA	MIN	6	5	5	4	4	4
	NM	26	24	22	20	18	16
	LB	341	317	290	266	242	220
	R/C	1251	1358	1496	1649	1820	2013
ISA -10°C	MIN	5	5	5	4	4	4
	NM	25	23	21	19	17	16
	LB	326	302	277	253	231	210
	R/C	1288	1399	1541	1698	1874	2074

PRESSURE ALTITUDE 15000 FEET — ISA = -15°C = 6°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +10°C	MIN	17	15	13	12	11	10
	NM	95	84	74	66	58	52
	LB	944	846	748	665	592	527
	R/C	432	506	602	705	819	947
ISA	MIN	10	9	9	8	7	6
	NM	53	49	44	40	36	33
	LB	603	556	505	458	415	376
	R/C	1020	1126	1262	1412	1579	1766
ISA -10°C	MIN	10	9	8	8	7	6
	NM	51	47	42	38	35	31
	LB	572	527	479	435	394	357
	R/C	1056	1166	1306	1461	1633	1826

PRESSURE ALTITUDE 17000 FEET — ISA = -19°C = - 2°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +10°C	MIN	22	19	17	15	13	12
	NM	126	111	96	85	74	66
	LB	1190	1055	923	813	719	637
	R/C	401	473	565	666	777	900
ISA	MIN	12	11	10	9	8	8
	NM	66	60	55	49	44	40
	LB	711	653	592	536	485	438
	R/C	1015	1121	1257	1406	1573	1761
ISA -10°C	MIN	12	11	10	9	8	7
	NM	63	57	52	47	42	38
	LB	674	619	561	508	460	415
	R/C	1054	1164	1304	1459	1632	1826

PRESSURE ALTITUDE 19000 FEET — ISA = -23°C = - 9°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +10°C	MIN	27	24	21	18	16	14
	NM	161	140	121	105	92	81
	LB	1451	1275	1106	968	851	751
	R/C	368	439	529	627	736	857
ISA	MIN	14	13	12	11	10	9
	NM	79	72	65	59	53	47
	LB	819	751	679	614	554	500
	R/C	988	1094	1229	1378	1544	1731
ISA -10°C	MIN	14	13	11	10	9	9
	NM	75	69	62	56	50	45
	LB	775	710	642	581	525	473
	R/C	1032	1142	1282	1437	1609	1803

PRESSURE ALTITUDE 21000 FEET — ISA = -27°C = -16°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +10°C	MIN	33	28	25	21	19	16
	NM	200	173	148	128	111	97
	LB	1724	1503	1295	1127	986	866
	R/C	346	415	503	601	708	828
ISA	MIN	16	15	13	12	11	10
	NM	93	85	76	68	62	55
	LB	928	849	766	691	623	561
	R/C	983	1090	1226	1376	1543	1732
ISA -10°C	MIN	16	14	13	12	11	10
	NM	88	80	72	65	58	52
	LB	875	801	723	653	589	531
	R/C	1035	1146	1287	1444	1618	1815

PRESSURE ALTITUDE 23000 FEET — ISA = -31°C = -23°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +10°C	MIN	39	33	29	25	22	19
	NM	241	207	176	152	131	114
	LB	2005	1737	1488	1288	1123	983
	R/C	336	404	491	588	695	815
ISA	MIN	18	17	15	14	12	11
	NM	107	97	87	78	70	63
	LB	1035	946	852	768	692	622
	R/C	986	1094	1232	1384	1553	1743
ISA -10°C	MIN	18	16	15	13	12	11
	NM	101	92	83	74	67	60
	LB	974	891	803	724	652	587
	R/C	1045	1158	1302	1461	1638	1837

PRESSURE ALTITUDE 25000 FEET — ISA = -35°C = -30°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +10°C	MIN	46	39	33	28	25	22
	NM	292	249	210	179	154	134
	LB	2333	2005	1703	1465	1271	1108
	R/C	261	324	407	499	600	713
ISA	MIN	20	19	17	15	14	12
	NM	122	111	100	89	80	72
	LB	1148	1047	941	847	762	685
	R/C	894	998	1132	1278	1442	1625
ISA -10°C	MIN	20	18	16	15	13	12
	NM	115	105	94	84	76	68
	LB	1078	984	886	797	718	645
	R/C	939	1048	1187	1340	1511	1701

PRESSURE ALTITUDE 27000 FEET — ISA = -38°C = -37°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +10°C	MIN	58	48	40	34	29	25
	NM	383	316	260	218	186	160
	LB	2877	2406	2003	1699	1459	1262
	R/C	117	174	247	329	419	520
ISA	MIN	23	21	19	17	15	14
	NM	141	128	114	102	92	82
	LB	1278	1163	1043	936	840	754
	R/C	693	788	910	1044	1192	1358
ISA -10°C	MIN	22	20	18	16	15	13
	NM	133	121	108	96	86	77
	LB	1199	1091	979	879	790	709
	R/C	739	839	967	1107	1262	1437

PRESSURE ALTITUDE 29000 FEET — ISA = -42°C = -44°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +10°C	MIN	----	----	51	41	35	29
	NM	----	----	344	277	230	195
	LB	----	----	2474	2031	1709	1459
	R/C	----	----	152	227	310	403
ISA	MIN	26	24	21	19	17	15
	NM	167	150	133	119	106	94
	LB	1437	1300	1160	1037	929	831
	R/C	559	649	763	889	1027	1182
ISA -10°C	MIN	25	23	20	18	16	15
	NM	156	140	125	111	99	88
	LB	1341	1215	1086	972	870	779
	R/C	610	705	826	958	1105	1269

PRESSURE ALTITUDE 31000 FEET — ISA = -46°C = -52°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +10°C	MIN	----	----	67	51	42	35
	NM	----	----	471	358	287	237
	LB	----	----	3156	2462	2012	1686
	R/C	----	----	110	182	266	361
ISA	MIN	30	27	24	21	19	17
	NM	195	175	154	136	121	107
	LB	1610	1448	1285	1144	1020	910
	R/C	528	621	740	870	1015	1177
ISA -10°C	MIN	28	26	23	20	18	16
	NM	181	162	143	127	113	100
	LB	1494	1346	1197	1067	953	851
	R/C	595	694	820	959	1113	1285

PRESSURE ALTITUDE 33000 FEET — ISA = -50°C = -59°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +10°C	MIN	----	----	75	58	46	38
	NM	----	----	538	407	324	266
	LB	----	----	3495	2710	2199	1831
	R/C	----	----	303	397	516	658
ISA	MIN	33	30	26	23	21	18
	NM	219	195	171	151	133	118
	LB	1746	1564	1382	1226	1090	971
	R/C	723	852	1018	1202	1405	1631
ISA -10°C	MIN	31	28	25	22	20	17
	NM	202	180	158	140	124	110
	LB	1613	1448	1283	1140	1016	905
	R/C	807	944	1119	1313	1526	1766

PRESSURE ALTITUDE 35000 FEET — ISA = -54°C = -66°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +10°C	MIN	----	----	81	62	50	41
	NM	----	----	588	445	354	289
	LB	----	----	3738	2896	2342	1943
	R/C	----	----	318	413	537	683
ISA	MIN	36	32	28	25	22	20
	NM	242	214	187	164	144	128
	LB	1871	1668	1468	1299	1152	1023
	R/C	643	773	942	1128	1335	1565
ISA -10°C	MIN	34	30	27	24	21	19
	NM	222	197	172	152	134	119
	LB	1723	1541	1360	1206	1072	953
	R/C	715	853	1030	1226	1443	1686

PRESSURE ALTITUDE 37000 FEET — ISA = -57°C = -70°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +10°C	MIN	----	----	90	69	55	45
	NM	----	----	657	494	389	316
	LB	----	----	4046	3118	2504	2065
	R/C	----	----	185	273	389	528
ISA	MIN	40	35	31	27	24	21
	NM	271	237	205	179	157	138
	LB	2017	1785	1562	1376	1216	1077
	R/C	481	620	781	960	1160	1381
ISA -10°C	MIN	37	33	29	25	22	20
	NM	247	217	189	165	145	128
	LB	1850	1643	1443	1275	1129	1002
	R/C	546	692	864	1052	1262	1496

PRESSURE ALTITUDE 39000 FEET — ISA = -57°C = -70°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +10°C	MIN	----	----	----	----	----	52
	NM	----	----	----	----	----	369
	LB	----	----	----	----	----	2280
	R/C	----	----	----	----	----	180
ISA	MIN	----	41	35	30	26	23
	NM	----	282	236	202	175	153
	LB	----	1994	1704	1482	1300	1145
	R/C	----	197	355	520	692	883
ISA -10°C	MIN	45	38	32	28	25	22
	NM	303	254	215	185	161	141
	LB	2111	1816	1565	1367	1203	1062
	R/C	125	258	426	601	782	985

PRESSURE ALTITUDE 41000 FEET — ISA = -57°C = -70°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +10°C	MIN	----	----	----	----	----	----
	NM	----	----	----	----	----	----
	LB	----	----	----	----	----	----
	R/C	----	----	----	----	----	----
ISA	MIN	----	----	----	37	31	26
	NM	----	----	----	260	210	178
	LB	----	----	----	1722	1445	1248
	R/C	----	----	----	134	309	482
ISA -10°C	MIN	----	----	----	34	28	24
	NM	----	----	----	230	190	162
	LB	----	----	----	1552	1322	1150
	R/C	----	----	----	203	388	572

WIND EFFECT ON CLIMB DISTANCE - NM
(SUBTRACT FOR HEADWIND, ADD FOR TAILWIND)

CLIMB TIME (MIN)	WIND 25KTS	50KTS	100KTS
5	2	4	8
10	4	8	16
15	6	12	25
20	8	16	33
25	10	20	41
30	12	25	50

CRUISE CLIMB SPEED - KIAS

PRESSURE ALTTITUDE-FEET									
0	5000	10000	15000	20000	25000	30000	35000	40000	41000
270	270	300	300	300	300	300	272	242	237

Figure 7-14

CRUISE CLIMB

270 KIAS/0.78 INDICATED MACH

TIME, DISTANCE, FUEL, AND RATE OF CLIMB — **ANTI-ICE SYSTEMS OFF**

T.O. WEIGHT	35700	34000	32000	30000	28000	26000	35700	34000	32000	30000	28000	26000	35700	34000	32000	30000	28000	26000
PRESSURE ALTITUDE	5000 FEET ISA = 5°C = 41°F						10000 FEET ISA = - 5°C = 23°F						15000 FEET ISA = -15°C = 6°F					
MIN	3	3	3	2	2	2	6	6	5	5	4	4	9	8	8	7	6	6
ISA NM	12	11	10	9	8	8	28	26	23	21	19	17	44	41	37	34	30	28
+20°C LB	169	157	144	131	120	109	351	325	297	271	246	223	522	483	440	401	365	331
R/C	1767	1909	2092	2295	2523	2781	1756	1900	2084	2290	2519	2780	1537	1672	1846	2039	2255	2499
MIN	2	2	2	2	2	2	5	4	4	4	4	3	7	6	6	6	5	5
ISA NM	9	8	8	7	6	6	20	19	17	16	14	13	33	30	28	25	23	21
+10°C LB	139	129	119	109	100	92	285	265	244	224	205	186	424	395	363	332	304	277
R/C	2341	2513	2735	2982	3261	3577	2263	2433	2653	2898	3173	3486	2084	2248	2461	2697	2961	3262
MIN	2	2	2	2	2	2	4	4	3	3	3	3	6	5	5	5	4	4
ISA NM	7	6	6	5	5	4	16	15	13	12	11	10	25	24	22	20	18	17
LB	117	110	102	94	86	79	240	225	207	191	175	160	359	336	310	285	262	239
R/C	3008	3214	3482	3780	4117	4501	2753	2950	3204	3487	3806	4170	2685	2881	3135	3418	3737	4099
MIN	2	2	2	2	2	2	4	4	3	3	3	3	6	5	5	4	4	4
ISA NM	7	6	6	5	5	4	15	14	13	12	11	10	24	23	21	19	17	16
-10°C LB	112	105	97	90	83	76	230	215	198	183	168	154	343	321	296	272	250	228
R/C	3066	3277	3550	3854	4198	4589	2812	3013	3273	3563	3889	4260	2737	2938	3198	3487	3812	4182
PRESSURE ALTITUDE	17000 FEET ISA = -19°C = - 2°F						19000 FEET ISA = -23°C = - 9°F						21000 FEET ISA = -27°C = -16°F					
MIN	10	10	9	8	7	7	12	11	10	9	8	8	14	13	12	11	10	9
ISA NM	52	48	44	40	36	33	62	57	52	47	42	38	73	67	61	55	50	45
+20°C LB	597	552	503	457	415	376	679	626	569	517	469	425	770	709	643	583	528	477
R/C	1380	1509	1675	1857	2062	2292	1204	1326	1481	1653	1844	2059	1020	1134	1279	1439	1617	1817
MIN	8	7	7	6	6	5	9	8	8	7	7	6	10	9	9	8	7	7
ISA NM	38	36	33	30	27	25	45	42	38	35	32	29	52	48	44	40	37	33
+10°C LB	483	449	412	378	345	314	544	506	464	424	387	353	609	565	518	473	431	392
R/C	1945	2104	2309	2537	2792	3081	1799	1952	2149	2368	2612	2889	1636	1783	1972	2181	2414	2678
MIN	6	6	6	5	5	4	7	7	6	6	5	5	8	8	7	6	6	5
ISA NM	30	28	25	23	21	19	35	32	30	27	25	23	40	37	34	31	29	26
LB	408	381	352	323	296	271	459	428	394	362	332	303	511	476	439	403	369	337
R/C	2508	2697	2941	3213	3518	3865	2354	2538	2774	3036	3331	3666	2210	2387	2616	2871	3157	3480
MIN	6	6	5	5	5	4	7	7	6	6	5	5	8	7	7	6	6	5
ISA NM	29	27	24	22	20	19	33	31	28	26	24	22	38	36	33	30	27	25
-10°C LB	390	364	336	309	283	259	438	409	376	346	317	290	487	455	418	384	352	321
R/C	2557	2751	3001	3279	3591	3946	2399	2587	2828	3097	3398	3740	2249	2430	2664	2924	3216	3546
PRESSURE ALTITUDE	23000 FEET ISA = -31°C = -23°F						25000 FEET ISA = -35°C = -30°F						27000 FEET ISA = -38°C = -37°F					
MIN	16	15	13	12	11	10	18	17	15	14	12	11	21	19	17	15	14	12
ISA NM	87	80	72	65	58	52	102	93	84	75	67	61	120	109	97	87	78	70
+20°C LB	870	798	721	652	589	532	975	891	804	725	653	588	1091	994	893	803	722	648
R/C	915	1025	1165	1319	1489	1681	854	962	1099	1249	1416	1603	734	837	968	1112	1271	1449
MIN	12	11	10	9	8	8	13	12	11	10	9	8	15	13	12	11	10	9
ISA NM	61	56	51	47	42	38	70	65	59	53	48	44	81	74	67	61	55	50
+10°C LB	677	628	574	524	477	433	749	693	633	577	525	476	827	764	695	633	575	521
R/C	1469	1609	1789	1987	2208	2458	1357	1493	1667	1858	2072	2313	1216	1346	1512	1696	1901	2130
MIN	9	8	8	7	7	6	10	9	9	8	7	7	11	10	10	9	8	7
ISA NM	46	43	39	36	33	30	52	48	44	41	37	34	59	55	50	46	42	38
LB	564	526	483	444	406	370	619	576	529	485	444	405	676	629	577	529	483	440
R/C	2081	2254	2476	2723	2999	3313	1979	2148	2366	2607	2877	3183	1827	1990	2201	2433	2694	2987
MIN	9	8	8	7	7	6	10	9	8	8	7	7	11	10	9	9	8	7
ISA NM	44	41	38	34	31	28	50	47	43	39	36	32	57	53	48	44	40	36
-10°C LB	538	501	461	423	387	353	590	549	505	462	423	385	644	599	550	504	460	419
R/C	2121	2298	2526	2779	3062	3382	2018	2192	2415	2662	2939	3252	1859	2027	2242	2480	2747	3048
PRESSURE ALTITUDE	29000 FEET ISA = -42°C = -44°F						31000 FEET ISA = -46°C = -52°F						33000 FEET ISA = -50°C = -59°F					
MIN	24	22	19	17	15	14	27	25	22	19	17	16	32	28	25	22	20	17
ISA NM	142	128	114	101	90	80	169	151	133	118	104	93	205	180	157	138	121	107
+20°C LB	1223	1108	991	887	795	713	1376	1239	1101	981	876	782	1565	1395	1228	1088	966	859
R/C	618	716	841	978	1129	1298	516	610	730	861	1005	1166	386	475	587	710	845	996
MIN	16	15	14	12	11	10	18	17	15	14	13	11	21	19	17	15	14	13
ISA NM	93	86	77	70	63	57	108	98	89	80	72	65	125	113	102	91	82	74
+10°C LB	911	839	762	692	627	568	1002	921	834	755	683	617	1103	1009	911	823	743	669
R/C	1077	1201	1361	1536	1731	1950	963	1084	1237	1407	1594	1805	845	961	1109	1272	1452	1653
MIN	12	11	10	10	9	8	14	13	12	11	10	9	15	14	13	12	11	10
ISA NM	67	62	57	52	47	43	77	71	65	59	53	48	87	80	73	66	60	54
LB	738	685	628	574	524	477	803	744	681	622	567	515	871	806	736	671	611	555
R/C	1634	1790	1989	2210	2457	2735	1490	1640	1833	2046	2282	2549	1406	1552	1741	1950	2183	2444
MIN	12	11	10	9	9	8	13	12	11	10	9	9	15	14	12	11	10	9
ISA NM	65	60	55	50	45	41	74	68	62	56	51	46	84	77	70	63	58	52
-10°C LB	703	653	598	547	499	454	764	709	648	592	539	490	830	768	701	639	581	528
R/C	1661	1822	2027	2253	2506	2791	1513	1667	1865	2083	2326	2599	1423	1575	1769	1983	2222	2490

Figure 7-15 (Sheet 1 of 2)

CRUISE CLIMB

270 KIAS/0.78 INDICATED MACH

TIME, DISTANCE, FUEL, AND RATE OF CLIMB — **ANTI-ICE SYSTEMS OFF**

	T.O. WEIGHT	35700	34000	32000	30000	28000	26000	35700	34000	32000	30000	28000	26000	35700	34000	32000	30000	28000	26000
	PRESSURE ALTITUDE	35000 FEET ISA = -54°C = -66°F						37000 FEET ISA = -57°C = -70°F						39000 FEET ISA = -57°C = -70°F					
ISA +20°C	MIN	37	33	28	25	22	19	43	37	32	27	24	21	* 76	* 45	37	31	27	23
	NM	245	213	183	159	139	122	290	246	208	179	155	136	560	308	247	207	177	152
	LB	1769	1557	1357	1193	1054	933	1978	1715	1477	1288	1131	997	3145	1981	1646	1408	1222	1069
	R/C	382	484	614	757	915	1090	338	460	616	787	976	1185	100	146	288	443	613	801
ISA +10°C	MIN	23	21	19	17	15	14	25	23	20	18	16	15	28	25	22	20	18	16
	NM	142	128	115	103	92	82	159	143	127	113	101	90	182	162	142	126	111	99
	LB	1200	1094	984	886	798	717	1290	1171	1049	942	846	759	1404	1264	1124	1004	898	803
	R/C	914	1050	1224	1413	1623	1858	915	1075	1280	1503	1750	2025	518	665	850	1052	1274	1519
ISA	MIN	16	15	14	13	11	10	18	16	15	14	12	11	19	18	16	15	13	12
	NM	97	89	81	73	66	60	107	98	89	80	73	65	120	109	98	88	80	72
	LB	937	866	789	718	653	592	997	919	836	759	689	624	1066	979	887	803	727	657
	R/C	1456	1624	1838	2073	2335	2629	1473	1668	1914	2186	2487	2824	1029	1207	1433	1680	1951	2255
ISA -10°C	MIN	16	15	14	12	11	10	17	16	15	13	12	11	19	18	16	14	13	12
	NM	94	86	78	71	64	58	104	95	86	77	70	63	116	106	95	85	77	69
	LB	893	824	751	683	621	563	951	876	796	723	656	593	1018	934	845	765	692	625
	R/C	1463	1635	1853	2094	2361	2660	1460	1657	1908	2182	2487	2827	1011	1192	1420	1670	1945	2252

	T.O. WEIGHT	35700	34000	32000	30000	28000	26000	35700	34000	32000	30000	28000	26000	35700	34000	32000	30000	28000	26000
	PRESSURE ALTITUDE	41000 FEET ISA = -57°C = -70°F						43000 FEET ISA = -57°C = -70°F						45000 FEET ISA = -57°C = -70°F					
ISA +20°C	MIN	* 197	* 141	* 81	39	31	27	* 305	* 259	* 200	* 129	* 64	33	* 416	* 374	* 314	* 255	* 189	* 110
	NM	1551	1100	612	269	214	178	2420	2067	1585	1017	477	230	3304	2990	2508	2039	1503	863
	LB	7062	5087	3072	1647	1367	1170	10256	8557	6557	4309	2296	1348	13316	11616	9616	7617	5616	3382
	R/C	100	100	100	155	317	496	100	100	100	100	100	210	100	100	100	100	100	100
ISA +10°C	MIN	35	30	25	22	20	17	* 125	* 75	33	27	23	20	* 252	* 201	* 129	* 63	29	23
	NM	235	197	167	144	126	111	979	565	222	177	149	128	2005	1591	1015	476	195	156
	LB	1636	1417	1232	1086	963	856	4570	2866	1450	1215	1053	924	8268	6564	4282	2278	1218	1024
	R/C	175	324	501	694	904	1136	100	101	165	356	558	778	101	101	100	100	216	426
ISA	MIN	22	20	18	16	14	13	27	23	20	18	16	14	* 81	32	25	21	18	16
	NM	139	125	111	99	88	79	176	150	129	113	100	89	620	217	163	135	116	101
	LB	1161	1056	949	855	771	694	1325	1170	1032	920	823	737	3109	1441	1170	1009	888	788
	R/C	656	837	1055	1292	1551	1838	288	464	685	921	1170	1444	100	105	323	556	811	1075
ISA -10°C	MIN	22	20	18	16	14	13	27	23	20	18	16	14	* 94	* 41	25	21	18	16
	NM	135	121	107	96	85	76	174	147	126	110	97	86	705	286	161	132	113	98
	LB	1112	1009	906	816	735	661	1281	1124	988	878	785	703	3379	1674	1130	968	850	752
	R/C	631	817	1039	1279	1541	1832	258	438	662	902	1154	1432	100	100	287	527	781	1049

	T.O. WEIGHT	35700	34000	32000	30000	28000	26000	35700	34000	32000	30000	28000	26000	35700	34000	32000	30000	28000	26000
	PRESSURE ALTITUDE	47000 FEET ISA = -57°C = -70°F						49000 FEET ISA = -57°C = -70°F						51000 FEET ISA = -57°C = -70°F					
ISA +20°C	MIN	* 525	* 489	* 430	* 374	* 309	* 241	* 621	* 592	* 533	* 482	* 417	* 351	* 703	* 684	* 625	* 581	* 516	* 454
	NM	4162	3908	3428	2999	2464	1928	4905	4723	4244	3867	3333	2828	5516	5427	4950	4644	4112	3659
	LB	16175	14476	12476	10476	8476	6476	18656	16956	14956	12956	10956	8956	20793	19093	17093	15093	13093	11093
	R/C	100	100	100	100	100	100	101	101	101	101	101	101	100	100	100	100	100	100
ISA +10°C	MIN	* 368	* 317	* 257	* 192	* 112	* 39	* 481	* 430	* 374	* 308	* 240	* 167	* 593	* 542	* 492	* 426	* 361	* 288
	NM	2935	2525	2061	1523	881	281	3828	3416	2993	2456	1924	1327	4695	4286	3925	3388	2897	2300
	LB	11378	9684	7685	5685	3429	1424	14200	12498	10498	8498	6500	4499	16840	15140	13140	11140	9140	7140
	R/C	100	101	101	101	100	100	100	100	100	100	100	100	100	100	100	100	100	100
ISA	MIN	* 199	* 139	* 73	27	22	18	* 316	* 267	* 202	* 124	* 51	23	* 434	* 388	* 323	* 257	* 185	* 97
	NM	1566	1086	554	184	143	119	2489	2121	1594	971	382	155	3405	3079	2552	2046	1462	759
	LB	6591	4606	2592	1189	988	855	9764	8064	6064	3789	1777	974	12744	11037	9037	7037	5038	2782
	R/C	100	100	100	185	432	700	100	100	100	101	100	281	102	100	100	100	100	100
ISA -10°C	MIN	* 214	* 162	* 84	28	22	18	* 335	* 282	* 217	* 137	* 61	23	* 456	* 404	* 342	* 274	* 199	* 108
	NM	1651	1233	633	185	140	116	2580	2163	1676	1053	455	154	3505	3088	2644	2134	1542	835
	LB	6807	5108	2821	1161	951	819	9950	8250	6250	3985	1972	942	12903	11202	9202	7202	5203	2952
	R/C	100	100	100	150	401	673	100	101	101	101	100	250	101	101	101	101	101	100

* INDICATES STEP CLIMB REQUIRED

NOTE: STEP CLIMB DATA INCLUDES TIME, DISTANCE AND FUEL USED IN CRUISE PORTION, BASED ON MAXIMUM CRUISE THRUST.

CRUISE CLIMB SPEED - KIAS

PRESSURE ALTITUDE-FEET											
0	5000	10000	15000	20000	25000	30000	35000	40000	45000	50000	51000
270	270	270	270	270	270	270	265	236	210	187	182

WIND EFFECT ON CLIMB DISTANCE - NM
(SUBTRACT FOR HEADWIND, ADD FOR TAILWIND)

CLIMB TIME (MIN)	WIND 25KTS	50KTS	100KTS
5	2	4	8
10	4	8	16
15	6	12	25
20	8	16	33
25	10	20	41
30	12	25	50

NOTE: FOR CLIMB CONDITIONS REQUIRING A STEP CLIMB, THE FOLLOWING TABLE GIVES THE WEIGHT AT THE END OF STEP CRUISE AT THE STEP ALTITUDE, REQUIRED TO CONTINUE CLIMB.

STEP CLIMB ALT IN FEET	TEMPERATURE ISA -10°C	ISA + 0°C	ISA +10°C	ISA +20°C
37000	----	----	----	32892
39000	----	----	----	29244
41000	----	----	31424	25989
43000	32589	32877	27979	22874
45000	29423	29662	24803	20214
47000	26231	26436	22163	18122
49000	23230	23407	19909	16335

Figure 7-15 (Sheet 2)

CRUISE CLIMB

270 KIAS/0.78 INDICATED MACH

TIME,DISTANCE,FUEL, AND RATE OF CLIMB **ANTI-ICE SYSTEMS ON**

PRESSURE ALTITUDE 5000 FEET, ISA = 5°C = 41°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +10°C	MIN	3	3	3	3	2	2
	NM	12	11	10	9	8	7
	LB	173	161	147	134	122	111
	R/C	1758	1902	2084	2289	2517	2776
ISA	MIN	2	2	2	2	2	2
	NM	9	8	8	7	6	6
	LB	141	132	121	111	102	93
	R/C	2312	2484	2705	2952	3229	3545
ISA -10°C	MIN	2	2	2	2	2	2
	NM	9	8	7	7	6	5
	LB	135	126	116	107	98	89
	R/C	2363	2539	2765	3018	3301	3624

PRESSURE ALTITUDE 10000 FEET, ISA = - 5°C = 23°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +10°C	MIN	6	6	5	5	5	4
	NM	29	27	24	22	20	18
	LB	373	344	313	285	259	234
	R/C	1373	1500	1662	1842	2042	2268
ISA	MIN	5	5	4	4	4	3
	NM	21	20	18	16	15	14
	LB	297	276	253	232	212	193
	R/C	1932	2088	2289	2512	2762	3045
ISA -10°C	MIN	5	5	4	4	4	3
	NM	20	19	17	16	14	13
	LB	284	264	242	221	202	184
	R/C	1979	2139	2344	2573	2829	3119

PRESSURE ALTITUDE 15000 FEET, ISA = -15°C = 6°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +10°C	MIN	11	10	9	8	8	7
	NM	55	50	45	41	37	33
	LB	618	565	510	461	416	375
	R/C	942	1050	1188	1340	1508	1698
ISA	MIN	8	7	7	6	6	5
	NM	38	35	32	29	26	24
	LB	471	437	399	364	331	300
	R/C	1478	1615	1790	1984	2201	2445
ISA -10°C	MIN	8	7	7	6	6	5
	NM	36	34	31	28	25	23
	LB	449	416	380	346	315	286
	R/C	1524	1664	1845	2045	2268	2519

PRESSURE ALTITUDE 17000 FEET, ISA = -19°C = - 2°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +10°C	MIN	13	12	11	10	9	8
	NM	68	61	55	49	44	40
	LB	727	663	597	538	484	435
	R/C	900	1007	1142	1291	1457	1643
ISA	MIN	9	9	8	7	7	6
	NM	46	42	38	35	32	29
	LB	545	504	459	418	380	345
	R/C	1450	1587	1761	1954	2169	2413
ISA -10°C	MIN	9	8	8	7	7	6
	NM	44	40	37	33	30	27
	LB	518	479	437	398	362	328
	R/C	1500	1640	1820	2019	2242	2492

PRESSURE ALTITUDE 19000 FEET, ISA = -23°C = - 9°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +10°C	MIN	16	14	13	11	10	9
	NM	81	74	66	59	53	47
	LB	840	764	685	616	553	496
	R/C	851	956	1089	1236	1400	1583
ISA	MIN	11	10	9	8	8	7
	NM	54	50	45	41	37	33
	LB	619	572	520	473	430	389
	R/C	1428	1564	1739	1932	2148	2391
ISA -10°C	MIN	10	10	9	8	7	7
	NM	52	47	43	39	35	32
	LB	588	543	494	449	408	370
	R/C	1483	1624	1805	2005	2228	2480

PRESSURE ALTITUDE 21000 FEET, ISA = -27°C = -16°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +10°C	MIN	18	16	15	13	12	11
	NM	97	87	78	69	62	55
	LB	956	868	776	695	623	558
	R/C	802	906	1038	1183	1343	1524
ISA	MIN	12	11	10	9	9	8
	NM	63	58	52	47	43	39
	LB	693	639	581	528	479	433
	R/C	1416	1553	1729	1923	2140	2384
ISA -10°C	MIN	12	11	10	9	8	8
	NM	60	55	50	45	41	37
	LB	657	606	551	500	454	411
	R/C	1478	1620	1802	2004	2229	2482

PRESSURE ALTITUDE 23000 FEET, ISA = -31°C = -23°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +10°C	MIN	21	19	17	15	13	12
	NM	113	102	90	80	72	64
	LB	1077	974	869	776	694	621
	R/C	763	865	996	1139	1299	1477
ISA	MIN	14	13	11	10	9	9
	NM	72	66	59	54	49	44
	LB	767	707	642	582	528	477
	R/C	1386	1523	1699	1893	2109	2353
ISA -10°C	MIN	13	12	11	10	9	8
	NM	68	62	57	51	46	42
	LB	727	669	608	552	500	452
	R/C	1440	1582	1764	1965	2189	2441

PRESSURE ALTITUDE 25000 FEET, ISA = -35°C = -30°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +10°C	MIN	23	21	19	17	15	13
	NM	132	118	105	93	82	73
	LB	1207	1088	967	862	769	686
	R/C	679	778	904	1044	1198	1370
ISA	MIN	15	14	13	12	10	9
	NM	82	75	68	61	55	50
	LB	846	778	705	639	578	522
	R/C	1238	1369	1537	1723	1929	2161
ISA -10°C	MIN	15	14	12	11	10	9
	NM	77	71	64	58	52	47
	LB	800	736	667	605	547	495
	R/C	1297	1433	1608	1801	2015	2256

PRESSURE ALTITUDE 27000 FEET, ISA = -38°C = -37°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +10°C	MIN	27	24	21	19	17	15
	NM	155	138	122	107	95	84
	LB	1359	1218	1077	956	851	757
	R/C	536	629	748	878	1022	1182
ISA	MIN	17	16	14	13	12	10
	NM	93	85	77	69	63	56
	LB	932	855	773	700	632	570
	R/C	1062	1186	1345	1519	1713	1931
ISA -10°C	MIN	16	15	14	12	11	10
	NM	88	81	73	66	59	53
	LB	880	807	731	661	598	539
	R/C	1122	1252	1417	1599	1802	2029

PRESSURE ALTITUDE 29000 FEET, ISA = -42°C = -44°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +10°C	MIN	31	28	24	21	19	17
	NM	185	163	142	125	110	97
	LB	1541	1371	1204	1063	942	835
	R/C	431	520	634	758	895	1047
ISA	MIN	19	17	16	14	13	12
	NM	107	98	88	79	71	64
	LB	1026	939	847	765	690	621
	R/C	944	1063	1216	1384	1570	1779
ISA -10°C	MIN	18	17	15	14	12	11
	NM	101	92	83	75	67	60
	LB	966	885	798	721	651	586
	R/C	1012	1138	1298	1475	1671	1890

PRESSURE ALTITUDE 31000 FEET, ISA = -46°C = -52°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +10°C	MIN	37	32	28	24	21	19
	NM	225	196	168	146	128	112
	LB	1769	1556	1353	1185	1044	922
	R/C	329	413	521	639	769	913
ISA	MIN	21	19	17	16	14	13
	NM	124	112	100	90	81	72
	LB	1131	1031	927	834	751	675
	R/C	838	954	1102	1264	1444	1645
ISA -10°C	MIN	20	19	17	15	14	12
	NM	116	105	94	85	76	68
	LB	1061	968	871	785	707	635
	R/C	911	1033	1189	1361	1551	1763

PRESSURE ALTITUDE 33000 FEET, ISA = -50°C = -59°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +10°C	MIN	46	39	33	28	25	22
	NM	294	246	206	176	152	132
	LB	2132	1822	1551	1341	1170	1025
	R/C	162	238	336	443	560	690
ISA	MIN	24	22	19	17	16	14
	NM	144	130	116	103	92	82
	LB	1253	1137	1017	912	819	734
	R/C	655	766	904	1055	1222	1408
ISA -10°C	MIN	23	21	19	17	15	14
	NM	134	121	108	96	86	77
	LB	1169	1063	952	855	768	689
	R/C	726	841	987	1147	1325	1522

PRESSURE ALTITUDE 35000 FEET, ISA = -54°C = -66°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +10°C	MIN	----	49	40	33	28	24
	NM	----	328	259	213	180	155
	LB	----	2222	1808	1525	1310	1136
	R/C	----	161	269	388	520	666
ISA	MIN	27	25	22	19	17	16
	NM	169	151	133	117	104	93
	LB	1389	1251	1112	992	887	792
	R/C	581	701	855	1023	1207	1413
ISA -10°C	MIN	26	23	21	19	17	15
	NM	156	140	123	109	97	87
	LB	1290	1165	1038	927	830	742
	R/C	638	766	928	1104	1299	1515

PRESSURE ALTITUDE 37000 FEET, ISA = -57°C = -70°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +10°C	MIN	----	----	50	39	33	28
	NM	----	----	334	260	212	179
	LB	----	----	2156	1736	1457	1246
	R/C	----	----	167	303	455	624
ISA	MIN	31	28	24	21	19	17
	NM	197	173	150	132	116	103
	LB	1532	1365	1203	1067	949	845
	R/C	518	659	839	1034	1250	1489
ISA -10°C	MIN	29	26	23	20	18	16
	NM	180	159	139	122	108	96
	LB	1415	1266	1119	995	886	790
	R/C	587	735	924	1129	1355	1606

PRESSURE ALTITUDE 39000 FEET, ISA = -57°C = -70°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +10°C	MIN	----	----	----	----	41	33
	NM	----	----	----	----	280	219
	LB	----	----	----	----	1733	1411
	R/C	----	----	----	----	114	261
ISA	MIN	39	33	28	24	21	19
	NM	254	211	177	152	132	116
	LB	1803	1545	1329	1162	1024	906
	R/C	130	256	417	591	781	991
ISA -10°C	MIN	36	30	26	23	20	18
	NM	227	192	163	140	122	107
	LB	1635	1419	1229	1079	953	845
	R/C	175	308	477	660	859	1079

PRESSURE ALTITUDE 41000 FEET, ISA = -57°C = -70°F

T.O. WEIGHT		35700	34000	32000	30000	28000	26000
ISA +10°C	MIN	----	----	----	----	----	----
	NM	----	----	----	----	----	----
	LB	----	----	----	----	----	----
	R/C	----	----	----	----	----	----
ISA	MIN	----	----	----	30	25	21
	NM	----	----	----	197	161	137
	LB	----	----	----	1349	1145	993
	R/C	----	----	----	208	385	579
ISA -10°C	MIN	----	----	35	28	23	20
	NM	----	----	226	176	147	126
	LB	----	----	1498	1231	1057	921
	R/C	----	----	105	277	464	668

WIND EFFECT ON CLIMB DISTANCE - NM
(SUBTRACT FOR HEADWIND, ADD FOR TAILWIND)

CLIMB TIME (MIN)	WIND 25KTS	50KTS	100KTS
5	2	4	8
10	4	8	16
15	6	12	25
20	8	16	33
25	10	20	41
30	12	25	50

CRUISE CLIMB SPEED - KIAS

PRESSURE ALTTITUDE-FEET									
0	5000	10000	15000	20000	25000	30000	35000	40000	41000
270	270	270	270	270	270	270	265	236	230

Figure 7-16

CRUISE CLIMB

300 KIAS/0.80 INDICATED MACH

TIME, DISTANCE, FUEL, AND RATE OF CLIMB — ANTI-ICE SYSTEMS OFF

T.O. WEIGHT	35700	34000	32000	30000	28000	26000	35700	34000	32000	30000	28000	26000	35700	34000	32000	30000	28000	26000
PRESSURE ALTITUDE	35000 FEET ISA = -54°C = -66°F						37000 FEET ISA = -57°C = -70°F						39000 FEET ISA = -57°C = -70°F					
ISA +20°C MIN	59	50	42	35	31	27	65	54	45	38	33	28	* 103	* 63	51	42	36	31
NM	430	358	297	251	214	185	474	393	324	272	232	199	792	466	369	305	257	219
LB	2832	2399	2020	1729	1496	1303	3039	2560	2145	1829	1578	1371	4403	2867	2338	1966	1682	1453
R/C	426	527	663	817	989	1182	328	430	561	710	879	1068	100	114	245	382	530	698
ISA +10°C MIN	28	25	23	20	18	16	30	27	24	22	19	17	34	30	26	23	21	19
NM	190	171	152	135	120	107	207	186	164	146	130	115	234	207	181	160	141	125
LB	1501	1360	1216	1089	977	875	1591	1437	1281	1145	1025	917	1718	1538	1362	1212	1081	965
R/C	1043	1195	1390	1606	1846	2114	864	1024	1214	1422	1654	1913	454	601	786	983	1186	1415
ISA MIN	18	17	15	14	13	12	20	18	16	15	14	12	21	20	18	16	15	13
NM	119	109	99	90	81	73	129	118	107	96	87	79	142	129	116	105	94	85
LB	1077	994	905	823	748	677	1135	1046	950	863	783	709	1207	1107	1003	908	823	743
R/C	1739	1931	2179	2454	2760	3104	1461	1659	1900	2160	2450	2776	994	1175	1406	1654	1911	2202
ISA -10°C MIN	18	17	15	14	13	11	19	18	16	15	13	12	21	19	18	16	14	13
NM	115	105	95	86	78	70	124	114	103	93	84	76	138	125	113	101	91	82
LB	1028	948	863	785	712	645	1084	998	907	823	746	675	1154	1058	958	867	784	708
R/C	1729	1924	2174	2452	2766	3109	1445	1645	1890	2152	2445	2775	972	1161	1390	1646	1902	2198
PRESSURE ALTITUDE	41000 FEET ISA = -57°C = -70°F						43000 FEET ISA = -57°C = -70°F						45000 FEET ISA = -57°C = -70°F					
ISA +20°C MIN	* 212	* 167	* 109	* 52	42	35	* 318	* 272	* 215	* 157	* 92	43	* 430	* 386	* 328	* 270	* 206	* 139
NM	1699	1328	858	386	303	251	2579	2207	1736	1253	726	318	3513	3147	2677	2195	1669	1117
LB	7951	6239	4239	2276	1857	1573	11070	9357	7357	5352	3349	1804	14064	12371	10370	8370	6370	4361
R/C	101	100	100	103	256	411	102	100	100	100	100	150	101	101	101	101	101	100
ISA +10°C MIN	42	35	30	26	23	20	* 150	* 100	* 41	31	26	23	* 263	* 213	* 154	* 89	34	27
NM	304	249	210	181	158	139	1197	787	299	220	184	158	2133	1725	1236	699	245	191
LB	2020	1722	1485	1302	1152	1022	5531	3832	1832	1455	1253	1096	8862	7166	5166	3154	1467	1213
R/C	107	251	431	625	834	1049	101	101	101	284	487	708	101	101	101	100	139	353
ISA MIN	24	22	19	18	16	14	29	25	22	20	17	16	* 91	* 41	27	23	20	17
NM	163	146	130	116	104	93	204	174	150	131	116	103	707	297	187	155	133	116
LB	1308	1189	1068	962	868	782	1491	1314	1157	1030	922	826	3506	1808	1309	1127	991	879
R/C	612	792	1016	1258	1521	1797	250	421	642	879	1136	1416	100	100	288	517	771	1046
ISA -10°C MIN	24	22	19	17	16	14	30	25	22	19	17	15	* 103	* 51	27	23	19	17
NM	158	142	126	112	100	90	202	171	146	127	112	99	790	373	186	152	129	112
LB	1255	1138	1021	919	828	746	1446	1264	1109	985	881	789	3762	2062	1268	1083	949	840
R/C	587	770	998	1243	1510	1790	220	394	617	859	1119	1402	100	100	254	486	744	1022
PRESSURE ALTITUDE	47000 FEET ISA = -57°C = -70°F						49000 FEET ISA = -57°C = -70°F						51000 FEET ISA = -57°C = -70°F					
ISA +20°C MIN	* 551	* 506	* 449	* 391	* 327	* 260	----	----	* 556	* 498	* 434	* 368	----	----	----	* 600	* 536	* 470
NM	4515	4147	3677	3195	2668	2120	----	----	4590	4109	3582	3034	----	----	----	4980	4454	3905
LB	16953	15252	13252	11251	9252	7252	----	----	15733	13733	11733	9733	----	----	----	15876	13876	11876
R/C	101	101	101	101	101	101	----	----	101	101	101	101	----	----	----	101	101	101
ISA +10°C MIN	* 376	* 326	* 267	* 202	* 136	* 64	* 493	* 443	* 384	* 319	* 253	* 181	----	* 561	* 503	* 438	* 371	* 300
NM	3074	2665	2177	1644	1091	495	4049	3638	3149	2616	2066	1471	----	4628	4139	3606	3055	2461
LB	11891	10194	8194	6194	4187	2184	14734	13028	11028	9029	7029	5028	----	15640	13641	11640	9640	7640
R/C	101	101	101	101	100	100	102	101	101	101	101	101	----	101	101	101	101	101
ISA MIN	* 203	* 153	* 88	30	24	20	* 320	* 270	* 206	* 140	* 69	25	* 442	* 392	* 328	* 262	* 191	* 116
NM	1627	1217	692	215	163	136	2590	2181	1659	1118	533	179	3597	3187	2665	2125	1542	925
LB	6845	5148	3137	1344	1102	951	10020	8323	6323	4320	2315	1093	13033	11333	9333	7333	5333	3322
R/C	101	101	100	128	367	634	100	101	101	100	100	217	101	101	101	101	101	100
ISA -10°C MIN	* 219	* 167	* 101	* 33	24	20	* 340	* 288	* 222	* 154	* 80	26	* 465	* 413	* 347	* 280	* 206	* 129
NM	1716	1299	775	234	161	133	2686	2270	1746	1204	610	179	3699	3282	2759	2216	1626	1009
LB	7073	5374	3374	1376	1063	912	10223	8526	6526	4526	2517	1062	13207	11508	9508	7508	5508	3505
R/C	100	100	100	100	336	607	101	101	101	101	100	183	101	101	101	101	101	100

* INDICATES STEP CLIMB REQUIRED

NOTE: STEP CLIMB DATA INCLUDES TIME, DISTANCE AND FUEL USED IN CRUISE PORTION, BASED ON MAXIMUM CRUISE THRUST.

CRUISE CLIMB SPEED - KIAS

PRESSURE ALTITUDE-FEET												
0	5000	10000	15000	20000	25000	30000	35000	40000	45000	50000	51000	
270	270	300	300	300	300	300	272	242	216	192	188	

WIND EFFECT ON CLIMB DISTANCE - NM
(SUBTRACT FOR HEADWIND, ADD FOR TAILWIND)

CLIMB TIME (MIN)	WIND 25KTS	50KTS	100KTS
5	2	4	8
10	4	8	16
15	6	12	25
20	8	16	33
25	10	20	41
30	12	25	50

NOTE: FOR CLIMB CONDITIONS REQUIRING A STEP CLIMB, THE FOLLOWING TABLE GIVES THE WEIGHT AT THE END OF STEP CRUISE AT THE STEP ALTITUDE, REQUIRED TO CONTINUE CLIMB.

STEP CLIMB ALT IN FEET	TEMPERATURE ISA -10°C	ISA + 0°C	ISA +10°C	ISA +20°C
37000	----	----	----	31627
39000	----	----	----	28076
41000	----	----	30454	24943
43000	32211	32480	27101	21895
45000	28857	29109	24045	18972
47000	25686	25898	21172	16471
49000	22670	22863	18538	14312

Figure 7-13 (Sheet 2)

CRUISE CLIMB

300 KIAS/0.80 INDICATED MACH

TIME, DISTANCE, FUEL, AND RATE OF CLIMB — ANTI-ICE SYSTEMS ON

T.O. WEIGHT	35700	34000	32000	30000	28000	26000	35700	34000	32000	30000	28000	26000	35700	34000	32000	30000	28000	26000
PRESSURE ALTITUDE	5000 FEET ISA = 5°C = 41°F						10000 FEET ISA = -5°C = 23°F						15000 FEET ISA = -15°C = 6°F					
ISA +10°C MIN	2	2	2	2	2	2	5	5	5	4	4	4	9	9	8	7	7	6
NM	9	8	8	7	6	6	25	23	21	19	17	16	48	44	40	37	33	30
LB	146	136	125	115	106	96	341	317	291	267	244	222	575	531	485	442	402	364
R/C	2321	2492	2713	2959	3236	3550	1529	1656	1819	2000	2203	2433	1130	1239	1379	1534	1707	1902
ISA MIN	2	2	2	2	2	2	4	4	4	3	3	3	7	6	6	5	5	5
NM	7	6	6	5	5	4	18	17	16	14	13	12	34	32	29	27	24	22
LB	123	115	106	98	90	83	279	261	241	222	203	186	449	419	385	353	323	295
R/C	2984	3189	3455	3752	4087	4468	2161	2321	2528	2758	3016	3310	1722	1863	2044	2245	2471	2726
ISA -10°C MIN	2	2	2	2	2	2	4	4	4	3	3	3	7	6	6	5	5	5
NM	7	6	6	5	5	4	18	16	15	14	13	11	33	30	28	25	23	21
LB	117	110	102	94	86	79	266	249	229	211	194	177	428	399	367	337	308	281
R/C	3042	3251	3522	3825	4166	4555	2207	2370	2581	2817	3081	3382	1752	1896	2081	2286	2517	2778
PRESSURE ALTITUDE	17000 FEET ISA = -19°C = - 2°F						19000 FEET ISA = -23°C = - 9°F						21000 FEET ISA = -27°C = -16°F					
ISA +10°C MIN	11	10	9	8	8	7	13	12	11	10	9	8	15	13	12	11	10	9
NM	60	55	50	45	41	37	72	66	60	54	49	44	84	77	70	63	57	51
LB	677	625	569	517	470	425	780	719	653	593	537	486	882	812	736	667	604	546
R/C	1119	1228	1369	1524	1697	1893	1101	1210	1351	1506	1679	1874	1098	1209	1351	1508	1683	1880
ISA MIN	8	7	7	6	6	5	9	9	8	7	7	6	10	10	9	8	7	7
NM	41	38	35	32	29	27	49	45	41	38	34	31	56	52	48	44	40	36
LB	520	485	445	408	373	340	591	550	504	462	422	384	661	615	563	516	471	429
R/C	1747	1891	2075	2280	2509	2769	1768	1913	2100	2308	2541	2805	1707	1851	2036	2241	2471	2731
ISA -10°C MIN	8	7	7	6	6	5	9	8	8	7	7	6	10	9	9	8	7	7
NM	40	37	34	31	28	26	47	43	40	36	33	30	54	50	46	42	38	35
LB	496	462	424	389	356	324	563	524	480	440	402	366	630	586	537	491	448	408
R/C	1777	1924	2112	2321	2555	2821	1799	1948	2139	2352	2590	2860	1736	1883	2072	2282	2518	2784
PRESSURE ALTITUDE	23000 FEET ISA = -31°C = -23°F						25000 FEET ISA = -35°C = -30°F						27000 FEET ISA = -38°C = -37°F					
ISA +10°C MIN	16	15	14	12	11	10	18	17	15	14	13	11	21	19	17	15	14	13
NM	97	89	80	72	65	59	111	101	91	82	74	67	128	116	105	94	85	76
LB	983	903	818	741	670	605	1089	999	903	817	738	665	1208	1106	998	900	812	731
R/C	1114	1227	1371	1530	1708	1908	1000	1108	1246	1399	1569	1760	832	933	1062	1203	1361	1538
ISA MIN	11	11	10	9	8	8	13	12	11	10	9	8	14	13	12	11	10	9
NM	65	60	55	50	45	41	73	68	62	56	51	46	83	77	70	64	58	52
LB	732	680	623	569	520	473	804	747	683	624	569	518	881	816	746	681	621	564
R/C	1696	1841	2027	2233	2464	2725	1625	1767	1950	2153	2380	2636	1467	1604	1779	1972	2186	2431
ISA -10°C MIN	11	10	10	9	8	7	12	12	11	10	9	8	14	13	12	11	10	9
NM	62	58	53	48	44	40	70	65	60	54	49	45	80	74	67	61	56	50
LB	697	648	593	542	495	450	766	711	650	594	542	492	839	777	710	648	591	536
R/C	1723	1871	2061	2272	2508	2775	1652	1798	1985	2193	2425	2688	1491	1630	1809	2007	2228	2477
PRESSURE ALTITUDE	29000 FEET ISA = -42°C = -44°F						31000 FEET ISA = -46°C = -52°F						33000 FEET ISA = -50°C = -59°F					
ISA +10°C MIN	23	21	19	17	15	14	26	24	21	19	17	15	28	25	23	20	18	16
NM	148	134	120	108	97	87	169	153	136	122	109	98	185	167	149	133	119	106
LB	1341	1223	1100	990	891	801	1476	1342	1204	1081	971	871	1576	1431	1280	1148	1029	922
R/C	741	838	963	1099	1251	1420	798	907	1047	1201	1372	1565	1045	1190	1376	1582	1809	2065
ISA MIN	15	14	13	12	11	10	17	16	14	13	12	11	18	17	15	14	13	11
NM	94	87	79	72	65	59	105	96	88	80	72	65	113	104	95	86	78	70
LB	961	889	812	740	674	612	1039	961	876	798	726	658	1100	1016	925	842	765	694
R/C	1373	1505	1677	1864	2075	2311	1544	1695	1889	2103	2344	2615	1927	2122	2372	2649	2959	3308
ISA -10°C MIN	15	14	13	12	11	10	17	15	14	13	12	11	18	16	15	14	12	11
NM	90	83	76	69	62	57	101	93	84	77	69	63	109	101	91	83	75	68
LB	915	847	773	705	641	582	990	915	834	760	691	626	1048	968	881	802	728	660
R/C	1390	1526	1700	1893	2108	2350	1554	1708	1906	2125	2370	2647	1921	2117	2370	2651	2963	3316
PRESSURE ALTITUDE	35000 FEET ISA = -54°C = -66°F						37000 FEET ISA = -57°C = -70°F						39000 FEET ISA = -57°C = -70°F					
ISA +10°C MIN	30	27	24	22	19	17	32	29	26	23	21	18	36	32	28	25	22	20
NM	200	181	160	143	127	113	217	195	173	153	136	121	247	218	191	168	149	132
LB	1664	1508	1347	1205	1079	966	1760	1590	1416	1265	1131	1011	1909	1706	1508	1340	1194	1064
R/C	1062	1214	1409	1625	1864	2133	851	1008	1195	1401	1629	1886	373	515	693	881	1076	1295
ISA MIN	19	18	16	15	13	12	20	19	17	15	14	13	22	20	18	17	15	14
NM	122	112	102	92	83	75	132	121	109	99	89	80	145	132	119	107	97	87
LB	1156	1067	971	883	801	726	1217	1121	1019	925	839	759	1294	1188	1075	973	881	796
R/C	1756	1948	2197	2472	2779	3124	1455	1651	1890	2149	2438	2763	978	1159	1387	1632	1888	2176
ISA -10°C MIN	19	17	16	14	13	12	20	18	17	15	14	13	22	20	18	16	15	13
NM	118	108	98	89	80	72	127	117	106	95	86	78	141	128	115	104	93	84
LB	1103	1017	925	841	763	691	1162	1070	971	882	799	723	1237	1134	1026	928	840	758
R/C	1744	1942	2189	2469	2779	3130	1435	1634	1877	2138	2429	2757	966	1150	1381	1632	1890	2182
PRESSURE ALTITUDE	41000 FEET ISA = -57°C = -70°F																	
ISA +10°C MIN	----	----	33	28	25	22												
NM	----	----	229	195	169	148												
LB	----	----	1680	1459	1283	1135												
R/C	----	----	269	450	646	844												
ISA MIN	25	23	20	18	16	15												
NM	168	150	133	119	106	95												
LB	1411	1280	1148	1034	931	838												
R/C	523	698	916	1151	1406	1672												
ISA -10°C MIN	25	22	20	18	16	14												
NM	162	145	129	115	103	92												
LB	1345	1220	1094	985	887	798												
R/C	581	760	986	1230	1496	1773												

WIND EFFECT ON CLIMB DISTANCE - NM
(SUBTRACT FOR HEADWIND, ADD FOR TAILWIND)

CLIMB TIME (MIN)	WIND 25KTS	50KTS	100KTS
5	2	4	8
10	4	8	16
15	6	12	25
20	8	16	33
25	10	20	41
30	12	25	50

CRUISE CLIMB SPEED - KIAS

PRESSURE ALTITUDE-FEET									
0	5000	10000	15000	20000	25000	30000	35000	40000	41000
270	270	300	300	300	300	300	272	242	237

Figure 7-14

CRUISE CLIMB

270 KIAS/0.78 INDICATED MACH

TIME, DISTANCE, FUEL, AND RATE OF CLIMB

ANTI-ICE SYSTEMS OFF

T.O. WEIGHT	35700	34000	32000	30000	28000	26000	35700	34000	32000	30000	28000	26000	35700	34000	32000	30000	28000	26000
PRESSURE ALTITUDE	5000 FEET ISA = 5°C = 41°F						10000 FEET ISA = - 5°C = 23°F						15000 FEET ISA = -15°C = 6°F					
MIN	3	3	3	2	2	2	6	6	5	5	4	4	9	8	8	7	6	6
ISA NM	12	11	10	9	8	8	27	25	23	21	19	17	45	41	38	34	31	28
+20°C LB	169	157	144	131	120	109	338	313	286	261	237	216	521	481	438	399	363	329
R/C	1767	1909	2092	2295	2523	2781	1752	1896	2082	2288	2519	2780	1534	1670	1845	2039	2255	2500
MIN	2	2	2	2	2	2	5	4	4	4	3	3	7	7	6	6	5	5
ISA NM	9	8	8	7	6	6	20	19	17	16	14	13	33	31	28	26	24	21
+10°C LB	139	129	119	109	100	92	278	259	238	219	200	182	424	395	362	332	303	276
R/C	2341	2513	2735	2982	3261	3577	2261	2433	2653	2899	3175	3488	2083	2249	2462	2699	2965	3266
MIN	2	2	2	2	2	2	4	4	3	3	3	3	6	5	5	5	4	4
ISA NM	7	6	6	5	5	4	16	15	13	12	11	10	26	24	22	20	18	17
LB	117	110	102	94	86	79	237	222	205	189	173	158	360	337	310	285	262	239
R/C	3008	3214	3482	3780	4117	4501	2754	2951	3206	3490	3810	4174	2687	2884	3139	3423	3743	4106
MIN	2	2	2	2	2	2	4	4	3	3	3	3	6	5	5	4	4	4
ISA NM	7	6	6	5	5	4	15	14	13	12	11	10	25	23	21	19	18	16
-10°C LB	112	105	97	90	83	76	227	212	196	180	166	152	344	322	297	273	250	229
R/C	3066	3277	3550	3854	4198	4589	2813	3014	3275	3565	3893	4265	2739	2941	3201	3492	3818	4189
PRESSURE ALTITUDE	17000 FEET ISA = -19°C = - 2°F						19000 FEET ISA = -23°C = - 9°F						21000 FEET ISA = -27°C = -16°F					
MIN	10	10	9	8	7	7	12	11	10	9	8	8	14	13	12	11	10	9
ISA NM	53	49	44	40	36	33	63	58	52	47	43	39	74	68	62	56	50	45
+20°C LB	597	551	501	456	414	375	679	626	568	516	468	423	770	708	642	582	526	475
R/C	1379	1509	1674	1857	2062	2293	1203	1325	1481	1652	1844	2059	1020	1134	1279	1439	1617	1817
MIN	8	7	7	6	6	5	9	8	8	7	7	6	10	10	9	8	7	7
ISA NM	39	36	33	30	28	25	46	42	39	35	32	29	53	49	45	41	37	34
+10°C LB	484	450	412	377	345	314	545	506	464	424	387	352	610	566	518	473	431	392
R/C	1945	2105	2310	2538	2793	3082	1799	1952	2150	2369	2614	2891	1637	1783	1972	2181	2414	2677
MIN	6	6	6	5	5	4	7	7	6	6	5	5	8	8	7	7	6	6
ISA NM	30	28	26	24	22	20	35	33	30	27	25	23	40	38	35	32	29	26
LB	409	382	352	324	297	271	460	429	395	363	332	304	512	477	439	403	369	337
R/C	2508	2698	2942	3215	3520	3868	2355	2539	2775	3038	3333	3668	2210	2387	2616	2871	3157	3480
MIN	6	6	5	5	5	4	7	7	6	6	5	5	8	7	7	6	6	5
ISA NM	29	27	25	23	21	19	34	31	29	26	24	22	39	36	33	30	28	25
-10°C LB	391	365	336	309	283	259	439	409	377	346	317	290	488	455	419	384	352	321
R/C	2558	2752	3002	3280	3593	3948	2400	2588	2829	3098	3400	3742	2249	2431	2664	2924	3216	3546
PRESSURE ALTITUDE	23000 FEET ISA = -31°C = -23°F						25000 FEET ISA = -35°C = -30°F						27000 FEET ISA = -38°C = -37°F					
MIN	16	15	13	12	11	10	18	17	15	14	12	11	21	19	17	15	14	12
ISA NM	88	81	73	65	59	53	104	94	85	76	68	61	121	110	98	88	79	70
+20°C LB	870	797	721	651	588	530	977	892	804	725	653	587	1093	995	893	802	721	648
R/C	915	1025	1165	1318	1489	1681	853	960	1097	1248	1416	1603	734	837	968	1112	1271	1449
MIN	12	11	10	9	8	8	13	12	11	10	9	8	15	13	12	11	10	9
ISA NM	61	57	52	47	43	39	71	65	59	54	49	44	82	75	68	62	56	50
+10°C LB	678	628	574	524	477	433	751	694	633	577	525	476	828	764	696	633	575	521
R/C	1469	1609	1789	1987	2208	2458	1357	1493	1667	1859	2073	2314	1216	1346	1513	1696	1901	2130
MIN	9	8	8	7	7	6	10	9	9	8	7	7	11	10	10	9	8	7
ISA NM	46	43	40	36	33	30	53	49	45	41	37	34	60	56	51	46	42	38
LB	565	527	484	444	406	370	620	578	530	486	444	405	678	630	578	529	484	440
R/C	2081	2254	2476	2723	3000	3313	1980	2149	2367	2609	2880	3186	1827	1990	2201	2433	2694	2987
MIN	9	8	8	7	7	6	10	9	9	8	7	7	11	10	9	9	8	7
ISA NM	45	41	38	35	32	29	51	47	43	39	36	33	58	53	49	45	41	37
-10°C LB	539	502	461	423	387	353	591	550	505	463	423	386	646	601	551	504	460	419
R/C	2121	2298	2526	2779	3062	3382	2019	2192	2416	2663	2941	3254	1859	2027	2242	2481	2747	3048
PRESSURE ALTITUDE	29000 FEET ISA = -42°C = -44°F						31000 FEET ISA = -46°C = -52°F						33000 FEET ISA = -50°C = -59°F					
MIN	24	22	19	17	16	14	28	25	22	20	17	16	32	29	25	22	20	17
ISA NM	143	129	115	102	91	81	170	152	134	118	105	93	206	181	158	139	122	108
+20°C LB	1225	1109	991	887	795	712	1378	1240	1101	981	875	781	1567	1396	1229	1088	966	859
R/C	618	716	841	978	1129	1298	516	610	730	861	1005	1166	386	475	587	710	845	996
MIN	16	15	14	12	11	10	18	17	15	14	13	11	21	19	17	15	14	13
ISA NM	94	86	78	71	64	57	109	99	89	81	73	65	125	114	102	92	83	74
+10°C LB	912	840	763	692	627	568	1004	921	834	755	683	617	1104	1010	911	823	743	669
R/C	1077	1201	1361	1536	1731	1950	963	1084	1237	1407	1594	1805	845	961	1109	1272	1452	1653
MIN	12	11	11	10	9	8	14	13	12	11	10	9	15	14	13	12	11	10
ISA NM	68	63	57	52	48	43	77	71	65	59	54	49	87	81	73	67	60	55
LB	739	687	629	575	525	477	804	746	682	623	567	515	873	808	737	672	612	555
R/C	1634	1790	1990	2210	2457	2735	1490	1640	1833	2046	2283	2549	1406	1552	1741	1950	2183	2444
MIN	12	11	10	9	9	8	13	12	11	10	10	9	15	14	12	11	10	9
ISA NM	65	60	55	50	46	41	74	69	62	57	52	47	84	77	70	64	58	52
-10°C LB	704	654	599	547	499	454	766	710	649	592	540	490	831	769	701	639	582	528
R/C	1661	1822	2027	2253	2506	2791	1513	1667	1865	2083	2326	2599	1423	1575	1769	1983	2222	2490

Figure 7-15 (Sheet 1 of 2)

CRUISE CLIMB

270 KIAS/0.78 INDICATED MACH

TIME, DISTANCE, FUEL, AND RATE OF CLIMB — ANTI-ICE SYSTEMS OFF

T.O. WEIGHT		35700	34000	32000	30000	28000	26000	35700	34000	32000	30000	28000	26000	35700	34000	32000	30000	28000	26000
PRESSURE ALTITUDE		35000 FEET ISA = -54°C = -66°F						37000 FEET ISA = -57°C = -70°F						39000 FEET ISA = -57°C = -70°F					
ISA +20°C	MIN	37	33	28	25	22	19	43	37	32	27	24	21	* 76	* 45	37	31	27	23
	NM	247	214	184	160	140	123	291	247	209	180	156	136	559	309	248	208	177	153
	LB	1770	1558	1357	1193	1053	932	1980	1716	1478	1288	1131	996	3138	1982	1646	1408	1222	1068
	R/C	382	484	614	757	915	1090	338	460	616	787	976	1185	100	147	288	443	613	801
ISA +10°C	MIN	23	21	19	17	15	14	25	23	20	18	16	15	28	25	22	20	18	16
	NM	143	129	115	103	92	83	159	143	127	113	101	90	183	163	143	126	112	99
	LB	1201	1095	984	886	798	717	1291	1172	1050	942	846	759	1405	1265	1124	1004	898	803
	R/C	915	1050	1224	1413	1623	1858	915	1075	1280	1503	1750	2025	519	665	850	1052	1274	1519
ISA	MIN	16	15	14	13	11	10	18	16	15	14	12	11	19	18	16	15	13	12
	NM	98	90	82	74	67	60	108	99	89	81	73	66	121	110	99	89	80	72
	LB	938	867	790	719	653	592	999	920	837	760	689	624	1068	980	888	804	728	657
	R/C	1456	1624	1838	2073	2335	2629	1473	1668	1914	2186	2487	2824	1030	1207	1433	1680	1952	2255
ISA -10°C	MIN	16	15	14	12	11	10	18	16	15	13	12	11	19	18	16	14	13	12
	NM	94	87	78	71	64	58	104	95	86	78	70	63	117	106	95	86	77	69
	LB	894	825	751	684	621	563	952	877	797	723	656	594	1020	935	846	766	693	626
	R/C	1464	1635	1853	2094	2361	2660	1460	1658	1908	2183	2487	2827	1011	1192	1420	1670	1945	2252
PRESSURE ALTITUDE		41000 FEET ISA = -57°C = -70°F						43000 FEET ISA = -57°C = -70°F						45000 FEET ISA = -57°C = -70°F					
ISA +20°C	MIN	* 188	* 140	* 81	39	32	27	* 298	* 250	* 191	* 129	* 64	33	* 414	* 366	* 307	* 245	* 180	* 110
	NM	1486	1095	611	270	215	179	2390	2003	1520	1012	477	230	3346	2959	2475	1971	1435	860
	LB	6780	5066	3065	1647	1366	1169	10004	8304	6303	4290	2293	1347	13080	11380	9380	7380	5380	3371
	R/C	101	100	100	155	317	495	101	101	101	100	100	210	101	101	101	101	101	100
ISA +10°C	MIN	35	30	26	22	20	17	* 125	* 74	33	27	23	20	* 241	* 191	* 129	* 63	29	23
	NM	236	197	168	145	127	111	975	562	223	178	149	128	1935	1522	1013	475	196	157
	LB	1637	1418	1233	1086	963	856	4554	2853	1451	1215	1053	924	7986	6284	4274	2275	1218	1024
	R/C	175	324	501	694	904	1136	100	100	165	356	558	778	101	101	100	100	215	426
ISA	MIN	22	20	18	16	14	13	27	23	20	18	16	14	* 81	32	25	21	18	16
	NM	140	126	111	99	89	79	176	151	130	114	100	89	617	217	164	136	116	101
	LB	1163	1057	950	856	772	695	1326	1171	1033	920	823	737	3097	1441	1170	1010	889	788
	R/C	656	838	1055	1292	1551	1838	288	464	685	921	1170	1444	100	106	323	556	811	1075
ISA -10°C	MIN	22	20	18	16	14	13	27	23	20	18	16	14	* 94	* 41	25	21	18	16
	NM	136	122	108	96	86	77	174	148	126	110	97	86	703	285	162	133	113	98
	LB	1113	1011	907	816	735	662	1282	1125	989	879	786	703	3371	1672	1131	969	850	753
	R/C	631	818	1039	1278	1541	1832	259	438	662	902	1154	1432	100	100	287	523	785	1053
PRESSURE ALTITUDE		47000 FEET ISA = -57°C = -70°F						49000 FEET ISA = -57°C = -70°F						51000 FEET ISA = -57°C = -70°F					
ISA +20°C	MIN	* 535	* 487	* 428	* 367	* 301	* 231	----	* 596	* 537	* 475	* 410	* 340	----	----	* 640	* 579	* 513	* 443
	NM	4340	3953	3470	2966	2430	1858	----	4873	4390	3886	3350	2778	----	----	5264	4760	4224	3652
	LB	15959	14260	12261	10260	8260	6260	----	16769	14770	12770	10770	8770	----	----	16929	14929	12929	10929
	R/C	101	101	101	101	101	101	----	101	101	101	101	101	----	----	101	101	101	101
ISA +10°C	MIN	* 359	* 309	* 247	* 181	* 112	* 39	* 477	* 426	* 365	* 299	* 230	* 157	----	* 548	* 486	* 420	* 351	* 278
	NM	2906	2495	1990	1451	881	283	3879	3466	2961	2423	1853	1255	----	4471	3965	3427	2857	2259
	LB	11126	9431	7431	5431	3428	1427	13973	12273	10273	8273	6273	4273	----	14935	12935	10935	8935	6935
	R/C	100	100	100	100	100	100	101	101	101	101	101	101	----	101	101	101	101	101
ISA	MIN	* 188	* 138	* 73	27	22	18	* 306	* 256	* 191	* 123	* 51	23	* 429	* 378	* 313	* 245	* 173	* 96
	NM	1494	1079	552	184	143	119	2459	2047	1519	967	381	155	3462	3047	2519	1969	1384	756
	LB	6289	4581	2583	1189	988	855	9480	7781	5781	3775	1772	974	12489	10781	8780	6780	4781	2773
	R/C	101	100	100	185	432	700	101	101	101	100	100	281	102	101	101	101	101	100
ISA -10°C	MIN	* 204	* 151	* 84	28	22	18	* 325	* 273	* 206	* 136	* 61	23	* 451	* 398	* 331	* 262	* 187	* 108
	NM	1580	1162	630	186	141	116	2549	2132	1602	1049	454	154	3558	3137	2607	2056	1462	832
	LB	6517	4818	2811	1163	951	819	9675	7977	5976	3974	1970	942	12655	10946	8947	6947	4946	2942
	R/C	100	101	100	150	401	673	100	101	101	100	100	250	102	101	101	101	101	100

* INDICATES STEP CLIMB REQUIRED
NOTE: STEP CLIMB DATA INCLUDES TIME, DISTANCE AND FUEL USED IN CRUISE PORTION, BASED ON MAXIMUM CRUISE THRUST.

CRUISE CLIMB SPEED - KIAS

PRESSURE ALTTITUDE-FEET												
0	5000	10000	15000	20000	25000	30000	35000	40000	45000	50000	51000
270	270	270	270	270	270	270	265	236	210	187	182

WIND EFFECT ON CLIMB DISTANCE - NM
(SUBTRACT FOR HEADWIND, ADD FOR TAILWIND)

CLIMB TIME (MIN)	WIND 25KTS	50KTS	100KTS
5	2	4	8
10	4	8	16
15	6	12	25
20	8	16	33
25	10	20	41
30	12	25	50

NOTE: FOR CLIMB CONDITIONS REQUIRING A STEP CLIMB, THE FOLLOWING TABLE GIVES THE WEIGHT AT THE END OF STEP CRUISE AT THE STEP ALTITUDE, REQUIRED TO CONTINUE CLIMB.

STEP CLIMB ALT IN FEET	TEMPERATURE ISA -10°C	ISA + 0°C	ISA +10°C	ISA +20°C
37000	----	----	----	32892
39000	----	----	----	29244
41000	----	----	31433	25988
43000	32591	32881	27979	22875
45000	29428	29666	24799	19954
47000	26231	26439	21932	17427
49000	23234	23411	19245	15252

Figure 7-15 (Sheet 2)

CRUISE CLIMB

270 KIAS/0.78 INDICATED MACH

TIME, DISTANCE, FUEL, AND RATE OF CLIMB — **ANTI-ICE SYSTEMS ON**

PRESSURE ALTITUDE		T.O. WEIGHT 35700	34000	32000	30000	28000	26000
5000 FEET ISA = 5°C = 41°F							
ISA +10°C	MIN	2	2	2	2	2	2
	NM	9	8	8	7	6	6
	LB	146	136	125	115	106	96
	R/C	2321	2493	2713	2959	3236	3550
ISA	MIN	2	2	2	2	2	2
	NM	7	6	6	5	5	4
	LB	123	115	106	98	90	83
	R/C	2984	3189	3455	3752	4087	4468
ISA -10°C	MIN	2	2	2	2	2	2
	NM	7	6	6	5	5	4
	LB	117	110	102	94	86	79
	R/C	3042	3251	3522	3825	4166	4555
10000 FEET ISA = - 5°C = 23°F							
ISA +10°C	MIN	5	4	4	4	4	3
	NM	21	19	18	16	15	13
	LB	300	280	257	236	216	196
	R/C	2246	2416	2635	2878	3152	3463
ISA	MIN	4	4	3	3	3	3
	NM	16	15	14	12	11	10
	LB	252	236	217	200	184	168
	R/C	2739	2934	3187	3470	3788	4149
ISA -10°C	MIN	4	4	3	3	3	3
	NM	15	14	13	12	11	10
	LB	240	225	208	191	176	161
	R/C	2792	2992	3250	3539	3863	4232
15000 FEET ISA = -15°C = 6°F							
ISA +10°C	MIN	7	7	6	6	5	5
	NM	33	31	28	26	23	21
	LB	447	416	382	350	320	292
	R/C	2071	2235	2446	2681	2944	3243
ISA	MIN	6	5	5	5	4	4
	NM	25	24	22	20	18	17
	LB	377	352	325	299	274	251
	R/C	2663	2859	3111	3392	3709	4069
ISA -10°C	MIN	6	5	5	4	4	4
	NM	25	23	21	19	18	16
	LB	360	336	310	285	262	239
	R/C	2721	2921	3179	3467	3791	4159
17000 FEET ISA = -19°C = - 2°F							
ISA +10°C	MIN	8	7	7	6	6	5
	NM	39	36	33	30	27	25
	LB	509	474	435	398	363	331
	R/C	1935	2093	2298	2524	2778	3066
ISA	MIN	6	6	6	5	5	4
	NM	30	28	26	23	21	20
	LB	428	400	369	339	311	284
	R/C	2492	2681	2924	3195	3499	3844
ISA -10°C	MIN	6	6	5	5	5	4
	NM	29	27	25	23	21	19
	LB	408	381	352	323	296	271
	R/C	2540	2732	2981	3258	3568	3921
19000 FEET ISA = -23°C = - 9°F							
ISA +10°C	MIN	9	8	8	7	7	6
	NM	45	42	38	35	32	29
	LB	574	534	489	447	408	371
	R/C	1785	1937	2133	2350	2594	2869
ISA	MIN	7	7	6	6	5	5
	NM	35	32	30	27	25	23
	LB	481	449	414	380	349	318
	R/C	2345	2527	2763	3025	3318	3652
ISA -10°C	MIN	7	7	6	6	5	5
	NM	33	31	29	26	24	22
	LB	459	428	394	362	332	303
	R/C	2384	2570	2811	3078	3378	3718
21000 FEET ISA = -27°C = -16°F							
ISA +10°C	MIN	10	10	9	8	7	7
	NM	53	49	45	41	37	33
	LB	643	597	546	499	455	414
	R/C	1615	1761	1948	2155	2386	2648
ISA	MIN	8	8	7	7	6	6
	NM	40	37	34	31	29	26
	LB	536	500	460	423	387	353
	R/C	2197	2374	2601	2855	3139	3460
ISA -10°C	MIN	8	7	7	6	6	5
	NM	39	36	33	30	28	25
	LB	511	477	438	403	369	336
	R/C	2233	2414	2647	2905	3195	3524
23000 FEET ISA = -31°C = -23°F							
ISA +10°C	MIN	12	11	10	9	8	8
	NM	61	57	52	47	43	39
	LB	715	663	606	553	504	457
	R/C	1454	1593	1772	1969	2189	2437
ISA	MIN	9	9	8	7	7	6
	NM	46	43	39	36	33	30
	LB	592	552	508	466	426	389
	R/C	2066	2238	2459	2704	2980	3291
ISA -10°C	MIN	9	8	8	7	7	6
	NM	44	41	38	35	32	29
	LB	564	526	483	443	406	370
	R/C	2105	2281	2508	2759	3041	3360
25000 FEET ISA = -35°C = -30°F							
ISA +10°C	MIN	13	12	11	10	9	8
	NM	71	65	59	54	49	44
	LB	792	733	668	609	554	503
	R/C	1343	1478	1650	1841	2053	2292
ISA	MIN	10	9	9	8	7	7
	NM	53	49	45	41	37	34
	LB	650	606	556	510	466	425
	R/C	1965	2134	2350	2590	2859	3163
ISA -10°C	MIN	10	9	9	8	7	7
	NM	51	47	43	39	36	32
	LB	619	577	529	485	444	404
	R/C	2004	2176	2398	2644	2920	3231
27000 FEET ISA = -38°C = -37°F							
ISA +10°C	MIN	15	14	12	11	10	9
	NM	81	75	68	62	56	50
	LB	874	807	735	668	607	550
	R/C	1204	1333	1499	1681	1884	2113
ISA	MIN	11	10	10	9	8	7
	NM	60	55	51	46	42	38
	LB	711	661	607	556	508	462
	R/C	1812	1975	2183	2415	2674	2966
ISA -10°C	MIN	11	10	9	9	8	7
	NM	57	53	49	44	40	37
	LB	677	629	577	529	483	440
	R/C	1844	2011	2225	2462	2727	3027
29000 FEET ISA = -42°C = -44°F							
ISA +10°C	MIN	16	15	14	13	11	10
	NM	94	86	78	71	64	57
	LB	964	888	806	732	663	600
	R/C	1062	1186	1345	1519	1712	1929
ISA	MIN	12	11	11	10	9	8
	NM	68	63	57	52	48	43
	LB	776	721	660	604	551	501
	R/C	1621	1776	1974	2194	2439	2716
ISA -10°C	MIN	12	11	10	10	9	8
	NM	65	60	55	50	46	41
	LB	739	686	628	574	524	477
	R/C	1646	1804	2008	2233	2484	2767
31000 FEET ISA = -46°C = -52°F							
ISA +10°C	MIN	18	17	15	14	13	11
	NM	109	99	90	81	73	65
	LB	1062	975	883	799	723	653
	R/C	952	1072	1224	1393	1579	1788
ISA	MIN	14	13	12	11	10	9
	NM	77	71	65	59	54	49
	LB	845	784	716	654	596	542
	R/C	1476	1626	1818	2029	2265	2530
ISA -10°C	MIN	13	12	11	10	10	9
	NM	74	69	62	57	52	47
	LB	804	745	681	622	567	515
	R/C	1498	1652	1848	2065	2307	2578
33000 FEET ISA = -50°C = -59°F							
ISA +10°C	MIN	21	19	17	15	14	13
	NM	126	115	103	92	83	74
	LB	1170	1070	965	872	786	709
	R/C	835	950	1097	1258	1437	1637
ISA	MIN	15	14	13	12	11	10
	NM	87	81	73	67	60	55
	LB	918	849	775	707	643	584
	R/C	1392	1539	1728	1935	2167	2427
ISA -10°C	MIN	15	14	13	11	10	10
	NM	84	78	70	64	58	52
	LB	873	808	737	672	611	555
	R/C	1409	1559	1753	1966	2202	2469
35000 FEET ISA = -54°C = -66°F							
ISA +10°C	MIN	23	21	19	17	15	14
	NM	143	130	116	103	93	83
	LB	1273	1161	1043	939	845	760
	R/C	906	1041	1213	1402	1611	1844
ISA	MIN	16	15	14	13	12	10
	NM	98	90	82	74	67	60
	LB	988	912	831	756	687	623
	R/C	1443	1611	1823	2058	2318	2611
ISA -10°C	MIN	16	15	14	12	11	10
	NM	94	87	79	71	64	58
	LB	940	868	790	719	653	592
	R/C	1446	1616	1834	2073	2338	2635
37000 FEET ISA = -57°C = -70°F							
ISA +10°C	MIN	25	23	20	18	16	15
	NM	160	144	128	114	102	91
	LB	1372	1245	1114	1000	898	805
	R/C	884	1043	1245	1466	1709	1980
ISA	MIN	18	16	15	14	12	11
	NM	108	99	90	81	73	66
	LB	1052	969	881	800	726	657
	R/C	1463	1657	1903	2173	2473	2808
ISA -10°C	MIN	18	16	15	13	12	11
	NM	104	96	86	78	70	63
	LB	1003	923	839	761	690	625
	R/C	1450	1645	1892	2167	2470	2809
39000 FEET ISA = -57°C = -70°F							
ISA +10°C	MIN	29	26	23	20	18	16
	NM	187	166	145	128	113	100
	LB	1509	1354	1201	1071	957	855
	R/C	412	553	730	924	1136	1370
ISA	MIN	20	18	16	15	13	12
	NM	121	110	99	89	80	72
	LB	1127	1034	936	848	767	693
	R/C	1010	1187	1411	1656	1926	2226
ISA -10°C	MIN	19	18	16	14	13	12
	NM	117	107	96	86	77	69
	LB	1075	985	891	807	730	659
	R/C	1003	1182	1410	1658	1932	2237
41000 FEET ISA = -57°C = -70°F							
ISA +10°C	MIN	----	33	27	23	20	18
	NM	----	220	179	152	132	115
	LB	----	1600	1355	1180	1040	921
	R/C	----	148	314	493	689	903
ISA	MIN	22	20	18	16	15	13
	NM	142	127	113	100	90	80
	LB	1236	1121	1006	906	816	734
	R/C	563	739	950	1179	1430	1708
ISA -10°C	MIN	22	20	18	16	14	13
	NM	137	122	108	96	86	77
	LB	1176	1067	957	861	775	698
	R/C	622	806	1026	1265	1525	1814

WIND EFFECT ON CLIMB DISTANCE - NM
(SUBTRACT FOR HEADWIND, ADD FOR TAILWIND)

CLIMB TIME (MIN)	WIND 25KTS	50KTS	100KTS
5	2	4	8
10	4	8	16
15	6	12	25
20	8	16	33
25	10	20	41
30	12	25	50

CRUISE CLIMB SPEED - KIAS

PRESSURE ALTTITUDE-FEET									
0	5000	10000	15000	20000	25000	30000	35000	40000	41000
270	270	270	270	270	270	270	265	236	230

Figure 7-16

CRUISE

Specific performance data are presented on the following pages for various combinations of fan speeds, weights, temperatures, altitudes and winds to enable the calculation of the cruise portion of a range profile.

The various fan speeds presented provide the specific ranges between maximum cruise thrust (maximum TAS) and the approximate maximum range thrust. It should be noted that reducing thrust to maintain a constant indicated airspeed as the airplane weight decreases during cruise results in a significant increase in range. The best range, however, results from decreasing thrust to fly a constantly decreasing airspeed as airplane weight decreases per the values shown in the tabulated data.

When the anti-ice systems are ON, increase the fuel flows and decrease the specific ranges that are presented for each altitude by nine percent. The cruise speeds will remain the same for a given fan RPM (N_1). The maximum allowable fan speeds with anti-ice systems ON are presented on each chart for each altitude. Only fan speeds equal to or lower than these values can be used.

The one engine specific range data is presented for use in the event of an enroute engine failure.

CRUISE
5000 FEET

ANTI-ICE SYSTEMS OFF **TWO ENGINES**

WT. LBS.	TEMP	RAT DEG. C	FAN PERCENT RPM	FUEL FLOW LBS/HR	KIAS	IND. MACH	KTAS	NAUTICAL MILES/100 LBS. FUEL: 100 KT. HEADWIND	50 KT. HEADWIND	ZERO WIND	50 KT. TAILWIND	100 KT. TAILWIND
35000.	ISA+20°C 25°C	37	(1) 68.3	2531	269	.44	300	7.9	9.9	11.8	13.8	15.8
		36	67.0	2412	261	.430	290	7.9	10.0	12.0	14.1	16.2
		36	66.2	2332	254	.420	283	7.9	10.0	12.1	14.3	16.4
		35	64.4	2183	242	.400	270	7.8	10.1	12.3	14.6	16.9
		34	(2) 63.6	2119	237	.39	263	7.7	10.1	12.4	14.8	17.1
	ISA+10°C 15°C	26	(1) 67.2	2476	269	.44	295	7.9	9.9	11.9	13.9	15.9
		26	65.9	2357	261	.430	285	7.9	10.0	12.1	14.2	16.3
		25	65.1	2280	254	.420	278	7.8	10.0	12.2	14.4	16.6
		25	64.2	2207	248	.410	272	7.8	10.0	12.3	14.6	16.8
		24	(2) 62.6	2074	237	.39	259	7.7	10.1	12.5	14.9	17.3
	ISA+ 0°C 5°C	16	(1) 66.0	2420	269	.44	290	7.8	9.9	12.0	14.0	16.1
		15	64.8	2304	261	.430	280	7.8	10.0	12.2	14.3	16.5
		15	64.0	2228	254	.420	274	7.8	10.0	12.3	14.5	16.8
		14	63.1	2156	248	.410	267	7.7	10.1	12.4	14.7	17.0
		14	(2) 61.5	2029	237	.39	255	7.6	10.1	12.5	15.0	17.5
	ISA-10°C -5°C	6	(1) 64.9	2364	269	.44	284	7.8	9.9	12.0	14.1	16.3
		5	63.7	2252	261	.430	275	7.8	10.0	12.2	14.4	16.7
		5	62.8	2178	254	.420	269	7.7	10.0	12.3	14.6	16.9
		4	62.0	2106	248	.410	262	7.7	10.1	12.4	14.8	17.2
		3	(2) 60.4	1981	237	.39	250	7.6	10.1	12.6	15.1	17.7
34000.	ISA+20°C 25°C	37	(1) 68.1	2516	269	.44	300	7.9	9.9	11.9	13.9	15.9
		36	66.9	2396	261	.430	290	7.9	10.0	12.1	14.2	16.3
		36	66.0	2316	254	.420	283	7.9	10.1	12.2	14.4	16.5
		35	65.1	2239	248	.410	276	7.9	10.1	12.3	14.6	16.8
		34	(2) 63.4	2103	237	.39	264	7.8	10.2	12.5	14.9	17.3
	ISA+10°C 15°C	26	(1) 67.0	2461	269	.44	295	7.9	9.9	12.0	14.0	16.0
		26	65.8	2342	261	.430	285	7.9	10.0	12.2	14.3	16.4
		25	64.9	2265	254	.420	278	7.9	10.1	12.3	14.5	16.7
		25	64.0	2190	248	.410	272	7.8	10.1	12.4	14.7	17.0
		24	(2) 62.4	2058	237	.39	259	7.7	10.2	12.6	15.0	17.5
	ISA+ 0°C 5°C	16	(1) 65.9	2406	269	.44	290	7.9	10.0	12.0	14.1	16.2
		15	64.6	2288	261	.430	280	7.9	10.1	12.2	14.4	16.6
		15	63.8	2212	254	.420	274	7.8	10.1	12.4	14.6	16.9
		14	62.9	2140	248	.410	267	7.8	10.1	12.5	14.8	17.2
		14	(2) 61.4	2023	238	.39	256	7.7	10.2	12.6	15.1	17.6
	ISA-10°C -5°C	6	(1) 64.7	2350	269	.44	284	7.8	10.0	12.1	14.2	16.4
		5	63.5	2237	261	.430	275	7.8	10.1	12.3	14.5	16.8
		5	62.7	2163	254	.420	269	7.8	10.1	12.4	14.7	17.0
		4	61.8	2090	248	.410	262	7.8	10.1	12.5	14.9	17.3
		3	(2) 60.3	1970	237	.39	250	7.6	10.2	12.7	15.3	17.8
32000.	ISA+20°C 25°C	37	(1) 67.8	2488	269	.44	300	8.0	10.0	12.1	14.1	16.1
		36	66.5	2366	261	.430	290	8.0	10.1	12.3	14.4	16.5
		36	65.6	2285	254	.420	283	8.0	10.2	12.4	14.6	16.8
		35	64.7	2207	248	.410	276	8.0	10.3	12.5	14.8	17.1
		34	(2) 63.0	2073	237	.39	264	7.9	10.3	12.7	15.1	17.6
	ISA+10°C 15°C	26	(1) 66.7	2434	269	.44	295	8.0	10.1	12.1	14.2	16.2
		26	65.4	2312	261	.430	285	8.0	10.2	12.3	14.5	16.7
		25	64.5	2234	254	.420	278	8.0	10.2	12.5	14.7	16.9
		25	63.6	2158	248	.410	272	8.0	10.3	12.6	14.9	17.2
		24	(2) 62.0	2031	238	.39	260	7.9	10.3	12.8	15.3	17.7
	ISA+ 0°C 5°C	16	(1) 65.6	2379	269	.44	290	8.0	10.1	12.2	14.3	16.4
		15	64.3	2260	261	.430	280	8.0	10.2	12.4	14.6	16.8
		15	63.4	2183	254	.420	274	8.0	10.2	12.5	14.8	17.1
		14	62.5	2109	248	.410	267	7.9	10.3	12.7	15.0	17.4
		14	(2) 61.0	1987	238	.39	256	7.8	10.3	12.9	15.4	17.9
	ISA-10°C -5°C	6	(1) 64.4	2324	269	.44	284	7.9	10.1	12.2	14.4	16.5
		5	63.2	2209	261	.430	275	7.9	10.2	12.4	14.7	17.0
		5	62.3	2133	254	.420	269	7.9	10.2	12.6	14.9	17.3
		4	61.4	2060	248	.410	262	7.9	10.3	12.7	15.1	17.6
		3	(2) 59.9	1941	238	.39	251	7.8	10.3	12.9	15.5	18.1
30000.	ISA+20°C 25°C	37	(1) 67.5	2461	269	.44	300	8.1	10.1	12.2	14.2	16.2
		36	66.2	2337	261	.430	290	8.1	10.3	12.4	14.5	16.7
		36	65.2	2255	254	.420	283	8.1	10.3	12.6	14.8	17.0
		35	63.3	2099	242	.400	270	8.1	10.5	12.8	15.2	17.6
		34	(2) 62.2	2021	235	.39	262	8.0	10.5	13.0	15.4	17.9
	ISA+10°C 15°C	26	(1) 66.4	2407	269	.44	295	8.1	10.2	12.2	14.3	16.4
		26	65.1	2286	261	.430	285	8.1	10.3	12.5	14.7	16.8
		25	64.2	2205	254	.420	278	8.1	10.4	12.6	14.9	17.2
		24	62.3	2053	242	.400	265	8.0	10.5	12.9	15.3	17.8
		24	(2) 61.2	1980	236	.39	258	8.0	10.5	13.0	15.6	18.1
	ISA+ 0°C 5°C	16	(1) 65.3	2353	269	.44	290	8.1	10.2	12.3	14.4	16.6
		15	64.0	2233	261	.430	280	8.1	10.3	12.5	14.8	17.0
		15	63.1	2155	254	.420	274	8.1	10.4	12.7	15.0	17.3
		14	61.2	2007	242	.400	260	8.0	10.5	13.0	15.5	18.0
		14	(2) 60.2	1937	236	.39	254	7.9	10.5	13.1	15.7	18.3
	ISA-10°C -5°C	6	(1) 64.2	2299	269	.44	284	8.0	10.2	12.4	14.5	16.7
		5	62.9	2183	261	.430	275	8.0	10.3	12.6	14.9	17.2
		5	62.0	2106	254	.420	269	8.0	10.4	12.8	15.1	17.5
		4	60.1	1960	242	.400	256	7.9	10.5	13.0	15.6	18.1
		3	(2) 59.1	1893	236	.39	249	7.9	10.5	13.2	15.8	18.4

Figure 7-17 (Sheet 1 of 40)

CRUISE
5000 FEET

ANTI-ICE SYSTEMS OFF **TWO ENGINES**

WT. LBS.	TEMP	RAT DEG. C	FAN PERCENT RPM	FUEL FLOW LBS/HR	KIAS	IND. MACH	KTAS	NAUTICAL MILES/100 LBS. FUEL 100 KT. HEADWIND	50 KT. HEADWIND	ZERO WIND	50 KT. TAILWIND	100 KT. TAILWIND
28000.	ISA+20°C 25°C	37	(1) 67.3	2436	269	.44	300	8.2	10.3	12.3	14.4	16.4
		36	65.9	2311	261	.430	290	8.2	10.4	12.5	14.7	16.9
		35	63.9	2147	248	.410	276	8.2	10.5	12.9	15.2	17.5
		34	61.9	2000	236	.390	263	8.1	10.6	13.1	15.6	18.1
		33	(2) 60.1	1903	226	.37	252	8.0	10.6	13.2	15.9	18.5
	ISA+10°C 15°C	26	(1) 66.2	2383	269	.44	295	8.2	10.3	12.4	14.5	16.6
		26	64.8	2260	261	.430	285	8.2	10.4	12.6	14.8	17.0
		25	62.9	2100	248	.410	272	8.2	10.6	12.9	15.3	17.7
		24	60.8	1956	236	.390	258	8.1	10.7	13.2	15.8	18.3
		23	(2) 59.4	1879	228	.38	250	8.0	10.6	13.3	16.0	18.6
	ISA+ 0°C 5°C	16	(1) 65.1	2329	269	.44	290	8.1	10.3	12.4	14.6	16.7
		15	63.7	2208	261	.430	280	8.2	10.4	12.7	15.0	17.2
		14	61.8	2052	248	.410	267	8.1	10.6	13.0	15.4	17.9
		14	59.8	1913	236	.390	254	8.0	10.7	13.3	15.9	18.5
		13	(2) 58.4	1838	228	.38	245	7.9	10.6	13.4	16.1	18.8
	ISA-10°C -5°C	6	(1) 63.9	2276	269	.44	284	8.1	10.3	12.5	14.7	16.9
		5	62.6	2158	261	.430	275	8.1	10.4	12.7	15.1	17.4
		4	60.7	2004	248	.410	262	8.1	10.6	13.1	15.6	18.1
		4	59.7	1935	242	.400	256	8.0	10.6	13.2	15.8	18.4
		3	(2) 57.5	1802	229	.38	242	7.9	10.6	13.4	16.2	19.0
26000.	ISA+20°C 25°C	37	(1) 67.0	2413	269	.44	300	8.3	10.4	12.4	14.5	16.6
		36	65.6	2286	261	.430	290	8.3	10.5	12.7	14.9	17.1
		35	62.5	2045	242	.400	270	8.3	10.7	13.2	15.6	18.1
		34	60.2	1914	230	.380	256	8.2	10.8	13.4	16.0	18.6
		33	(2) 58.3	1807	219	.36	244	8.0	10.8	13.5	16.3	19.1
	ISA+10°C 15°C	26	(1) 65.9	2360	269	.44	295	8.3	10.4	12.5	14.6	16.7
		26	64.5	2236	261	.430	285	8.3	10.5	12.8	15.0	17.2
		24	61.5	2000	242	.400	265	8.3	10.8	13.3	15.8	18.3
		23	59.2	1872	230	.380	252	8.1	10.8	13.4	16.1	18.8
		23	(2) 57.4	1771	220	.36	240	7.9	10.8	13.6	16.4	19.2
	ISA+ 0°C 5°C	16	(1) 64.8	2307	269	.44	290	8.2	10.4	12.6	14.7	16.9
		15	62.5	2104	254	.420	274	8.2	10.6	13.0	15.4	17.8
		14	60.4	1956	242	.400	260	8.2	10.8	13.3	15.9	18.4
		13	58.2	1831	230	.380	247	8.0	10.8	13.5	16.2	19.0
		12	(2) 56.3	1728	219	.36	236	7.9	10.7	13.6	16.5	19.4
	ISA-10°C -5°C	6	(1) 63.7	2254	269	.44	284	8.2	10.4	12.6	14.8	17.1
		5	62.3	2135	261	.430	275	8.2	10.5	12.9	15.2	17.6
		4	59.4	1910	242	.400	256	8.2	10.8	13.4	16.0	18.6
		3	57.2	1788	230	.380	243	8.0	10.8	13.6	16.4	19.2
		2	(2) 55.4	1690	219	.36	232	7.8	10.8	13.7	16.7	19.6
24000.	ISA+20°C 25°C	37	(1) 66.8	2392	269	.44	300	8.4	10.4	12.5	14.6	16.7
		36	64.3	2178	254	.420	283	8.4	10.7	13.0	15.3	17.6
		35	62.1	2021	242	.400	270	8.4	10.9	13.3	15.8	18.3
		33	58.6	1827	224	.370	249	8.2	10.9	13.6	16.4	19.1
		32	(2) 56.0	1690	210	.35	234	7.9	10.9	13.8	16.8	19.8
	ISA+10°C 15°C	26	(1) 65.7	2339	269	.44	295	8.3	10.5	12.6	14.7	16.9
		25	63.2	2130	254	.420	278	8.4	10.7	13.1	15.4	17.8
		24	61.1	1977	242	.400	265	8.3	10.9	13.4	15.9	18.5
		23	57.6	1788	224	.370	245	8.1	10.9	13.7	16.5	19.3
		22	(2) 54.9	1648	209	.35	229	7.8	10.9	13.9	16.9	20.0
	ISA+ 0°C 5°C	16	(1) 64.6	2286	269	.44	290	8.3	10.5	12.7	14.9	17.0
		15	62.2	2082	254	.420	274	8.3	10.7	13.1	15.5	17.9
		14	60.1	1933	242	.400	260	8.3	10.9	13.5	16.1	18.6
		13	56.6	1749	224	.370	241	8.1	10.9	13.8	16.6	19.5
		12	(2) 54.1	1614	210	.35	225	7.8	10.9	14.0	17.1	20.2
	ISA-10°C -5°C	6	(1) 63.4	2234	269	.44	284	8.3	10.5	12.7	15.0	17.2
		5	61.1	2033	254	.420	269	8.3	10.8	13.2	15.7	18.1
		4	59.0	1889	242	.400	256	8.2	10.9	13.5	16.2	18.8
		2	55.7	1708	224	.370	236	8.0	10.9	13.8	16.8	19.7
		2	(2) 53.1	1577	210	.35	221	7.7	10.9	14.0	17.2	20.4

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

ANTI-ICE SYSTEMS ON		
MAX. FAN %RPM		
15°C	5°C	-5°C
66.3	65.2	64.0
INCREASE FUEL FLOWS AND DECREASE SPECIFIC RANGES BY 10%		

Figure 7-17 (Sheet 2)

CRUISE
10,000 FEET

ANTI-ICE SYSTEMS OFF **TWO ENGINES**

WT. LBS.	TEMP	RAT DEG. C	FAN PERCENT RPM	FUEL FLOW LBS/HR	KIAS	IND. MACH	KTAS	NAUTICAL MILES/100 LBS. FUEL: 100 KT. HEADWIND	50 KT. HEADWIND	ZERO WIND	50 KT. TAILWIND	100 KT. TAILWIND
35000.	ISA+20°C 15°C	36	(1) 80.3	3354	332	.60	396	8.8	10.3	11.8	13.3	14.8
		33	76.9	2941	306	.550	365	9.0	10.7	12.4	14.1	15.8
		30	73.6	2621	283	.510	339	9.1	11.0	12.9	14.8	16.7
		28	70.3	2333	260	.470	312	9.1	11.2	13.4	15.5	17.7
		25	(2) 66.7	2023	233	.42	280	8.9	11.4	13.8	16.3	18.8
	ISA+10°C 5°C	27	(1) 81.0	3577	349	.63	409	8.6	10.0	11.4	12.8	14.2
		24	77.8	3133	323	.580	379	8.9	10.5	12.1	13.7	15.3
		21	74.0	2712	294	.530	346	9.1	10.9	12.8	14.6	16.4
		18	69.1	2280	260	.470	306	9.1	11.2	13.4	15.6	17.8
		15	(2) 65.6	1978	234	.42	275	8.9	11.4	13.9	16.4	19.0
	ISA+ 0°C -5°C	16	(1) 79.6	3495	349	.63	401	8.6	10.1	11.5	12.9	14.3
		13	76.5	3059	323	.580	372	8.9	10.5	12.1	13.8	15.4
		10	72.7	2648	294	.530	340	9.0	10.9	12.8	14.7	16.6
		8	68.6	2295	266	.480	307	9.0	11.2	13.4	15.6	17.8
		5	(2) 64.5	1940	234	.42	271	8.8	11.4	14.0	16.6	19.1
	ISA-10°C -15°C	6	(1) 78.1	3411	349	.63	394	8.6	10.1	11.5	13.0	14.5
		3	75.1	2987	323	.580	365	8.9	10.5	12.2	13.9	15.6
		0	71.4	2583	294	.530	333	9.0	11.0	12.9	14.8	16.8
		-3	67.4	2240	266	.480	302	9.0	11.2	13.5	15.7	17.9
		-6	(2) 63.3	1893	234	.42	266	8.8	11.4	14.0	16.7	19.3
34000.	ISA+20°C 15°C	36	(1) 80.2	3349	332	.60	396	8.8	10.3	11.8	13.3	14.8
		33	76.8	2930	306	.550	365	9.1	10.8	12.5	14.2	15.9
		30	73.4	2609	283	.510	339	9.1	11.1	13.0	14.9	16.8
		27	69.3	2247	255	.460	305	9.1	11.4	13.6	15.8	18.0
		25	(2) 66.0	1972	230	.42	276	8.9	11.5	14.0	16.6	19.1
	ISA+10°C 5°C	27	(1) 80.9	3567	349	.63	409	8.7	10.1	11.5	12.9	14.3
		24	77.7	3123	323	.580	379	8.9	10.5	12.1	13.7	15.3
		20	73.0	2622	289	.520	339	9.1	11.0	12.9	14.8	16.8
		18	68.9	2265	260	.470	306	9.1	11.3	13.5	15.7	17.9
		15	(2) 65.0	1934	231	.42	272	8.9	11.5	14.1	16.7	19.3
	ISA+ 0°C -5°C	16	(1) 79.5	3486	349	.63	401	8.6	10.1	11.5	12.9	14.4
		13	76.4	3050	323	.580	372	8.9	10.5	12.2	13.8	15.5
		10	71.8	2561	289	.520	333	9.1	11.1	13.0	15.0	16.9
		7	67.7	2212	260	.470	301	9.1	11.3	13.6	15.9	18.1
		5	(2) 63.9	1890	231	.42	268	8.9	11.5	14.2	16.8	19.4
	ISA-10°C -15°C	6	(1) 78.1	3403	349	.63	394	8.6	10.1	11.6	13.0	14.5
		3	75.0	2977	323	.580	365	8.9	10.6	12.3	13.9	15.6
		-1	70.5	2498	289	.520	327	9.1	11.1	13.1	15.1	17.1
		-3	66.5	2158	260	.470	295	9.0	11.4	13.7	16.0	18.3
		-6	(2) 62.7	1844	231	.42	262	8.8	11.5	14.2	16.9	19.7
32000.	ISA+20°C 15°C	36	(1) 80.2	3354	333	.60	398	8.9	10.4	11.9	13.4	14.8
		33	76.5	2909	306	.550	365	9.1	10.8	12.6	14.3	16.0
		30	72.2	2512	277	.500	332	9.2	11.2	13.2	15.2	17.2
		27	69.0	2216	255	.460	305	9.3	11.5	13.8	16.0	18.3
		25	(2) 64.7	1872	225	.41	269	9.1	11.7	14.4	17.1	19.7
	ISA+10°C 5°C	27	(1) 80.8	3550	349	.63	409	8.7	10.1	11.5	12.9	14.3
		23	76.8	3015	317	.570	372	9.0	10.7	12.3	14.0	15.7
		20	72.7	2600	289	.520	339	9.2	11.1	13.1	15.0	16.9
		17	67.8	2166	255	.460	300	9.2	11.5	13.8	16.2	18.5
		14	(2) 63.7	1838	225	.41	266	9.0	11.7	14.5	17.2	19.9
	ISA+ 0°C -5°C	16	(1) 79.4	3468	349	.63	401	8.7	10.1	11.6	13.0	14.5
		13	75.5	2944	317	.570	365	9.0	10.7	12.4	14.1	15.8
		10	71.5	2538	289	.520	333	9.2	11.2	13.1	15.1	17.1
		7	66.6	2115	255	.460	294	9.2	11.6	13.9	16.3	18.6
		4	(2) 62.6	1795	225	.41	261	9.0	11.7	14.5	17.3	20.1
	ISA-10°C -15°C	6	(1) 77.9	3386	349	.63	394	8.7	10.2	11.6	13.1	14.6
		2	74.1	2873	317	.570	358	9.0	10.7	12.5	14.2	16.0
		-1	70.2	2476	289	.520	327	9.2	11.2	13.2	15.2	17.2
		-4	65.4	2065	255	.460	289	9.1	11.6	14.0	16.4	18.8
		-6	(2) 61.4	1752	225	.41	256	8.9	11.7	14.6	17.5	20.3
30000.	ISA+20°C 15°C	36	(1) 80.3	3357	334	.60	399	8.9	10.4	11.9	13.4	14.9
		33	76.3	2889	306	.550	365	9.2	10.9	12.6	14.4	16.1
		30	71.9	2489	277	.500	332	9.3	11.3	13.3	15.3	17.4
		27	67.8	2115	249	.450	299	9.4	11.7	14.1	16.5	18.8
		24	(2) 63.3	1773	219	.40	262	9.2	12.0	14.8	17.6	20.4
	ISA+10°C 5°C	27	(1) 80.7	3533	349	.63	409	8.7	10.2	11.6	13.0	14.4
		23	76.6	2996	317	.570	372	9.1	10.7	12.4	14.1	15.8
		20	71.6	2504	283	.510	333	9.3	11.3	13.3	15.3	17.3
		17	67.5	2136	255	.460	300	9.4	11.7	14.0	16.4	18.7
		14	(2) 62.3	1742	219	.40	259	9.1	12.0	14.9	17.7	20.6
	ISA+ 0°C -5°C	16	(1) 79.2	3452	349	.63	401	8.7	10.2	11.6	13.1	14.5
		13	75.3	2926	317	.570	365	9.1	10.8	12.5	14.2	15.9
		9	70.3	2445	283	.510	327	9.3	11.3	13.4	15.4	17.5
		7	66.3	2087	255	.460	294	9.3	11.7	14.1	16.5	18.9
		4	(2) 61.2	1701	219	.40	254	9.0	12.0	14.9	17.9	20.8
	ISA-10°C -15°C	6	(1) 77.8	3370	349	.63	394	8.7	10.2	11.7	13.2	14.7
		2	73.9	2856	317	.570	358	9.0	10.8	12.5	14.3	16.1
		-1	69.1	2385	283	.510	321	9.2	11.3	13.4	15.5	17.6
		-4	65.1	2037	255	.460	289	9.3	11.7	14.2	16.6	19.1
		-7	(2) 60.1	1660	219	.40	249	9.0	12.0	15.0	18.0	21.0

Figure 7-17 (Sheet 3)

CRUISE
10,000 FEET

ANTI-ICE SYSTEMS OFF **TWO ENGINES**

WT. LBS.	TEMP	RAT DEG. C	FAN PERCENT RPM	FUEL FLOW LBS/HR	KIAS	IND. MACH	KTAS	NAUTICAL MILES/100 LBS. FUEL 100 KT. HEADWIND	50 KT. HEADWIND	ZERO WIND	50 KT. TAILWIND	100 KT. TAILWIND
28000.	ISA+20°C 15°C	36	(1) 80.2	3359	335	.60	400	8.9	10.4	11.9	13.4	14.9
		33	76.1	2870	306	.550	365	9.2	11.0	12.7	14.5	16.2
		30	71.6	2467	277	.500	332	9.4	11.4	13.5	15.5	17.5
		27	67.4	2086	249	.450	299	9.5	11.9	14.3	16.7	19.1
		24	(2) 62.4	1719	217	.39	260	9.3	12.2	15.1	18.0	21.0
	ISA+10°C 5°C	27	(1) 80.5	3518	349	.63	409	8.8	10.2	11.6	13.0	14.5
		23	76.5	2979	317	.570	372	9.1	10.8	12.5	14.2	15.8
		20	71.3	2484	283	.510	333	9.4	11.4	13.4	15.4	17.4
		16	66.3	2038	249	.450	293	9.5	11.9	14.4	16.8	19.3
		14	(2) 61.4	1681	217	.39	256	9.3	12.2	15.2	18.2	21.2
	ISA+ 0°C -5°C	16	(1) 79.1	3437	349	.63	401	8.8	10.2	11.7	13.1	14.6
		13	75.1	2909	317	.570	365	9.1	10.8	12.6	14.3	16.0
		9	70.1	2425	283	.510	327	9.3	11.4	13.5	15.5	17.6
		6	65.1	1992	249	.450	288	9.4	11.9	14.5	17.0	19.5
		3	(2) 60.3	1642	217	.39	251	9.2	12.2	15.3	18.3	21.4
	ISA-10°C -15°C	6	(1) 77.7	3355	349	.63	394	8.8	10.2	11.7	13.2	14.7
		2	73.8	2839	317	.570	358	9.1	10.9	12.6	14.4	16.1
		-1	68.8	2366	283	.510	321	9.3	11.4	13.5	15.7	17.8
		-4	64.0	1945	249	.450	283	9.4	12.0	14.5	17.1	19.7
		-7	(2) 59.2	1602	217	.39	246	9.1	12.2	15.4	18.5	21.6
26000.	ISA+20°C 15°C	36	(1) 80.2	3358	336	.60	401	9.0	10.5	12.0	13.4	14.9
		33	75.9	2852	306	.550	365	9.3	11.1	12.8	14.6	16.3
		30	71.4	2445	277	.500	332	9.5	11.5	13.6	15.6	17.7
		27	67.1	2059	249	.450	299	9.6	12.1	14.5	16.9	19.4
		24	(2) 61.8	1681	217	.39	260	9.5	12.5	15.5	18.4	21.4
	ISA+10°C 5°C	27	(1) 80.4	3504	349	.63	409	8.8	10.2	11.7	13.1	14.5
		23	76.3	2963	317	.570	372	9.2	10.9	12.6	14.2	15.9
		20	71.1	2466	283	.510	333	9.4	11.5	13.5	15.5	17.5
		16	66.0	2011	249	.450	293	9.6	12.1	14.6	17.1	19.6
		14	(2) 60.8	1644	217	.39	255	9.5	12.5	15.5	18.6	21.6
	ISA+ 0°C -5°C	16	(1) 79.0	3423	349	.63	401	8.8	10.3	11.7	13.2	14.6
		13	75.0	2893	317	.570	365	9.2	10.9	12.6	14.4	16.1
		9	69.8	2407	283	.510	327	9.4	11.5	13.6	15.6	17.7
		6	64.8	1966	249	.450	288	9.6	12.1	14.6	17.2	19.7
		3	(2) 59.7	1605	216	.39	251	9.4	12.5	15.6	18.7	21.8
	ISA-10°C -15°C	6	(1) 77.6	3342	349	.63	394	8.8	10.3	11.8	13.3	14.8
		2	73.6	2824	317	.570	358	9.2	10.9	12.7	14.5	16.2
		-1	68.6	2348	283	.510	321	9.4	11.5	13.6	15.8	17.9
		-4	63.6	1919	249	.450	283	9.5	12.1	14.7	17.3	19.9
		-7	(2) 58.6	1568	217	.39	246	9.3	12.5	15.7	18.9	22.1
24000.	ISA+20°C 15°C	36	(1) 80.2	3358	337	.61	402	9.0	10.5	12.0	13.5	15.0
		33	75.8	2836	306	.550	365	9.4	11.1	12.9	14.6	16.4
		30	71.2	2425	277	.500	332	9.6	11.6	13.7	15.8	17.8
		26	65.9	1962	243	.440	292	9.8	12.3	14.9	17.4	20.0
		24	(2) 60.6	1617	213	.39	256	9.6	12.7	15.8	18.9	22.0
	ISA+10°C 5°C	27	(1) 80.3	3490	349	.63	409	8.8	10.3	11.7	13.1	14.6
		23	76.2	2948	317	.570	372	9.2	10.9	12.6	14.3	16.0
		20	70.8	2449	283	.510	333	9.5	11.5	13.6	15.6	17.7
		16	65.7	1987	249	.450	293	9.7	12.2	14.8	17.3	19.8
		13	(2) 59.5	1580	213	.39	251	9.5	12.7	15.9	19.0	22.2
	ISA+ 0°C -5°C	16	(1) 78.9	3410	349	.63	401	8.8	10.3	11.8	13.2	14.7
		13	74.8	2878	317	.570	365	9.2	11.0	12.7	14.4	16.2
		9	69.6	2390	283	.510	327	9.5	11.6	13.7	15.8	17.8
		6	64.5	1941	249	.450	288	9.7	12.3	14.8	17.4	20.0
		3	(2) 58.4	1539	212	.38	246	9.5	12.7	16.0	19.2	22.5
	ISA-10°C -15°C	6	(1) 77.5	3328	349	.63	394	8.8	10.3	11.8	13.3	14.8
		2	73.5	2809	317	.570	358	9.2	11.0	12.8	14.5	16.3
		-1	68.3	2333	283	.510	321	9.5	11.6	13.7	15.9	18.0
		-4	63.3	1896	249	.450	283	9.6	12.3	14.9	17.5	20.2
		-7	(2) 57.4	1505	213	.38	241	9.4	12.7	16.0	19.4	22.7

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

ANTI-ICE SYSTEMS ON		
MAX. FAN %RPM		
5°C	-5°C	-15°C
78.5	79.2	77.8
INCREASE FUEL FLOWS AND DECREASE SPECIFIC RANGES BY 10%		

Figure 7-17 (Sheet 4)

CRUISE
15,000 FEET

ANTI-ICE SYSTEMS OFF **TWO ENGINES**

WT. LBS.	TEMP	RAT DEG. C	FAN PERCENT RPM	FUEL FLOW LBS/HR	KIAS	IND. MACH	KTAS	NAUTICAL MILES/100 LBS. FUEL 100 KT. HEADWIND	50 KT. HEADWIND	ZERO WIND	50 KT. TAILWIND	100 KT. TAILWIND
35000.	ISA+20°C 5°C	27	(1) 81.1	2976	315	.62	405	10.3	11.9	13.6	15.3	17.0
		25	79.2	2735	299	.590	385	10.4	12.3	14.1	15.9	17.7
		22	76.5	2455	278	.550	359	10.5	12.6	14.6	16.7	18.7
		20	73.6	2206	257	.510	333	10.6	12.8	15.1	17.4	19.6
		18	(2) 70.9	2014	239	.47	310	10.4	12.9	15.4	17.9	20.3
	ISA+10°C -5°C	19	(1) 82.0	3234	336	.66	424	10.0	11.6	13.1	14.6	16.2
		16	79.7	2899	315	.620	397	10.3	12.0	13.7	15.4	17.2
		13	76.5	2529	289	.570	365	10.5	12.5	14.4	16.4	18.4
		10	73.0	2211	263	.520	333	10.5	12.8	15.1	17.3	19.6
		7	(2) 69.7	1968	239	.48	304	10.4	12.9	15.5	18.0	20.5
	ISA+ 0°C -15°C	10	(1) 81.8	3362	349	.68	431	9.8	11.3	12.8	14.3	15.8
		7	79.4	2985	325	.640	403	10.1	11.8	13.5	15.2	16.8
		3	75.8	2534	294	.580	365	10.4	12.4	14.4	16.4	18.3
		0	72.4	2215	268	.530	333	10.5	12.8	15.0	17.3	19.6
		-3	(2) 68.4	1923	240	.48	299	10.3	12.9	15.5	18.1	20.7
	ISA-10°C -25°C	-1	(1) 80.2	3279	349	.68	422	9.8	11.4	12.9	14.4	15.9
		-4	77.9	2910	325	.640	395	10.1	11.8	13.6	15.3	17.0
		-8	74.3	2469	294	.580	358	10.4	12.5	14.5	16.5	18.5
		-11	71.0	2160	268	.530	327	10.5	12.8	15.1	17.4	19.8
		-13	(2) 67.1	1874	240	.48	293	10.3	13.0	15.6	18.3	21.0
34000.	ISA+20°C 5°C	27	(1) 81.2	2982	316	.62	407	10.3	12.0	13.6	15.3	17.0
		25	79.1	2723	299	.590	385	10.5	12.3	14.1	16.0	17.8
		22	76.3	2441	278	.550	359	10.6	12.7	14.7	16.8	18.8
		20	73.3	2191	257	.510	333	10.6	12.9	15.2	17.5	19.8
		17	(2) 69.9	1942	234	.46	303	10.4	13.0	15.6	18.2	20.7
	ISA+10°C -5°C	19	(1) 82.0	3235	337	.66	424	10.0	11.6	13.1	14.7	16.2
		16	79.6	2888	315	.620	397	10.3	12.0	13.8	15.5	17.2
		13	76.4	2517	289	.570	365	10.5	12.5	14.5	16.5	18.5
		10	72.8	2197	263	.520	333	10.6	12.9	15.2	17.4	19.7
		7	(2) 68.7	1899	234	.46	297	10.4	13.0	15.7	18.3	20.9
	ISA+ 0°C -15°C	10	(1) 81.7	3354	349	.68	431	9.9	11.4	12.8	14.3	15.8
		6	78.8	2895	320	.630	396	10.2	12.0	13.7	15.4	17.1
		3	75.6	2523	294	.580	365	10.5	12.5	14.5	16.4	18.4
		-1	71.5	2143	263	.520	327	10.6	12.9	15.3	17.6	19.9
		-4	(2) 67.4	1856	234	.46	292	10.3	13.0	15.7	18.4	21.1
	ISA-10°C -25°C	-1	(1) 80.2	3270	349	.68	422	9.9	11.4	12.9	14.4	16.0
		-5	77.3	2822	320	.630	389	10.2	12.0	13.8	15.5	17.3
		-8	74.2	2458	294	.580	358	10.5	12.5	14.5	16.6	18.6
		-11	70.2	2090	263	.520	321	10.6	12.9	15.3	17.7	20.1
		-14	(2) 66.2	1810	234	.46	286	10.3	13.1	15.8	18.6	21.3
32000.	ISA+20°C 5°C	27	(1) 81.1	2973	317	.62	408	10.3	12.0	13.7	15.4	17.1
		24	78.1	2626	294	.580	379	10.6	12.5	14.4	16.3	18.2
		22	75.2	2349	273	.540	352	10.7	12.9	15.0	17.1	19.3
		19	71.3	2047	247	.490	320	10.7	13.2	15.6	18.1	20.5
		16	(2) 68.3	1823	225	.45	292	10.5	13.3	16.0	18.8	21.5
	ISA+10°C -5°C	19	(1) 82.0	3236	338	.66	426	10.1	11.6	13.2	14.7	16.3
		15	78.8	2787	309	.610	391	10.4	12.2	14.0	15.8	17.6
		12	75.4	2425	283	.560	359	10.7	12.7	14.8	16.9	18.9
		9	70.9	2053	252	.500	320	10.7	13.2	15.6	18.0	20.5
		6	(2) 67.1	1781	225	.45	287	10.5	13.3	16.1	18.9	21.7
	ISA+ 0°C -15°C	10	(1) 81.6	3336	349	.68	431	9.9	11.4	12.9	14.4	15.9
		6	78.6	2875	320	.630	396	10.3	12.0	13.8	15.5	17.3
		2	74.7	2432	289	.570	358	10.6	12.7	14.7	16.8	18.9
		-1	70.4	2058	257	.510	321	10.7	13.1	15.6	18.0	20.4
		-4	(2) 65.9	1741	226	.45	282	10.4	13.3	16.2	19.0	21.9
	ISA-10°C -25°C	-1	(1) 80.0	3253	349	.68	422	9.9	11.4	13.0	14.5	16.1
		-5	77.1	2802	320	.630	389	10.3	12.1	13.9	15.7	17.4
		-9	73.3	2370	289	.570	351	10.6	12.7	14.8	16.9	19.0
		-12	69.0	2007	257	.510	314	10.7	13.2	15.7	18.2	20.6
		-15	(2) 64.7	1702	226	.45	277	10.4	13.3	16.3	19.2	22.1
30000.	ISA+20°C 5°C	27	(1) 81.1	2974	318	.63	409	10.4	12.1	13.8	15.4	17.1
		24	77.9	2603	294	.580	379	10.7	12.6	14.5	16.5	18.4
		21	74.1	2259	268	.530	346	10.9	13.1	15.3	17.5	19.7
		18	70.0	1962	242	.480	313	10.9	13.4	16.0	18.5	21.0
		16	(2) 66.5	1699	216	.43	281	10.6	13.6	16.5	19.5	22.4
	ISA+10°C -5°C	19	(1) 81.9	3230	339	.67	427	10.1	11.7	13.2	14.8	16.3
		15	78.6	2767	309	.610	391	10.5	12.3	14.1	15.9	17.7
		12	74.4	2334	278	.550	352	10.8	13.0	15.1	17.2	19.4
		8	69.6	1971	247	.490	314	10.8	13.4	15.9	18.5	21.0
		5	(2) 65.4	1665	217	.43	276	10.6	13.6	16.6	19.6	22.6
	ISA+ 0°C -15°C	10	(1) 81.5	3319	349	.68	431	10.0	11.5	13.0	14.5	16.0
		5	77.8	2775	315	.620	390	10.4	12.3	14.1	15.9	17.7
		2	73.8	2343	283	.560	352	10.8	12.9	15.0	17.2	19.3
		-2	69.2	1977	252	.500	314	10.8	13.4	15.9	18.4	21.0
		-5	(2) 64.3	1631	218	.43	272	10.5	13.6	16.7	19.7	22.8
	ISA-10°C -25°C	-1	(1) 79.9	3236	349	.68	422	10.0	11.5	13.0	14.6	16.1
		-6	76.3	2705	315	.620	382	10.4	12.3	14.1	16.0	17.8
		-9	72.4	2284	283	.560	345	10.7	12.9	15.1	17.3	19.5
		-12	67.9	1927	252	.500	308	10.8	13.4	16.0	18.6	21.2
		-15	(2) 63.1	1590	218	.43	266	10.5	13.6	16.8	19.9	23.0

Figure 7-17 (Sheet 5)

CRUISE
15,000 FEET

ANTI-ICE SYSTEMS OFF — **TWO ENGINES**

WT. LBS.	TEMP	RAT DEG. C	FAN PERCENT RPM	FUEL FLOW LBS/HR	KIAS	IND. MACH	KTAS	NAUTICAL MILES/100 LBS. FUEL: 100 KT. HEADWIND	50 KT. HEADWIND	ZERO WIND	50 KT. TAILWIND	100 KT. TAILWIND
28000.	ISA+20°C 5°C	27	(1) 81.1	2979	320	.63	411	10.4	12.1	13.8	15.5	17.2
		24	77.7	2583	294	.580	379	10.8	12.7	14.7	16.6	18.5
		21	73.8	2235	268	.530	346	11.0	13.2	15.5	17.7	19.9
		18	68.9	1874	237	.470	306	11.0	13.7	16.4	19.0	21.7
		15	(2) 65.1	1607	211	.42	273	10.8	13.9	17.0	20.1	23.2
	ISA+10°C -5°C	19	(1) 82.0	3238	340	.67	428	10.1	11.7	13.2	14.8	16.3
		15	78.4	2748	309	.610	391	10.6	12.4	14.2	16.1	17.9
		12	74.1	2312	278	.550	352	10.9	13.1	15.2	17.4	19.6
		8	68.4	1888	242	.480	307	11.0	13.6	16.3	18.9	21.6
		5	(2) 64.0	1570	211	.42	268	10.7	13.9	17.1	20.3	23.5
	ISA+ 0°C -15°C	10	(1) 81.4	3304	349	.68	431	10.0	11.5	13.0	14.6	16.1
		5	77.6	2757	315	.620	390	10.5	12.3	14.1	16.0	17.8
		1	72.8	2256	278	.550	346	10.9	13.1	15.3	17.5	19.8
		-2	67.9	1899	247	.490	308	10.9	13.6	16.2	18.8	21.5
		-6	(2) 62.8	1532	211	.42	263	10.6	13.9	17.2	20.4	23.7
	ISA-10°C -25°C	-1	(1) 79.8	3221	349	.68	422	10.0	11.6	13.1	14.7	16.2
		-6	76.2	2687	315	.620	382	10.5	12.4	14.2	16.1	18.0
		-10	71.4	2200	278	.550	339	10.9	13.1	15.4	17.7	20.0
		-13	66.6	1852	247	.490	302	10.9	13.6	16.3	19.0	21.7
		-16	(2) 61.6	1494	210	.42	258	10.6	13.9	17.3	20.6	24.0
26000.	ISA+20°C 5°C	28	(1) 81.1	2982	321	.63	413	10.5	12.2	13.8	15.5	17.2
		24	77.5	2564	294	.580	379	10.9	12.8	14.8	16.7	18.7
		20	72.7	2148	263	.520	339	11.1	13.5	15.8	18.1	20.5
		17	67.7	1787	232	.460	300	11.2	14.0	16.8	19.6	22.4
		15	(2) 63.5	1511	204	.41	265	10.9	14.2	17.5	20.9	24.2
	ISA+10°C -5°C	19	(1) 82.0	3239	341	.67	430	10.2	11.7	13.3	14.8	16.4
		15	78.2	2730	309	.610	391	10.7	12.5	14.3	16.2	18.0
		11	73.1	2225	273	.540	346	11.1	13.3	15.6	17.8	20.0
		7	67.3	1802	237	.470	301	11.2	13.9	16.7	19.5	22.3
		4	(2) 62.4	1474	204	.41	260	10.8	14.2	17.6	21.0	24.4
	ISA+ 0°C -15°C	10	(1) 81.3	3289	349	.68	431	10.1	11.6	13.1	14.6	16.1
		5	77.5	2740	315	.620	390	10.6	12.4	14.2	16.1	17.9
		1	72.5	2236	278	.550	346	11.0	13.2	15.5	17.7	19.9
		-3	66.8	1816	242	.480	302	11.1	13.9	16.6	19.4	22.1
		-6	(2) 61.3	1441	204	.41	255	10.8	14.2	17.7	21.2	24.7
	ISA-10°C -25°C	-1	(1) 79.7	3206	349	.68	422	10.1	11.6	13.2	14.7	16.3
		-6	76.0	2670	315	.620	382	10.6	12.4	14.3	16.2	18.1
		-10	71.2	2180	278	.550	339	11.0	13.3	15.6	17.8	20.1
		-13	65.6	1771	242	.480	296	11.1	13.9	16.7	19.5	22.3
		-16	(2) 60.1	1406	204	.41	250	10.7	14.3	17.8	21.4	24.9
24000.	ISA+20°C 5°C	28	(1) 81.0	2980	322	.63	414	10.5	12.2	13.9	15.6	17.2
		24	77.3	2546	294	.580	379	10.9	12.9	14.9	16.8	18.8
		20	72.3	2127	263	.520	339	11.3	13.6	16.0	18.3	20.7
		17	67.3	1758	232	.460	300	11.4	14.2	17.1	19.9	22.7
		14	(2) 61.9	1418	198	.39	257	11.1	14.6	18.1	21.7	25.2
	ISA+10°C -5°C	20	(1) 81.9	3236	342	.67	430	10.2	11.8	13.3	14.8	16.4
		15	77.4	2636	304	.600	385	10.8	12.7	14.6	16.5	18.4
		10	72.0	2140	268	.530	340	11.2	13.5	15.9	18.2	20.5
		7	66.1	1717	232	.460	294	11.3	14.2	17.1	20.1	23.0
		4	(2) 60.7	1382	198	.39	252	11.0	14.6	18.2	21.8	25.5
	ISA+ 0°C -15°C	10	(1) 81.2	3276	349	.68	431	10.1	11.6	13.1	14.7	16.2
		5	76.7	2646	309	.610	384	10.7	12.6	14.5	16.4	18.3
		0	71.5	2151	273	.540	340	11.1	13.5	15.8	18.1	20.4
		-3	65.7	1733	237	.470	295	11.3	14.2	17.0	19.9	22.8
		-7	(2) 59.6	1349	198	.39	247	10.9	14.6	18.3	22.0	25.7
	ISA-10°C -25°C	-1	(1) 79.6	3193	349	.68	422	10.1	11.7	13.2	14.8	16.4
		-6	75.2	2579	309	.610	376	10.7	12.6	14.6	16.5	18.5
		-10	70.1	2098	273	.540	333	11.1	13.5	15.9	18.3	20.6
		-14	64.5	1690	237	.470	290	11.2	14.2	17.1	20.1	23.0
		-17	(2) 58.5	1316	198	.39	242	10.8	14.6	18.4	22.2	26.0

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

ANTI-ICE SYSTEMS ON		
MAX. FAN %RPM		
-5°C	-15°C	-25°C
79.0	79.8	78.4
INCREASE FUEL FLOWS AND DECREASE SPECIFIC RANGES BY 10%		

Figure 7-17 (Sheet 6)

CRUISE
17,000 FEET

ANTI-ICE SYSTEMS OFF **TWO ENGINES**

WT. LBS.	TEMP	RAT DEG. C	FAN PERCENT RPM	FUEL FLOW LBS/HR	KIAS	IND. MACH	KTAS	NAUTICAL MILES/100 LBS. FUEL 100 KT. HEADWIND	50 KT. HEADWIND	ZERO WIND	50 KT. TAILWIND	100 KT. TAILWIND
35000.	ISA+20°C	23	(1) 81.1	2784	305	.62	405	10.9	12.7	14.5	16.3	18.1
	1°C	21	79.6	2609	293	.600	389	11.1	13.0	14.9	16.8	18.7
		19	77.1	2347	273	.560	363	11.2	13.3	15.5	17.6	19.7
		17	75.1	2172	258	.530	343	11.2	13.5	15.8	18.1	20.4
		15	(2) 72.8	2002	242	.50	323	11.1	13.6	16.1	18.6	21.1
	ISA+10°C	15	(1) 82.1	3063	328	.67	426	10.7	12.3	13.9	15.5	17.2
	-9°C	12	80.0	2760	308	.630	401	10.9	12.7	14.5	16.3	18.2
		10	77.6	2480	288	.590	375	11.1	13.1	15.1	17.2	19.2
		7	74.4	2175	263	.540	343	11.2	13.5	15.8	18.1	20.4
		4	(2) 71.5	1955	242	.50	317	11.1	13.6	16.2	18.8	21.3
	ISA+ 0°C	7	(1) 82.5	3313	349	.71	443	10.4	11.9	13.4	14.9	16.4
	-19°C	4	80.1	2912	323	.660	412	10.7	12.4	14.2	15.9	17.6
		0	77.4	2551	298	.610	381	11.0	13.0	14.9	16.9	18.8
		-3	73.7	2177	268	.550	343	11.2	13.5	15.8	18.1	20.4
		-6	(2) 70.3	1910	242	.50	311	11.0	13.7	16.3	18.9	21.5
	ISA-10°C	-4	(1) 81.0	3229	349	.71	434	10.4	11.9	13.5	15.0	16.6
	-29°C	-7	78.6	2836	323	.660	404	10.7	12.5	14.2	16.0	17.8
		-10	75.9	2485	298	.610	373	11.0	13.0	15.0	17.0	19.0
		-14	72.3	2122	268	.550	336	11.1	13.5	15.9	18.2	20.6
		-17	(2) 68.9	1861	242	.50	305	11.0	13.7	16.4	19.1	21.7
34000.	ISA+20°C	23	(1) 81.1	2789	306	.63	406	11.0	12.8	14.6	16.4	18.1
	1°C	21	79.5	2596	293	.600	389	11.1	13.1	15.0	16.9	18.8
		19	76.9	2333	273	.560	363	11.3	13.4	15.6	17.7	19.8
		17	74.8	2156	258	.530	343	11.3	13.6	15.9	18.2	20.6
		15	(2) 72.1	1953	238	.49	318	11.2	13.7	16.3	18.9	21.4
	ISA+10°C	15	(1) 82.1	3063	329	.67	427	10.7	12.3	13.9	15.6	17.2
	-9°C	12	79.9	2748	308	.630	401	10.9	12.8	14.6	16.4	18.2
		9	76.8	2402	283	.580	369	11.2	13.3	15.4	17.4	19.5
		7	74.2	2161	263	.540	343	11.3	13.6	15.9	18.2	20.5
		4	(2) 70.8	1907	238	.49	312	11.1	13.8	16.4	19.0	21.6
	ISA+ 0°C	7	(1) 82.5	3304	349	.71	443	10.4	11.9	13.4	14.9	16.4
	-19°C	4	80.0	2901	323	.660	412	10.8	12.5	14.2	15.9	17.7
		0	76.7	2470	293	.600	374	11.1	13.1	15.2	17.2	19.2
		-3	73.5	2163	268	.550	343	11.2	13.6	15.9	18.2	20.5
		-6	(2) 69.6	1868	239	.49	307	11.1	13.8	16.5	19.1	21.8
	ISA-10°C	-4	(1) 80.9	3220	349	.71	434	10.4	11.9	13.5	15.0	16.6
	-29°C	-7	78.5	2826	323	.660	404	10.8	12.5	14.3	16.1	17.8
		-11	75.2	2407	293	.600	367	11.1	13.2	15.2	17.3	19.4
		-14	72.1	2109	268	.550	336	11.2	13.6	16.0	18.3	20.7
		-17	(2) 68.3	1820	239	.49	301	11.1	13.8	16.6	19.3	22.0
32000.	ISA+20°C	23	(1) 81.1	2790	308	.63	408	11.0	12.8	14.6	16.4	18.2
	1°C	20	78.6	2502	288	.590	382	11.3	13.3	15.3	17.3	19.3
		18	75.9	2245	268	.550	356	11.4	13.6	15.9	18.1	20.3
		16	73.0	2016	248	.510	330	11.4	13.9	16.4	18.9	21.3
		13	(2) 69.9	1818	228	.47	304	11.2	14.0	16.7	19.5	22.2
	ISA+10°C	15	(1) 82.1	3064	330	.67	429	10.7	12.4	14.0	15.6	17.3
	-9°C	12	79.7	2726	308	.630	401	11.0	12.9	14.7	16.5	18.4
		9	76.5	2377	283	.580	369	11.3	13.4	15.5	17.6	19.7
		6	72.4	2021	253	.520	331	11.4	13.9	16.4	18.8	21.3
		3	(2) 68.9	1785	229	.47	300	11.2	14.0	16.8	19.6	22.4
	ISA+ 0°C	7	(1) 82.4	3286	349	.71	443	10.4	12.0	13.5	15.0	16.5
	-19°C	3	79.3	2806	318	.650	406	10.9	12.7	14.5	16.2	18.0
		-1	75.8	2381	288	.590	368	11.3	13.4	15.5	17.6	19.7
		-4	71.8	2025	258	.530	331	11.4	13.9	16.3	18.8	21.3
		-7	(2) 67.6	1744	229	.47	294	11.2	14.0	16.9	19.8	22.6
	ISA-10°C	-4	(1) 80.8	3202	349	.71	434	10.4	12.0	13.6	15.1	16.7
	-29°C	-8	77.8	2732	318	.650	398	10.9	12.7	14.6	16.4	18.2
		-12	74.3	2320	288	.590	361	11.2	13.4	15.6	17.7	19.9
		-15	70.4	1974	258	.530	324	11.4	13.9	16.4	19.0	21.5
		-18	(2) 66.4	1705	229	.47	290	11.1	14.0	17.0	19.9	22.8
30000.	ISA+20°C	23	(1) 81.0	2790	309	.63	410	11.1	12.9	14.7	16.5	18.3
	1°C	20	78.3	2479	288	.590	382	11.4	13.4	15.4	17.4	19.5
		17	74.8	2158	263	.540	350	11.6	13.9	16.2	18.5	20.8
		15	71.7	1933	243	.500	324	11.6	14.2	16.8	19.3	21.9
		13	(2) 68.3	1702	219	.45	293	11.3	14.3	17.2	20.2	23.1
	ISA+10°C	16	(1) 82.0	3061	331	.68	430	10.8	12.4	14.0	15.7	17.3
	-9°C	12	78.9	2630	303	.620	395	11.2	13.1	15.0	16.9	18.8
		9	75.6	2289	278	.570	363	11.5	13.7	15.8	18.0	20.2
		5	71.2	1939	248	.510	324	11.6	14.1	16.7	19.3	21.9
		2	(2) 67.0	1661	219	.45	287	11.3	14.3	17.3	20.3	23.3
	ISA+ 0°C	7	(1) 82.2	3269	349	.71	443	10.5	12.0	13.6	15.1	16.6
	-19°C	3	79.2	2787	318	.650	406	11.0	12.8	14.6	16.4	18.2
		-1	74.9	2295	283	.580	362	11.4	13.6	15.8	18.0	20.1
		-5	70.7	1945	253	.520	324	11.5	14.1	16.7	19.3	21.8
		-8	(2) 65.8	1626	219	.45	283	11.2	14.3	17.4	20.5	23.5
	ISA-10°C	-4	(1) 80.7	3186	349	.71	434	10.5	12.1	13.6	15.2	16.8
	-29°C	-8	77.7	2714	318	.650	398	11.0	12.8	14.7	16.5	18.3
		-12	73.5	2236	283	.580	355	11.4	13.6	15.9	18.1	20.3
		-15	69.3	1896	253	.520	318	11.5	14.1	16.8	19.4	22.0
		-19	(2) 64.6	1585	219	.45	277	11.2	14.3	17.5	20.6	23.8

Figure 7-17 (Sheet 7)

CRUISE
17,000 FEET

ANTI-ICE SYSTEMS OFF **TWO ENGINES**

WT. LBS.	TEMP	RAT DEG. C	FAN PERCENT RPM	FUEL FLOW LBS/HR	KIAS	IND. MACH	KTAS	NAUTICAL MILES/100 LBS. FUEL: 100 KT. HEADWIND	50 KT. HEADWIND	ZERO WIND	50 KT. TAILWIND	100 KT. TAILWIND
28000.	ISA+20°C 1°C	24	(1) 81.0	2793	311	.64	412	11.2	13.0	14.7	16.5	18.3
		20	78.1	2457	288	.590	382	11.5	13.5	15.6	17.6	19.6
		17	74.5	2133	263	.540	350	11.7	14.1	16.4	18.7	21.1
		15	70.4	1854	238	.490	317	11.7	14.4	17.1	19.8	22.5
		12	(2) 66.5	1588	211	.44	282	11.5	14.6	17.8	20.9	24.1
	ISA+10°C -9°C	16	(1) 82.0	3064	332	.68	432	10.8	12.5	14.1	15.7	17.3
		12	78.7	2610	303	.620	395	11.3	13.2	15.1	17.0	18.9
		8	74.6	2204	273	.560	356	11.6	13.9	16.2	18.4	20.7
		5	70.0	1860	243	.500	318	11.7	14.4	17.1	19.8	22.5
		1	(2) 65.3	1547	210	.44	276	11.4	14.6	17.9	21.1	24.3
	ISA+ 0°C -19°C	7	(1) 82.1	3254	349	.71	443	10.5	12.1	13.6	15.2	16.7
		2	78.4	2693	313	.640	400	11.1	13.0	14.8	16.7	18.5
		-1	74.6	2273	283	.580	362	11.5	13.7	15.9	18.1	20.3
		-5	69.5	1866	248	.510	318	11.7	14.4	17.0	19.7	22.4
		-9	(2) 64.1	1513	211	.44	272	11.3	14.6	17.9	21.3	24.6
	ISA-10°C -29°C	-4	(1) 80.6	3170	349	.71	434	10.5	12.1	13.7	15.3	16.9
		-9	77.0	2623	313	.640	392	11.1	13.0	14.9	16.8	18.7
		-12	73.2	2216	283	.580	355	11.5	13.8	16.0	18.3	20.5
		-16	68.2	1818	248	.510	312	11.6	14.4	17.1	19.9	22.6
		-19	(2) 62.9	1477	211	.44	266	11.3	14.7	18.0	21.4	24.8
26000.	ISA+20°C 1°C	24	(1) 81.0	2793	312	.64	413	11.2	13.0	14.8	16.6	18.4
		20	77.9	2436	288	.590	382	11.6	13.6	15.7	17.7	19.8
		17	73.3	2049	258	.530	343	11.9	14.3	16.8	19.2	21.6
		14	69.2	1773	233	.480	311	11.9	14.7	17.5	20.3	23.2
		11	(2) 65.0	1495	205	.42	274	11.6	15.0	18.3	21.7	25.0
	ISA+10°C -9°C	16	(1) 82.0	3066	334	.68	433	10.9	12.5	14.1	15.8	17.4
		12	78.5	2591	303	.620	395	11.4	13.3	15.2	17.2	19.1
		7	73.6	2120	268	.550	350	11.8	14.1	16.5	18.9	21.2
		4	68.7	1785	238	.490	312	11.9	14.7	17.5	20.3	23.1
		1	(2) 63.7	1450	203	.42	268	11.6	15.0	18.5	21.9	25.3
	ISA+ 0°C -19°C	7	(1) 82.0	3239	349	.71	443	10.6	12.1	13.7	15.2	16.8
		2	78.3	2676	313	.640	400	11.2	13.1	14.9	16.8	18.7
		-2	73.7	2190	278	.570	356	11.7	14.0	16.2	18.5	20.8
		-6	67.4	1742	238	.490	306	11.8	14.7	17.5	20.4	23.3
		-10	(2) 62.4	1412	203	.42	262	11.5	15.0	18.5	22.1	25.6
	ISA-10°C -29°C	-4	(1) 80.5	3156	349	.71	434	10.6	12.2	13.8	15.3	16.9
		-9	76.8	2606	313	.640	392	11.2	13.1	15.0	16.9	18.9
		-13	72.3	2135	278	.570	349	11.6	14.0	16.3	18.7	21.0
		-17	66.1	1698	238	.490	300	11.8	14.7	17.6	20.6	23.5
		-20	(2) 61.2	1373	203	.42	256	11.4	15.0	18.7	22.3	25.9
24000.	ISA+20°C 1°C	24	(1) 81.0	2798	313	.64	415	11.3	13.0	14.8	16.6	18.4
		20	76.9	2349	283	.580	376	11.7	13.9	16.0	18.1	20.3
		17	73.0	2026	258	.530	343	12.0	14.5	16.9	19.4	21.9
		13	68.0	1691	228	.470	304	12.1	15.0	18.0	21.0	23.9
		10	(2) 63.2	1393	197	.41	264	11.8	15.4	19.0	22.5	26.1
	ISA+10°C -9°C	16	(1) 82.0	3072	335	.68	434	10.9	12.5	14.1	15.8	17.4
		12	78.3	2574	303	.620	395	11.4	13.4	15.3	17.3	19.2
		7	73.3	2099	268	.550	350	11.9	14.3	16.7	19.0	21.4
		4	67.6	1704	233	.480	305	12.0	15.0	17.9	20.8	23.8
		0	(2) 62.0	1358	197	.41	259	11.7	15.4	19.1	22.8	26.4
	ISA+ 0°C -19°C	7	(1) 81.9	3225	349	.71	443	10.6	12.2	13.7	15.3	16.8
		2	78.1	2660	313	.640	400	11.3	13.1	15.0	16.9	18.8
		-3	72.7	2109	273	.560	349	11.8	14.2	16.6	18.9	21.3
		-7	66.3	1664	233	.480	299	12.0	15.0	18.0	21.0	24.0
		-10	(2) 60.9	1324	197	.41	254	11.6	15.4	19.2	23.0	26.7
	ISA-10°C -29°C	-4	(1) 80.4	3143	349	.71	434	10.6	12.2	13.8	15.4	17.0
		-9	76.7	2590	313	.640	392	11.3	13.2	15.1	17.0	19.0
		-13	71.3	2056	273	.560	342	11.8	14.2	16.7	19.1	21.5
		-17	65.0	1622	233	.480	293	11.9	15.0	18.1	21.2	24.3
		-21	(2) 59.6	1289	196	.41	248	11.5	15.4	19.3	23.2	27.0

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

ANTI-ICE SYSTEMS ON		
MAX. FAN %RPM		
-9°C	-19°C	-29°C
78.9	79.9	78.4
INCREASE FUEL FLOWS AND DECREASE SPECIFIC RANGES BY 10%		

Figure 7-17 (Sheet 8)

CRUISE
19,000 FEET

ANTI-ICE SYSTEMS OFF **TWO ENGINES**

WT. LBS.	TEMP	RAT DEG. C	FAN PERCENT RPM	FUEL FLOW LBS/HR	KIAS	IND. MACH	KTAS	NAUTICAL MILES/100 LBS. FUEL 100 KT. HEADWIND	50 KT. HEADWIND	ZERO WIND	50 KT. TAILWIND	100 KT. TAILWIND
35000.	ISA+20°C	19	(1) 81.0	2602	295	.63	404	11.7	13.6	15.5	17.4	19.4
	-3°C	17	79.4	2425	281	.600	386	11.8	13.9	15.9	18.0	20.0
		15	77.6	2244	267	.570	367	11.9	14.1	16.3	18.6	20.8
		14	76.4	2134	257	.550	354	11.9	14.2	16.6	18.9	21.3
		12	(2) 74.2	1960	240	.52	331	11.8	14.3	16.9	19.5	22.0
	ISA+10°C	11	(1) 82.1	2892	320	.68	428	11.3	13.1	14.8	16.5	18.3
	-13°C	9	80.2	2624	301	.640	404	11.6	13.5	15.4	17.3	19.2
		6	78.0	2366	281	.600	379	11.8	13.9	16.0	18.1	20.2
		4	75.7	2135	262	.560	354	11.9	14.2	16.6	18.9	21.2
		1	(2) 72.9	1917	241	.52	326	11.8	14.4	17.0	19.6	22.2
	ISA+ 0°C	4	(1) 82.9	3188	344	.73	450	11.0	12.5	14.1	15.7	17.3
	-23°C	1	80.7	2836	321	.680	421	11.3	13.1	14.9	16.6	18.4
		-3	77.7	2430	291	.620	384	11.7	13.7	15.8	17.9	19.9
		-6	74.8	2135	267	.570	353	11.8	14.2	16.5	18.9	21.2
		-9	(2) 71.5	1864	240	.51	319	11.7	14.4	17.1	19.8	22.5
	ISA-10°C	-7	(1) 81.3	3096	343	.72	440	11.0	12.6	14.2	15.8	17.5
	-33°C	-10	79.2	2761	321	.680	413	11.3	13.1	15.0	16.8	18.6
		-14	76.2	2366	291	.620	376	11.7	13.8	15.9	18.0	20.1
		-17	73.4	2080	267	.570	346	11.8	14.2	16.6	19.0	21.4
		-20	(2) 70.1	1817	240	.51	312	11.7	14.4	17.2	19.9	22.7
34000.	ISA+20°C	19	(1) 81.0	2607	296	.63	405	11.7	13.6	15.5	17.5	19.4
	-3°C	17	79.3	2410	281	.600	386	11.9	13.9	16.0	18.1	20.2
		15	77.5	2229	267	.570	367	12.0	14.2	16.5	18.7	20.9
		13	75.6	2066	252	.540	347	12.0	14.4	16.8	19.2	21.7
		11	(2) 73.6	1917	238	.51	328	11.9	14.5	17.1	19.7	22.3
	ISA+10°C	12	(1) 82.1	2892	321	.68	429	11.4	13.1	14.8	16.6	18.3
	-13°C	9	80.1	2612	301	.640	404	11.6	13.6	15.5	17.4	19.3
		6	77.9	2352	281	.600	379	11.9	14.0	16.1	18.2	20.4
		3	74.8	2067	257	.550	347	12.0	14.4	16.8	19.2	21.6
		1	(2) 72.3	1870	238	.51	322	11.9	14.5	17.2	19.9	22.5
	ISA+ 0°C	4	(1) 82.9	3191	345	.73	451	11.0	12.6	14.1	15.7	17.3
	-23°C	1	80.6	2825	321	.680	421	11.4	13.1	14.9	16.7	18.5
		-3	77.6	2417	291	.620	384	11.7	13.8	15.9	18.0	20.0
		-6	74.7	2121	267	.570	353	11.9	14.3	16.6	19.0	21.4
		-10	(2) 70.9	1824	238	.51	315	11.8	14.5	17.3	20.0	22.8
	ISA-10°C	-7	(1) 81.3	3106	345	.73	442	11.0	12.6	14.2	15.8	17.4
	-33°C	-10	79.1	2750	321	.680	413	11.4	13.2	15.0	16.8	18.6
		-14	76.1	2354	291	.620	376	11.7	13.9	16.0	18.1	20.2
		-17	73.2	2067	267	.570	346	11.9	14.3	16.7	19.2	21.6
		-20	(2) 69.5	1777	238	.51	309	11.8	14.6	17.4	20.2	23.0
32000.	ISA+20°C	19	(1) 81.0	2607	298	.63	408	11.8	13.7	15.6	17.6	19.5
	-3°C	17	79.0	2383	281	.600	386	12.0	14.1	16.2	18.3	20.4
		15	77.1	2200	267	.570	367	12.1	14.4	16.7	18.9	21.2
		13	74.5	1983	248	.530	341	12.1	14.7	17.2	19.7	22.2
		11	(2) 72.2	1826	232	.50	320	12.0	14.8	17.5	20.3	23.0
	ISA+10°C	12	(1) 82.1	2890	322	.68	431	11.4	13.2	14.9	16.6	18.4
	-13°C	9	79.9	2589	301	.640	404	11.7	13.7	15.6	17.5	19.5
		6	77.0	2265	277	.590	373	12.0	14.2	16.4	18.7	20.9
		3	74.4	2038	257	.550	347	12.1	14.6	17.0	19.5	21.9
		0	(2) 70.9	1781	232	.50	314	12.0	14.8	17.6	20.4	23.2
	ISA+ 0°C	4	(1) 82.9	3200	346	.73	453	11.0	12.6	14.2	15.7	17.3
	-23°C	1	80.5	2805	321	.680	421	11.5	13.2	15.0	16.8	18.6
		-3	77.3	2393	291	.620	384	11.9	14.0	16.0	18.1	20.2
		-7	73.7	2040	262	.560	347	12.1	14.5	17.0	19.4	21.9
		-10	(2) 69.6	1737	232	.50	308	11.9	14.8	17.7	20.6	23.5
	ISA-10°C	-7	(1) 81.2	3099	345	.73	443	11.1	12.7	14.3	15.9	17.5
	-33°C	-11	78.4	2659	316	.670	407	11.5	13.4	15.3	17.2	19.1
		-14	75.8	2331	291	.620	376	11.9	14.0	16.1	18.3	20.4
		-18	72.3	1988	262	.560	340	12.1	14.6	17.1	19.6	22.1
		-21	(2) 68.2	1692	232	.50	301	11.9	14.9	17.8	20.8	23.7
30000.	ISA+20°C	19	(1) 81.0	2607	299	.64	410	11.9	13.8	15.7	17.6	19.6
	-3°C	17	78.7	2358	281	.600	386	12.1	14.3	16.4	18.5	20.6
		14	76.1	2116	262	.560	360	12.3	14.7	17.0	19.4	21.7
		12	73.3	1902	243	.520	334	12.3	15.0	17.6	20.2	22.8
		10	(2) 70.3	1716	223	.48	309	12.2	15.1	18.0	20.9	23.8
	ISA+10°C	12	(1) 82.0	2892	323	.68	433	11.5	13.2	15.0	16.7	18.4
	-13°C	9	79.7	2568	301	.640	404	11.8	13.8	15.7	17.7	19.6
		6	76.7	2240	277	.590	373	12.2	14.4	16.6	18.9	21.1
		2	72.7	1906	248	.530	335	12.3	14.9	17.6	20.2	22.8
		-1	(2) 69.2	1680	224	.48	304	12.1	15.1	18.1	21.1	24.0
	ISA+ 0°C	4	(1) 82.9	3203	348	.73	455	11.1	12.6	14.2	15.8	17.3
	-23°C	0	79.8	2712	316	.670	415	11.6	13.5	15.3	17.2	19.0
		-4	76.5	2306	286	.610	378	12.0	14.2	16.4	18.6	20.7
		-7	72.7	1961	257	.550	340	12.3	14.8	17.4	19.9	22.5
		-11	(2) 67.8	1632	223	.48	297	12.1	15.1	18.2	21.2	24.3
	ISA-10°C	-7	(1) 81.2	3102	347	.73	444	11.1	12.7	14.3	15.9	17.5
	-33°C	-11	78.3	2640	316	.670	407	11.6	13.5	15.4	17.3	19.2
		-15	75.0	2246	286	.610	370	12.0	14.3	16.5	18.7	20.9
		-18	71.3	1911	257	.550	334	12.2	14.8	17.5	20.1	22.7
		-22	(2) 66.5	1594	224	.48	291	12.0	15.1	18.3	21.4	24.6

Figure 7-17 (Sheet 9)

CRUISE
19,000 FEET

ANTI-ICE SYSTEMS OFF **TWO ENGINES**

WT. LBS.	TEMP	RAT DEG. C	FAN PERCENT RPM	FUEL FLOW LBS/HR	KIAS	IND. MACH	KTAS	NAUTICAL MILES/100 LBS. FUEL 100 KT. HEADWIND	50 KT. HEADWIND	ZERO WIND	50 KT. TAILWIND	100 KT. TAILWIND
28000.	ISA+20°C -3°C	20	(1) 81.0	2612	301	.64	412	11.9	13.9	15.8	17.7	19.6
		17	78.5	2335	281	.600	386	12.3	14.4	16.5	18.7	20.8
		14	75.1	2035	257	.550	354	12.5	14.9	17.4	19.8	22.3
		11	72.1	1823	238	.510	328	12.5	15.2	18.0	20.7	23.5
		9	(2) 68.2	1588	213	.46	294	12.2	15.4	18.5	21.7	24.8
	ISA+10°C -13°C	12	(1) 82.1	2899	325	.69	435	11.5	13.3	15.0	16.7	18.4
		8	78.9	2478	296	.630	398	12.0	14.0	16.1	18.1	20.1
		5	75.8	2156	272	.580	366	12.3	14.7	17.0	19.3	21.6
		1	71.5	1828	243	.520	328	12.5	15.2	18.0	20.7	23.4
		-2	(2) 67.0	1549	213	.46	289	12.2	15.4	18.6	21.9	25.1
	ISA+ 0°C -23°C	5	(1) 82.8	3198	348	.73	455	11.1	12.7	14.2	15.8	17.4
		0	79.6	2693	316	.670	415	11.7	13.6	15.4	17.3	19.1
		-5	75.6	2222	281	.600	372	12.2	14.5	16.7	19.0	21.2
		-9	70.9	1833	248	.530	328	12.4	15.2	17.9	20.6	23.4
		-12	(2) 65.7	1509	213	.46	283	12.1	15.4	18.7	22.1	25.4
	ISA-10°C -33°C	-7	(1) 81.2	3113	348	.73	446	11.1	12.7	14.3	15.9	17.5
		-11	78.1	2622	316	.670	407	11.7	13.6	15.5	17.4	19.3
		-15	74.2	2164	281	.600	364	12.2	14.5	16.8	19.1	21.4
		-19	69.5	1786	248	.530	321	12.4	15.2	18.0	20.8	23.6
		-23	(2) 64.4	1470	213	.46	277	12.0	15.4	18.8	22.2	25.6
26000.	ISA+20°C -3°C	20	(1) 81.0	2616	303	.64	414	12.0	13.9	15.8	17.7	19.7
		17	78.2	2313	281	.600	386	12.4	14.5	16.7	18.9	21.0
		13	74.0	1954	252	.540	347	12.7	15.2	17.8	20.3	22.9
		10	70.0	1700	228	.490	315	12.6	15.6	18.5	21.5	24.4
		8	(2) 66.3	1473	204	.44	282	12.4	15.8	19.2	22.6	25.9
	ISA+10°C -13°C	12	(1) 82.0	2900	326	.69	436	11.6	13.3	15.0	16.8	18.5
		8	78.7	2458	296	.630	398	12.1	14.2	16.2	18.2	20.3
		4	74.8	2075	267	.570	360	12.5	14.9	17.3	19.8	22.2
		0	69.5	1704	233	.500	316	12.6	15.6	18.5	21.5	24.4
		-3	(2) 65.1	1438	204	.44	277	12.3	15.8	19.3	22.7	26.2
	ISA+ 0°C -23°C	5	(1) 82.8	3192	349	.74	456	11.2	12.7	14.3	15.9	17.4
		-1	79.0	2604	311	.660	409	11.9	13.8	15.7	17.6	19.5
		-5	74.7	2140	277	.590	365	12.4	14.7	17.1	19.4	21.7
		-10	69.0	1710	238	.510	316	12.6	15.5	18.5	21.4	24.3
		-13	(2) 63.9	1400	204	.44	271	12.2	15.8	19.4	23.0	26.5
	ISA-10°C -33°C	-6	(1) 81.2	3108	349	.74	447	11.2	12.8	14.4	16.0	17.6
		-12	77.4	2536	311	.660	401	11.9	13.8	15.8	17.8	19.7
		-16	73.3	2085	277	.590	358	12.4	14.8	17.2	19.6	22.0
		-20	67.7	1666	238	.510	309	12.6	15.6	18.6	21.6	24.6
		-23	(2) 62.5	1360	203	.44	265	12.1	15.8	19.5	23.2	26.9
24000.	ISA+20°C -3°C	20	(1) 80.9	2614	304	.65	416	12.1	14.0	15.9	17.8	19.7
		16	77.3	2229	277	.590	380	12.5	14.8	17.0	19.3	21.5
		13	73.6	1931	252	.540	347	12.8	15.4	18.0	20.6	23.2
		10	68.7	1625	223	.480	309	12.8	15.9	19.0	22.1	25.1
		7	(2) 64.4	1365	196	.42	271	12.5	16.2	19.8	23.5	27.2
	ISA+10°C -13°C	12	(1) 82.0	2899	327	.69	437	11.6	13.4	15.1	16.8	18.5
		8	78.5	2440	296	.630	398	12.2	14.3	16.3	18.4	20.4
		4	73.8	1996	262	.560	354	12.7	15.2	17.7	20.2	22.7
		0	68.2	1634	228	.490	309	12.8	15.9	18.9	22.0	25.0
		-3	(2) 63.3	1334	196	.42	266	12.5	16.2	20.0	23.7	27.4
	ISA+ 0°C -23°C	5	(1) 82.7	3179	349	.74	456	11.2	12.8	14.3	15.9	17.5
		-1	78.8	2588	311	.660	409	11.9	13.9	15.8	17.7	19.7
		-6	73.8	2061	272	.580	359	12.6	15.0	17.4	19.8	22.3
		-10	67.8	1639	233	.500	309	12.8	15.8	18.9	21.9	25.0
		-14	(2) 62.1	1299	196	.42	261	12.4	16.2	20.1	23.9	27.8
	ISA-10°C -33°C	-6	(1) 81.1	3095	349	.74	447	11.2	12.8	14.4	16.1	17.7
		-12	77.3	2520	311	.660	401	11.9	13.9	15.9	17.9	19.9
		-16	72.4	2009	272	.580	352	12.5	15.0	17.5	20.0	22.5
		-21	66.4	1597	233	.500	303	12.7	15.9	19.0	22.1	25.2
		-24	(2) 60.8	1264	195	.42	255	12.3	16.2	20.2	24.1	28.1

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

ANTI-ICE SYSTEMS ON		
MAX. FAN %RPM		
-13°C	-23°C	-33°C
78.9	80.0	78.5
INCREASE FUEL FLOWS AND DECREASE SPECIFIC RANGES BY 10%		

Figure 7-17 (Sheet 10)

CRUISE
21,000 FEET

ANTI-ICE SYSTEMS OFF **TWO ENGINES**

WT. LBS.	TEMP	RAT DEG. C	FAN PERCENT RPM	FUEL FLOW LBS/HR	KIAS	IND. MACH	KTAS	NAUTICAL MILES/100 LBS. FUEL 100 KT. HEADWIND	50 KT. HEADWIND	ZERO WIND	50 KT. TAILWIND	100 KT. TAILWIND
35000.	ISA+20°C -7°C	15	(1) 81.5	2502	290	.64	410	12.4	14.4	16.4	18.4	20.4
		14	80.4	2372	280	.620	396	12.5	14.6	16.7	18.8	20.9
		12	78.8	2202	266	.590	377	12.6	14.8	17.1	19.4	21.7
		10	77.1	2045	252	.560	358	12.6	15.0	17.5	19.9	22.4
		9	(2) 75.6	1929	240	.54	342	12.5	15.1	17.7	20.3	22.9
	ISA+10°C -17°C	8	(1) 82.7	2807	317	.70	437	12.0	13.8	15.6	17.3	19.1
		6	81.0	2557	299	.660	414	12.3	14.2	16.2	18.1	20.1
		3	79.0	2314	280	.620	389	12.5	14.6	16.8	19.0	21.1
		1	76.8	2094	261	.580	363	12.6	15.0	17.4	19.7	22.1
		-2	(2) 74.3	1881	240	.54	335	12.5	15.2	17.8	20.5	23.1
	ISA+ 0°C -27°C	1	(1) 83.6	3116	342	.75	460	11.6	13.2	14.8	16.4	18.0
		-2	81.3	2756	318	.700	430	12.0	13.8	15.6	17.4	19.2
		-6	78.5	2370	289	.640	393	12.4	14.5	16.6	18.7	20.8
		-9	75.9	2093	266	.590	362	12.5	14.9	17.3	19.7	22.1
		-12	(2) 72.9	1834	240	.54	329	12.5	15.2	17.9	20.7	23.4
	ISA-10°C -37°C	-10	(1) 81.9	3021	341	.75	450	11.6	13.2	14.9	16.6	18.2
		-13	79.7	2683	318	.700	422	12.0	13.8	15.7	17.6	19.4
		-17	76.9	2307	289	.640	385	12.4	14.5	16.7	18.9	21.0
		-20	74.4	2039	266	.590	355	12.5	15.0	17.4	19.9	22.3
		-23	(2) 71.4	1785	240	.53	322	12.4	15.2	18.0	20.8	23.6
34000.	ISA+20°C -7°C	16	(1) 81.5	2506	291	.64	411	12.4	14.4	16.4	18.4	20.4
		14	80.3	2358	280	.620	396	12.6	14.7	16.8	18.9	21.0
		12	78.6	2186	266	.590	377	12.7	15.0	17.2	19.5	21.8
		10	76.8	2029	252	.560	358	12.7	15.2	17.6	20.1	22.6
		8	(2) 75.0	1884	237	.53	338	12.6	15.3	17.9	20.6	23.2
	ISA+10°C -17°C	9	(1) 82.7	2808	317	.70	438	12.0	13.8	15.6	17.4	19.2
		6	80.8	2544	299	.660	414	12.3	14.3	16.3	18.2	20.2
		3	78.8	2300	280	.620	389	12.5	14.7	16.9	19.1	21.2
		0	76.0	2027	256	.570	357	12.7	15.1	17.6	20.1	22.5
		-2	(2) 73.7	1837	237	.53	331	12.6	15.3	18.0	20.8	23.5
	ISA+ 0°C -27°C	1	(1) 83.6	3120	342	.75	461	11.6	13.2	14.8	16.4	18.0
		-2	81.2	2745	318	.700	430	12.0	13.9	15.7	17.5	19.3
		-6	78.3	2358	289	.640	393	12.4	14.6	16.7	18.8	20.9
		-9	75.7	2078	266	.590	362	12.6	15.0	17.4	19.9	22.3
		-13	(2) 72.3	1792	237	.53	325	12.6	15.3	18.1	20.9	23.7
	ISA-10°C -37°C	-10	(1) 81.8	3022	342	.75	451	11.6	13.3	14.9	16.6	18.2
		-13	79.6	2672	318	.700	422	12.0	13.9	15.8	17.6	19.5
		-17	76.8	2295	289	.640	385	12.4	14.6	16.8	19.0	21.1
		-20	74.2	2024	266	.590	355	12.6	15.1	17.5	20.0	22.5
		-23	(2) 70.7	1739	237	.53	317	12.5	15.4	18.2	21.1	24.0
32000.	ISA+20°C -7°C	16	(1) 81.5	2509	293	.65	414	12.5	14.5	16.5	18.5	20.5
		14	80.0	2331	280	.620	396	12.7	14.8	17.0	19.1	21.3
		11	77.6	2101	261	.580	370	12.9	15.3	17.6	20.0	22.4
		10	75.8	1948	247	.550	351	12.9	15.5	18.0	20.6	23.2
		8	(2) 73.6	1790	231	.52	329	12.8	15.6	18.4	21.2	24.0
	ISA+10°C -17°C	9	(1) 82.6	2812	319	.70	440	12.1	13.9	15.7	17.4	19.2
		6	80.6	2521	299	.660	414	12.4	14.4	16.4	18.4	20.4
		3	78.0	2215	275	.610	382	12.7	15.0	17.3	19.5	21.8
		0	75.0	1947	252	.560	351	12.9	15.4	18.0	20.6	23.2
		-3	(2) 72.3	1747	231	.52	323	12.8	15.6	18.5	21.4	24.2
	ISA+ 0°C -27°C	2	(1) 83.5	3123	344	.75	463	11.6	13.2	14.8	16.4	18.0
		-2	81.0	2724	318	.700	430	12.1	14.0	15.8	17.6	19.5
		-6	78.1	2333	289	.640	393	12.6	14.7	16.9	19.0	21.1
		-10	74.8	1997	261	.580	356	12.8	15.3	17.8	20.3	22.8
		-14	(2) 70.9	1697	230	.51	316	12.7	15.7	18.6	21.5	24.5
	ISA-10°C -37°C	-10	(1) 81.8	3026	343	.75	453	11.7	13.3	15.0	16.6	18.3
		-13	79.4	2652	318	.700	422	12.1	14.0	15.9	17.8	19.7
		-17	76.6	2271	289	.640	385	12.6	14.8	17.0	19.2	21.4
		-21	73.3	1946	261	.580	349	12.8	15.4	17.9	20.5	23.1
		-24	(2) 69.4	1651	230	.51	309	12.7	15.7	18.7	21.7	24.8
30000.	ISA+20°C -7°C	16	(1) 81.5	2510	295	.65	417	12.6	14.6	16.6	18.6	20.6
		14	79.7	2305	280	.620	396	12.8	15.0	17.2	19.3	21.5
		11	77.3	2073	261	.580	370	13.0	15.5	17.9	20.3	22.7
		9	74.7	1869	242	.540	345	13.1	15.8	18.4	21.1	23.8
		7	(2) 72.2	1701	225	.50	321	13.0	15.9	18.9	21.8	24.7
	ISA+10°C -17°C	9	(1) 82.6	2812	321	.70	442	12.2	13.9	15.7	17.5	19.3
		6	80.4	2498	299	.660	414	12.6	14.6	16.6	18.6	20.6
		3	77.7	2189	275	.610	382	12.9	15.2	17.5	19.7	22.0
		0	74.6	1918	252	.560	351	13.1	15.7	18.3	20.9	23.5
		-4	(2) 71.0	1664	226	.50	316	13.0	16.0	19.0	22.0	25.0
	ISA+ 0°C -27°C	2	(1) 83.5	3127	345	.76	465	11.7	13.3	14.9	16.5	18.1
		-2	80.8	2704	318	.700	430	12.2	14.1	15.9	17.8	19.6
		-7	77.3	2250	285	.630	387	12.8	15.0	17.2	19.4	21.6
		-11	73.8	1919	256	.570	350	13.0	15.6	18.2	20.8	23.5
		-14	(2) 69.5	1616	225	.50	308	12.9	16.0	19.1	22.2	25.3
	ISA-10°C -37°C	-10	(1) 81.8	3028	344	.75	454	11.7	13.4	15.0	16.7	18.3
		-14	78.8	2564	313	.690	415	12.3	14.3	16.2	18.2	20.1
		-18	75.8	2192	285	.630	379	12.7	15.0	17.3	19.6	21.9
		-21	72.4	1870	256	.570	343	13.0	15.7	18.3	21.0	23.7
		-25	(2) 68.0	1567	224	.50	301	12.8	16.0	19.2	22.4	25.6

Figure 7-17 (Sheet 11)

CRUISE
21,000 FEET

ANTI-ICE SYSTEMS OFF **TWO ENGINES**

WT. LBS.	TEMP	RAT DEG. C	FAN PERCENT RPM	FUEL FLOW LBS/HR	KIAS	IND. MACH	KTAS	NAUTICAL MILES/100 LBS. FUEL 100 KT. HEADWIND	50 KT. HEADWIND	ZERO WIND	50 KT. TAILWIND	100 KT. TAILWIND
28000.	ISA+20°C -7°C	16	(1) 81.5	2513	297	.66	419	12.7	14.7	16.7	18.7	20.7
		14	79.4	2281	280	.620	396	13.0	15.2	17.4	19.6	21.7
		11	76.3	1992	256	.570	364	13.3	15.8	18.3	20.8	23.3
		8	73.6	1791	238	.530	338	13.3	16.1	18.9	21.7	24.5
		6	(2) 70.4	1598	217	.49	310	13.1	16.3	19.4	22.5	25.6
	ISA+10°C -17°C	9	(1) 82.6	2813	322	.71	444	12.2	14.0	15.8	17.6	19.3
		6	80.2	2477	299	.660	414	12.7	14.7	16.7	18.7	20.7
		2	76.8	2107	270	.600	376	13.1	15.5	17.8	20.2	22.6
		-2	72.9	1794	242	.540	338	13.3	16.1	18.9	21.6	24.4
		-4	(2) 69.2	1564	218	.49	305	13.1	16.3	19.5	22.7	25.9
	ISA+ 0°C -27°C	2	(1) 83.5	3127	346	.76	466	11.7	13.3	14.9	16.5	18.1
		-3	80.2	2615	313	.690	424	12.4	14.3	16.2	18.1	20.0
		-7	77.1	2228	285	.630	387	12.9	15.1	17.4	19.6	21.9
		-11	72.8	1844	252	.560	344	13.2	15.9	18.7	21.4	24.1
		-15	(2) 67.9	1523	218	.49	299	13.0	16.3	19.6	22.9	26.2
	ISA-10°C -37°C	-9	(1) 81.8	3029	346	.76	456	11.7	13.4	15.0	16.7	18.3
		-14	78.6	2545	313	.690	415	12.4	14.4	16.3	18.3	20.3
		-18	75.0	2112	280	.620	373	12.9	15.3	17.7	20.0	22.4
		-22	71.4	1797	252	.560	337	13.2	16.0	18.7	21.5	24.3
		-25	(2) 66.5	1481	217	.49	292	13.0	16.3	19.7	23.1	26.5
26000.	ISA+20°C -7°C	17	(1) 81.5	2521	299	.66	422	12.8	14.7	16.7	18.7	20.7
		13	78.6	2197	275	.610	390	13.2	15.5	17.7	20.0	22.3
		10	75.2	1914	252	.560	358	13.5	16.1	18.7	21.3	23.9
		7	71.6	1671	228	.510	326	13.5	16.5	19.5	22.5	25.5
		5	(2) 68.0	1473	206	.46	295	13.2	16.6	20.0	23.4	26.8
	ISA+10°C -17°C	9	(1) 82.6	2815	323	.71	445	12.3	14.1	15.8	17.6	19.4
		5	79.5	2392	294	.650	407	12.9	14.9	17.0	19.1	21.2
		1	75.9	2027	266	.590	370	13.3	15.8	18.2	20.7	23.2
		-2	71.8	1720	238	.530	332	13.5	16.4	19.3	22.2	25.1
		-6	(2) 66.7	1432	206	.46	288	13.1	16.6	20.1	23.6	27.1
	ISA+ 0°C -27°C	2	(1) 83.5	3134	348	.76	468	11.7	13.3	14.9	16.5	18.1
		-3	80.0	2597	313	.690	424	12.5	14.4	16.3	18.3	20.2
		-8	75.7	2088	275	.610	375	13.2	15.6	17.9	20.3	22.7
		-12	71.1	1723	242	.540	332	13.4	16.3	19.2	22.1	25.0
		-16	(2) 65.5	1400	206	.46	283	13.1	16.7	20.2	23.8	27.4
	ISA-10°C -37°C	-9	(1) 81.8	3036	347	.76	457	11.8	13.4	15.1	16.7	18.4
		-14	78.5	2528	313	.690	415	12.5	14.5	16.4	18.4	20.4
		-19	74.2	2034	275	.610	367	13.1	15.6	18.0	20.5	23.0
		-23	69.7	1679	242	.540	325	13.4	16.4	19.3	22.3	25.3
		-27	(2) 64.2	1361	206	.46	277	13.0	16.7	20.4	24.0	27.7
24000.	ISA+20°C -7°C	17	(1) 81.5	2520	300	.66	423	12.8	14.8	16.8	18.8	20.8
		13	78.3	2175	275	.610	390	13.3	15.6	17.9	20.2	22.5
		10	74.2	1838	247	.550	351	13.7	16.4	19.1	21.8	24.5
		7	70.3	1599	224	.500	319	13.7	16.8	20.0	23.1	26.2
		4	(2) 66.0	1355	196	.44	281	13.4	17.0	20.7	24.4	28.1
	ISA+10°C -17°C	10	(1) 82.6	2819	324	.71	447	12.3	14.1	15.9	17.6	19.4
		5	79.3	2374	294	.650	407	13.0	15.1	17.2	19.3	21.4
		1	74.9	1950	261	.580	363	13.5	16.1	18.6	21.2	23.8
		-3	69.8	1603	228	.510	319	13.7	16.8	19.9	23.0	26.2
		-7	(2) 64.7	1322	196	.44	276	13.3	17.1	20.8	24.6	28.4
	ISA+ 0°C -27°C	2	(1) 83.5	3137	349	.76	469	11.8	13.4	15.0	16.6	18.1
		-3	79.9	2581	313	.690	424	12.6	14.5	16.4	18.4	20.3
		-9	74.8	2011	270	.600	369	13.4	15.8	18.3	20.8	23.3
		-13	69.2	1606	233	.520	319	13.7	16.8	19.9	23.0	26.1
		-17	(2) 63.5	1290	197	.44	271	13.2	17.1	21.0	24.8	28.7
	ISA-10°C -37°C	-9	(1) 81.8	3038	348	.76	459	11.8	13.5	15.1	16.7	18.4
		-15	77.8	2445	309	.680	409	12.7	14.7	16.7	18.8	20.8
		-20	73.3	1959	270	.600	361	13.3	15.9	18.4	21.0	23.5
		-24	67.9	1565	233	.520	313	13.6	16.8	20.0	23.2	26.4
		-27	(2) 62.3	1257	197	.44	265	13.1	17.1	21.1	25.1	29.1

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

ANTI-ICE SYSTEMS ON		
MAX. FAN %RPM		
-17°C	-27°C	-37°C
79.3	80.5	79.0
INCREASE FUEL FLOWS AND DECREASE SPECIFIC RANGES BY 10%		

Figure 7-17 (Sheet 12)

CRUISE
23,000 FEET

ANTI-ICE SYSTEMS OFF **TWO ENGINES**

WT. LBS.	TEMP	RAT DEG. C	FAN PERCENT RPM	FUEL FLOW LBS/HR	KIAS	IND. MACH	KTAS	NAUTICAL MILES/100 LBS. FUEL: 100 KT. HEADWIND	50 KT. HEADWIND	ZERO WIND	50 KT. TAILWIND	100 KT. TAILWIND
35000.	ISA+20°C -11°C	13	(1) 82.7	2497	292	.67	425	13.0	15.0	17.0	19.0	21.0
		11	81.3	2316	278	.640	406	13.2	15.4	17.5	19.7	21.8
		10	80.3	2207	269	.620	393	13.3	15.5	17.8	20.1	22.3
		8	78.8	2055	255	.590	374	13.3	15.8	18.2	20.6	23.1
		6	(2) 76.9	1894	239	.55	352	13.3	15.9	18.6	21.2	23.8
	ISA+10°C -21°C	6	(1) 83.8	2802	319	.73	453	12.6	14.4	16.2	18.0	19.7
		4	82.1	2550	301	.690	429	12.9	14.9	16.8	18.8	20.8
		0	79.8	2257	278	.640	398	13.2	15.4	17.6	19.8	22.1
		-2	77.9	2052	260	.600	373	13.3	15.7	18.2	20.6	23.1
		-5	(2) 75.5	1847	239	.55	345	13.3	16.0	18.7	21.4	24.1
	ISA+ 0°C -31°C	-1	(1) 84.8	3143	344	.78	478	12.0	13.6	15.2	16.8	18.4
		-5	82.3	2740	319	.730	445	12.6	14.4	16.2	18.1	19.9
		-9	79.6	2365	292	.670	408	13.0	15.2	17.3	19.4	21.5
		-12	76.8	2047	264	.610	372	13.3	15.7	18.2	20.6	23.1
		-16	(2) 74.1	1800	239	.55	338	13.2	16.0	18.8	21.6	24.3
	ISA-10°C -41°C	-12	(1) 83.0	3041	344	.78	467	12.1	13.7	15.3	17.0	18.6
		-16	80.7	2667	319	.730	436	12.6	14.5	16.3	18.2	20.1
		-20	78.0	2302	292	.670	400	13.0	15.2	17.4	19.5	21.7
		-23	75.3	1993	264	.610	364	13.2	15.8	18.3	20.8	23.3
		-26	(2) 72.5	1746	238	.55	330	13.2	16.0	18.9	21.8	24.6
34000.	ISA+20°C -11°C	13	(1) 82.7	2499	293	.67	427	13.1	15.1	17.1	19.1	21.1
		11	81.1	2301	278	.640	406	13.3	15.5	17.6	19.8	22.0
		9	79.6	2139	264	.610	387	13.4	15.7	18.1	20.4	22.8
		7	78.0	1991	251	.580	368	13.4	16.0	18.5	21.0	23.5
		5	(2) 76.3	1848	236	.55	347	13.4	16.1	18.8	21.5	24.2
	ISA+10°C -21°C	7	(1) 83.8	2807	320	.73	455	12.6	14.4	16.2	18.0	19.8
		4	81.9	2537	301	.690	429	13.0	15.0	16.9	18.9	20.9
		0	79.6	2243	278	.640	398	13.3	15.5	17.7	20.0	22.2
		-2	77.7	2037	260	.600	373	13.4	15.9	18.3	20.8	23.2
		-5	(2) 74.9	1802	236	.55	341	13.4	16.1	18.9	21.7	24.5
	ISA+ 0°C -31°C	-1	(1) 84.7	3146	345	.79	478	12.0	13.6	15.2	16.8	18.4
		-5	82.2	2728	319	.730	445	12.7	14.5	16.3	18.2	20.0
		-9	79.5	2352	292	.670	408	13.1	15.2	17.4	19.5	21.6
		-12	76.7	2031	264	.610	372	13.4	15.8	18.3	20.8	23.2
		-16	(2) 73.5	1756	236	.55	334	13.3	16.2	19.0	21.9	24.7
	ISA-10°C -41°C	-12	(1) 83.0	3045	344	.78	468	12.1	13.7	15.4	17.0	18.6
		-16	80.5	2655	319	.730	436	12.6	14.5	16.4	18.3	20.2
		-20	77.9	2289	292	.670	400	13.1	15.3	17.5	19.7	21.8
		-23	75.1	1979	264	.610	364	13.3	15.9	18.4	20.9	23.5
		-27	(2) 72.0	1708	236	.55	327	13.3	16.2	19.1	22.1	25.0
32000.	ISA+20°C -11°C	14	(1) 82.7	2502	295	.68	430	13.2	15.2	17.2	19.2	21.2
		12	81.3	2331	282	.650	412	13.4	15.5	17.7	19.8	22.0
		9	79.3	2109	264	.610	387	13.6	16.0	18.3	20.7	23.1
		7	77.0	1910	246	.570	361	13.7	16.3	18.9	21.5	24.2
		5	(2) 75.0	1758	230	.54	339	13.6	16.4	19.3	22.1	25.0
	ISA+10°C -21°C	7	(1) 83.8	2811	322	.73	457	12.7	14.5	16.3	18.0	19.8
		4	81.7	2512	301	.690	429	13.1	15.1	17.1	19.1	21.1
		0	79.3	2216	278	.640	398	13.4	15.7	18.0	20.2	22.5
		-3	76.7	1957	255	.590	367	13.6	16.2	18.7	21.3	23.9
		-6	(2) 73.7	1718	231	.54	333	13.6	16.5	19.4	22.3	25.2
	ISA+ 0°C -31°C	0	(1) 84.7	3149	346	.79	480	12.1	13.7	15.2	16.8	18.4
		-5	82.0	2705	319	.730	445	12.8	14.6	16.5	18.3	20.1
		-9	78.8	2270	287	.660	402	13.3	15.5	17.7	19.9	22.1
		-13	75.8	1954	260	.600	366	13.6	16.2	18.7	21.3	23.8
		-17	(2) 72.2	1670	230	.54	326	13.5	16.5	19.5	22.5	25.5
	ISA-10°C -41°C	-12	(1) 83.0	3047	346	.79	469	12.1	13.8	15.4	17.0	18.7
		-16	80.3	2633	319	.730	436	12.8	14.7	16.6	18.5	20.4
		-20	77.2	2209	287	.660	394	13.3	15.6	17.8	20.1	22.4
		-24	74.3	1903	260	.600	358	13.6	16.2	18.8	21.4	24.1
		-27	(2) 70.7	1624	230	.53	319	13.5	16.6	19.6	22.7	25.8
30000.	ISA+20°C -11°C	14	(1) 82.7	2509	298	.68	433	13.3	15.3	17.3	19.3	21.2
		12	81.1	2306	282	.650	412	13.5	15.7	17.9	20.0	22.2
		8	78.4	2028	260	.600	380	13.8	16.3	18.8	21.2	23.7
		6	76.0	1832	242	.560	355	13.9	16.6	19.4	22.1	24.8
		4	(2) 73.6	1667	224	.52	330	13.8	16.8	19.8	22.8	25.8
	ISA+10°C -21°C	7	(1) 83.8	2817	323	.74	459	12.8	14.5	16.3	18.1	19.9
		4	81.5	2490	301	.690	429	13.2	15.2	17.2	19.3	21.3
		0	78.5	2136	273	.630	392	13.7	16.0	18.3	20.7	23.0
		-4	75.8	1878	251	.580	361	13.9	16.5	19.2	21.9	24.5
		-7	(2) 72.3	1626	224	.52	324	13.8	16.8	19.9	23.0	26.1
	ISA+ 0°C -31°C	0	(1) 84.7	3151	348	.79	482	12.1	13.7	15.3	16.9	18.5
		-5	81.8	2685	319	.730	445	12.9	14.7	16.6	18.4	20.3
		-9	78.5	2246	287	.660	402	13.5	15.7	17.9	20.1	22.4
		-14	74.9	1877	255	.590	360	13.8	16.5	19.2	21.8	24.5
		-17	(2) 70.8	1583	224	.52	317	13.7	16.9	20.0	23.2	26.3
	ISA-10°C -41°C	-12	(1) 83.0	3051	347	.79	471	12.2	13.8	15.4	17.1	18.7
		-16	79.7	2548	315	.720	430	12.9	14.9	16.9	18.8	20.8
		-20	77.0	2186	287	.660	394	13.4	15.7	18.0	20.3	22.6
		-24	73.4	1828	255	.590	352	13.8	16.5	19.3	22.0	24.7
		-28	(2) 69.3	1536	223	.52	310	13.7	16.9	20.2	23.4	26.7

Figure 7-17 (Sheet 13)

CRUISE
23,000 FEET

ANTI-ICE SYSTEMS OFF **TWO ENGINES**

WT. LBS.	TEMP	RAT DEG. C		FAN PERCENT RPM	FUEL FLOW LBS/HR	KIAS	IND. MACH	KTAS	NAUTICAL MILES/100 LBS. FUEL 100 KT. HEADWIND	50 KT. HEADWIND	ZERO WIND	50 KT. TAILWIND	100 KT. TAILWIND
28000.	ISA+20°C -11°C	14	(1)	82.6	2511	299	.69	435	13.4	15.3	17.3	19.3	21.3
		11		80.3	2223	278	.640	406	13.8	16.0	18.3	20.5	22.8
		8		78.0	2000	260	.600	380	14.0	16.5	19.0	21.5	24.0
		5		74.9	1757	237	.550	349	14.1	17.0	19.8	22.7	25.5
		3	(2)	72.1	1577	218	.51	321	14.0	17.2	20.4	23.5	26.7
	ISA+10°C -21°C	7	(1)	83.7	2817	325	.74	461	12.8	14.6	16.4	18.1	19.9
		4		81.3	2468	301	.690	429	13.3	15.4	17.4	19.4	21.4
		0		78.3	2111	273	.630	392	13.8	16.2	18.6	20.9	23.3
		-4		74.8	1803	246	.570	354	14.1	16.9	19.7	22.4	25.2
		-8	(2)	70.8	1538	218	.51	315	14.0	17.2	20.5	23.7	27.0
	ISA+ 0°C -31°C	0	(1)	84.7	3156	349	.79	483	12.1	13.7	15.3	16.9	18.5
		-5		81.1	2599	315	.720	439	13.0	15.0	16.9	18.8	20.7
		-10		77.8	2166	282	.650	396	13.7	16.0	18.3	20.6	22.9
		-14		73.9	1803	251	.580	353	14.1	16.8	19.6	22.4	25.2
		-18	(2)	69.4	1498	218	.51	308	13.9	17.3	20.6	23.9	27.3
	ISA-10°C -41°C	-11	(1)	83.0	3058	348	.79	472	12.2	13.8	15.5	17.1	18.7
		-16		79.5	2529	315	.720	430	13.0	15.0	17.0	19.0	20.9
		-21		76.2	2109	282	.650	388	13.7	16.0	18.4	20.8	23.1
		-25		72.4	1755	251	.580	346	14.0	16.9	19.7	22.6	25.4
		-29	(2)	68.0	1457	218	.51	302	13.9	17.3	20.7	24.2	27.6
26000.	ISA+20°C -11°C	15	(1)	82.6	2509	301	.69	437	13.4	15.4	17.4	19.4	21.4
		11		80.0	2200	278	.640	406	13.9	16.2	18.4	20.7	23.0
		8		77.0	1922	255	.590	374	14.3	16.9	19.5	22.1	24.7
		5		73.8	1683	233	.540	342	14.4	17.4	20.3	23.3	26.3
		2	(2)	70.3	1481	210	.49	310	14.2	17.6	21.0	24.3	27.7
	ISA+10°C -21°C	8	(1)	83.7	2821	326	.74	463	12.9	14.6	16.4	18.2	20.0
		3		80.6	2384	296	.680	423	13.5	15.6	17.7	19.8	21.9
		-1		77.4	2033	269	.620	386	14.0	16.5	19.0	21.4	23.9
		-5		73.7	1730	242	.560	348	14.3	17.2	20.1	23.0	25.9
		-8	(2)	69.0	1449	211	.49	305	14.2	17.6	21.1	24.5	28.0
	ISA+ 0°C -31°C	0	(1)	84.6	3139	349	.79	483	12.2	13.8	15.4	17.0	18.6
		-5		81.0	2581	315	.720	439	13.1	15.1	17.0	18.9	20.9
		-11		77.1	2089	278	.640	390	13.9	16.3	18.7	21.1	23.5
		-15		72.9	1731	246	.570	347	14.3	17.2	20.1	23.0	25.8
		-19	(2)	67.7	1411	211	.49	299	14.1	17.6	21.2	24.7	28.3
	ISA-10°C -41°C	-11	(1)	82.9	3052	349	.79	473	12.2	13.9	15.5	17.1	18.8
		-16		79.4	2511	315	.720	430	13.1	15.1	17.1	19.1	21.1
		-21		75.5	2035	278	.640	382	13.9	16.3	18.8	21.2	23.7
		-25		71.5	1685	246	.570	340	14.2	17.2	20.2	23.1	26.1
		-29	(2)	66.4	1373	211	.49	293	14.0	17.7	21.3	25.0	28.6
24000.	ISA+20°C -11°C	15	(1)	82.6	2511	302	.69	439	13.5	15.5	17.5	19.5	21.5
		11		79.8	2179	278	.640	406	14.0	16.3	18.6	20.9	23.2
		7		76.0	1847	251	.580	368	14.5	17.2	19.9	22.6	25.3
		4		71.8	1569	224	.520	329	14.6	17.8	21.0	24.2	27.4
		1	(2)	67.7	1357	199	.46	294	14.3	18.0	21.7	25.4	29.0
	ISA+10°C -21°C	8	(1)	83.7	2823	327	.75	464	12.9	14.7	16.5	18.2	20.0
		3		80.4	2366	296	.680	423	13.7	15.8	17.9	20.0	22.1
		-2		76.6	1956	264	.610	379	14.3	16.8	19.4	21.9	24.5
		-6		71.9	1615	233	.540	336	14.6	17.7	20.8	23.9	27.0
		-10	(2)	66.4	1319	198	.46	287	14.2	18.0	21.8	25.6	29.4
	ISA+ 0°C -31°C	0	(1)	84.5	3123	349	.79	483	12.3	13.9	15.5	17.1	18.7
		-6		80.3	2497	310	.710	433	13.3	15.3	17.3	19.3	21.3
		-11		76.3	2014	273	.630	384	14.1	16.6	19.1	21.6	24.0
		-16		71.2	1617	237	.550	335	14.5	17.6	20.7	23.8	26.9
		-20	(2)	65.1	1287	199	.46	282	14.2	18.0	21.9	25.8	29.7
	ISA-10°C -41°C	-11	(1)	82.8	3036	349	.79	473	12.3	13.9	15.6	17.2	18.9
		-17		78.7	2430	310	.710	424	13.3	15.4	17.4	19.5	21.6
		-22		74.7	1961	273	.630	376	14.1	16.6	19.2	21.7	24.3
		-26		69.8	1574	237	.550	328	14.5	17.7	20.8	24.0	27.2
		-31	(2)	63.9	1255	199	.46	277	14.1	18.1	22.1	26.0	30.0

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

ANTI-ICE SYSTEMS ON		
MAX. FAN %RPM		
-21°C	-31°C	-41°C
80.3	81.5	80.0
INCREASE FUEL FLOWS AND DECREASE SPECIFIC RANGES BY 10%		

Figure 7-17 (Sheet 14)

CRUISE
25,000 FEET

ANTI-ICE SYSTEMS OFF **TWO ENGINES**

WT. LBS.	TEMP	RAT DEG. C	FAN PERCENT RPM	FUEL FLOW LBS/HR	KIAS	IND. MACH	KTAS	NAUTICAL MILES/100 LBS. FUEL 100 KT. HEADWIND	50 KT. HEADWIND	ZERO WIND	50 KT. TAILWIND	100 KT. TAILWIND
35000.	ISA+20°C -15°C	11	(1) 84.0	2505	295	.70	443	13.7	15.7	17.7	19.7	21.7
		9	82.5	2312	280	.670	422	13.9	16.1	18.2	20.4	22.6
		7	81.2	2154	267	.640	403	14.1	16.4	18.7	21.0	23.3
		5	79.8	2012	253	.610	384	14.1	16.6	19.1	21.6	24.0
		3	(2) 78.2	1869	239	.58	363	14.1	16.7	19.4	22.1	24.8
	ISA+10°C -25°C	5	(1) 85.1	2830	322	.76	471	13.1	14.9	16.7	18.4	20.2
		1	83.1	2535	302	.720	444	13.6	15.6	17.5	19.5	21.5
		-2	80.9	2252	280	.670	413	13.9	16.1	18.4	20.6	22.8
		-5	79.2	2052	262	.630	389	14.1	16.5	18.9	21.4	23.8
		-8	(2) 76.7	1815	238	.58	355	14.0	16.8	19.5	22.3	25.1
	ISA+ 0°C -35°C	-3	(1) 86.0	3170	346	.82	493	12.4	14.0	15.6	17.1	18.7
		-7	83.3	2725	320	.760	459	13.2	15.0	16.9	18.7	20.5
		-11	80.6	2353	293	.700	423	13.7	15.9	18.0	20.1	22.2
		-15	78.1	2044	267	.640	387	14.0	16.5	18.9	21.4	23.8
		-19	(2) 75.3	1772	239	.58	348	14.0	16.8	19.6	22.5	25.3
	ISA-10°C -45°C	-14	(1) 84.2	3063	345	.82	482	12.5	14.1	15.7	17.4	19.0
		-18	81.6	2652	320	.760	450	13.2	15.1	17.0	18.8	20.7
		-22	79.0	2289	293	.700	414	13.7	15.9	18.1	20.3	22.5
		-26	76.5	1989	267	.640	379	14.0	16.5	19.0	21.6	24.1
		-29	(2) 73.7	1723	238	.58	340	14.0	16.9	19.8	22.7	25.6
34000.	ISA+20°C -15°C	11	(1) 84.0	2514	296	.71	445	13.7	15.7	17.7	19.7	21.7
		9	82.8	2353	284	.680	428	13.9	16.1	18.2	20.3	22.4
		7	81.0	2138	267	.640	403	14.2	16.5	18.8	21.2	23.5
		5	79.6	1995	253	.610	384	14.2	16.7	19.2	21.7	24.3
		2	(2) 77.6	1817	235	.57	358	14.2	16.9	19.7	22.4	25.2
	ISA+10°C -25°C	5	(1) 85.1	2830	323	.77	473	13.2	14.9	16.7	18.5	20.2
		1	83.0	2521	302	.720	444	13.7	15.6	17.6	19.6	21.6
		-2	80.8	2237	280	.670	413	14.0	16.2	18.5	20.7	22.9
		-5	78.6	1990	258	.620	383	14.2	16.7	19.2	21.7	24.3
		-8	(2) 76.1	1766	235	.57	350	14.1	17.0	19.8	22.6	25.5
	ISA+ 0°C -35°C	-3	(1) 86.0	3170	346	.82	494	12.4	14.0	15.6	17.2	18.7
		-7	83.2	2713	320	.760	459	13.2	15.1	16.9	18.8	20.6
		-11	80.5	2340	293	.700	423	13.8	16.0	18.1	20.2	22.4
		-16	77.5	1982	262	.630	381	14.2	16.7	19.2	21.7	24.3
		-19	(2) 74.6	1725	235	.57	343	14.1	17.0	19.9	22.8	25.7
	ISA-10°C -45°C	-14	(1) 84.2	3063	345	.82	483	12.5	14.1	15.8	17.4	19.0
		-18	81.5	2640	320	.760	450	13.2	15.1	17.0	18.9	20.8
		-23	78.4	2223	289	.690	408	13.9	16.1	18.4	20.6	22.9
		-26	75.9	1929	262	.630	373	14.1	16.7	19.3	21.9	24.5
		-30	(2) 73.0	1673	235	.57	335	14.1	17.0	20.0	23.0	26.0
32000.	ISA+20°C -15°C	12	(1) 83.9	2513	298	.71	448	13.8	15.8	17.8	19.8	21.8
		9	82.5	2325	284	.680	428	14.1	16.3	18.4	20.6	22.7
		7	80.6	2108	267	.640	403	14.4	16.7	19.1	21.5	23.8
		4	78.7	1917	249	.600	378	14.5	17.1	19.7	22.3	24.9
		1	(2) 76.3	1726	229	.55	349	14.4	17.3	20.2	23.1	26.0
	ISA+10°C -25°C	5	(1) 85.0	2832	324	.77	475	13.2	15.0	16.8	18.5	20.3
		1	82.8	2496	302	.720	444	13.8	15.8	17.8	19.8	21.8
		-2	80.5	2210	280	.670	413	14.2	16.4	18.7	21.0	23.2
		-6	77.7	1913	253	.610	376	14.4	17.1	19.7	22.3	24.9
		-9	(2) 74.9	1682	229	.55	342	14.4	17.4	20.3	23.3	26.3
	ISA+ 0°C -35°C	-2	(1) 85.9	3168	347	.82	495	12.5	14.1	15.6	17.2	18.8
		-7	83.0	2689	320	.760	459	13.4	15.2	17.1	18.9	20.8
		-12	79.8	2259	289	.690	417	14.0	16.3	18.5	20.7	22.9
		-16	76.7	1907	258	.620	375	14.4	17.0	19.6	22.3	24.9
		-20	(2) 73.4	1638	229	.55	335	14.4	17.4	20.5	23.5	26.6
	ISA-10°C -45°C	-14	(1) 84.1	3065	346	.82	484	12.5	14.2	15.8	17.4	19.1
		-18	81.3	2617	320	.760	450	13.4	15.3	17.2	19.1	21.0
		-23	78.2	2198	289	.690	408	14.0	16.3	18.6	20.9	23.1
		-27	75.1	1856	258	.620	367	14.4	17.1	19.8	22.5	25.2
		-30	(2) 71.9	1593	229	.55	328	14.3	17.4	20.6	23.7	26.9
30000.	ISA+20°C -15°C	12	(1) 83.9	2518	300	.72	451	13.9	15.9	17.9	19.9	21.9
		9	82.2	2298	284	.680	428	14.3	16.4	18.6	20.8	23.0
		6	79.8	2029	262	.630	396	14.6	17.1	19.5	22.0	24.5
		4	77.7	1840	245	.590	371	14.7	17.5	20.2	22.9	25.6
		1	(2) 74.9	1635	223	.54	340	14.7	17.7	20.8	23.8	26.9
	ISA+10°C -25°C	5	(1) 85.0	2830	326	.77	477	13.3	15.1	16.8	18.6	20.4
		1	82.5	2473	302	.720	444	13.9	15.9	18.0	20.0	22.0
		-3	79.8	2130	275	.660	407	14.4	16.8	19.1	21.5	23.8
		-7	76.8	1837	249	.600	370	14.7	17.4	20.1	22.9	25.6
		-10	(2) 73.6	1598	224	.54	334	14.6	17.8	20.9	24.0	27.2
	ISA+ 0°C -35°C	-2	(1) 85.9	3174	348	.82	497	12.5	14.1	15.7	17.2	18.8
		-8	82.3	2598	316	.750	453	13.6	15.5	17.5	19.4	21.3
		-12	79.1	2180	284	.680	411	14.3	16.6	18.9	21.2	23.4
		-17	75.8	1834	253	.610	369	14.7	17.4	20.1	22.8	25.6
		-21	(2) 72.1	1552	223	.54	326	14.6	17.8	21.0	24.3	27.5
	ISA-10°C -45°C	-14	(1) 84.1	3072	348	.82	486	12.6	14.2	15.8	17.4	19.1
		-19	80.6	2529	316	.750	444	13.6	15.6	17.6	19.5	21.5
		-23	77.5	2121	284	.680	402	14.3	16.6	19.0	21.3	23.7
		-27	74.3	1785	253	.610	361	14.6	17.4	20.2	23.0	25.8
		-31	(2) 70.6	1509	223	.54	319	14.5	17.9	21.2	24.5	27.8

Figure 7-17 (Sheet 15)

CRUISE
25,000 FEET

ANTI-ICE SYSTEMS OFF **TWO ENGINES**

WT. LBS.	TEMP	RAT DEG. C	FAN PERCENT RPM	FUEL FLOW LBS/HR	KIAS	IND. MACH	KTAS	NAUTICAL MILES/100 LBS. FUEL 100 KT. HEADWIND	50 KT. HEADWIND	ZERO WIND	50 KT. TAILWIND	100 KT. TAILWIND
28000.	ISA+20°C -15°C	12	(1) 83.9	2521	302	.72	453	14.0	16.0	18.0	20.0	21.9
		9	81.5	2215	280	.670	422	14.5	16.8	19.0	21.3	23.5
		6	79.5	2003	262	.630	396	14.8	17.3	19.8	22.3	24.8
		3	76.7	1764	240	.580	365	15.0	17.9	20.7	23.5	26.4
		0	(2) 73.5	1545	217	.53	330	14.9	18.2	21.4	24.6	27.9
	ISA+10°C -25°C	6	(1) 85.0	2835	327	.78	479	13.4	15.1	16.9	18.7	20.4
		1	82.3	2451	302	.720	444	14.0	16.1	18.1	20.2	22.2
		-3	79.0	2053	271	.650	401	14.7	17.1	19.5	22.0	24.4
		-7	75.8	1763	245	.590	364	15.0	17.8	20.6	23.5	26.3
		-11	(2) 72.1	1506	217	.53	324	14.9	18.2	21.5	24.8	28.2
	ISA+ 0°C -35°C	-2	(1) 85.9	3168	349	.82	498	12.5	14.1	15.7	17.3	18.9
		-8	82.1	2576	316	.750	453	13.7	15.7	17.6	19.5	21.5
		-12	78.9	2157	284	.680	411	14.4	16.7	19.1	21.4	23.7
		-17	74.9	1762	249	.600	363	14.9	17.7	20.6	23.4	26.3
		-21	(2) 70.7	1466	217	.53	317	14.8	18.2	21.6	25.0	28.5
	ISA-10°C -45°C	-13	(1) 84.1	3074	349	.82	487	12.6	14.2	15.8	17.5	19.1
		-19	80.4	2508	316	.750	444	13.7	15.7	17.7	19.7	21.7
		-23	77.3	2099	284	.680	402	14.4	16.8	19.2	21.6	23.9
		-28	73.4	1714	249	.600	355	14.9	17.8	20.7	23.6	26.5
		-32	(2) 69.2	1427	217	.53	311	14.8	18.3	21.8	25.3	28.8
26000.	ISA+20°C -15°C	13	(1) 83.9	2527	304	.72	456	14.1	16.1	18.0	20.0	22.0
		9	81.3	2192	280	.670	422	14.7	17.0	19.2	21.5	23.8
		5	78.6	1927	258	.620	390	15.1	17.7	20.3	22.8	25.4
		2	75.6	1691	236	.570	359	15.3	18.2	21.2	24.2	27.1
		-1	(2) 71.9	1459	211	.51	321	15.2	18.6	22.0	25.4	28.9
	ISA+10°C -25°C	6	(1) 84.9	2836	329	.78	480	13.4	15.2	16.9	18.7	20.5
		1	81.6	2370	298	.710	438	14.3	16.4	18.5	20.6	22.7
		-3	78.7	2030	271	.650	401	14.8	17.3	19.8	22.2	24.7
		-8	74.8	1691	240	.580	358	15.2	18.2	21.2	24.1	27.1
		-12	(2) 70.5	1420	210	.51	315	15.1	18.6	22.1	25.7	29.2
	ISA+ 0°C -35°C	-2	(1) 85.7	3150	349	.82	498	12.6	14.2	15.8	17.4	19.0
		-8	81.9	2556	316	.750	453	13.8	15.8	17.7	19.7	21.6
		-13	78.2	2081	280	.670	405	14.7	17.1	19.5	21.9	24.3
		-18	74.0	1690	245	.590	357	15.2	18.1	21.1	24.1	27.0
		-22	(2) 69.1	1382	210	.51	308	15.0	18.7	22.3	25.9	29.5
	ISA-10°C -45°C	-13	(1) 84.0	3060	349	.82	487	12.6	14.3	15.9	17.5	19.2
		-19	80.3	2488	316	.750	444	13.8	15.8	17.8	19.8	21.9
		-24	76.6	2025	280	.670	396	14.6	17.1	19.6	22.0	24.5
		-29	72.5	1644	245	.590	349	15.1	18.2	21.2	24.3	27.3
		-33	(2) 67.7	1344	210	.51	301	15.0	18.7	22.4	26.1	29.9
24000.	ISA+20°C -15°C	13	(1) 83.8	2530	306	.73	458	14.2	16.1	18.1	20.1	22.1
		9	81.0	2171	280	.670	422	14.8	17.1	19.4	21.7	24.0
		5	77.7	1852	253	.610	384	15.3	18.0	20.7	23.4	26.1
		1	73.9	1578	227	.550	346	15.6	18.7	21.9	25.1	28.3
		-2	(2) 70.0	1366	203	.49	310	15.4	19.0	22.7	26.4	30.0
	ISA+10°C -25°C	6	(1) 84.9	2842	330	.78	482	13.5	15.2	17.0	18.7	20.5
		1	81.4	2351	298	.710	438	14.4	16.5	18.6	20.8	22.9
		-4	78.0	1956	267	.640	395	15.1	17.6	20.2	22.7	25.3
		-8	73.8	1621	236	.570	352	15.5	18.6	21.7	24.8	27.9
		-12	(2) 68.7	1331	203	.49	304	15.3	19.1	22.8	26.6	30.4
	ISA+ 0°C -35°C	-2	(1) 85.6	3134	349	.82	498	12.7	14.3	15.9	17.5	19.1
		-8	81.3	2473	311	.740	447	14.0	16.1	18.1	20.1	22.1
		-14	77.5	2007	275	.660	399	14.9	17.4	19.9	22.4	24.9
		-18	73.0	1622	240	.580	350	15.4	18.5	21.6	24.7	27.8
		-23	(2) 67.4	1296	203	.49	298	15.3	19.1	23.0	26.8	30.7
	ISA-10°C -45°C	-13	(1) 83.9	3044	349	.82	487	12.7	14.4	16.0	17.6	19.3
		-19	79.6	2406	311	.740	438	14.0	16.1	18.2	20.3	22.4
		-25	75.9	1953	275	.660	391	14.9	17.4	20.0	22.6	25.1
		-29	71.5	1578	240	.580	343	15.4	18.6	21.7	24.9	28.1
		-33	(2) 66.1	1265	204	.50	292	15.2	19.2	23.1	27.1	31.0

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

ANTI-ICE SYSTEMS ON		
MAX. FAN %RPM		
-25°C	-35°C	-45°C
81.3	82.6	81.0
INCREASE FUEL FLOWS AND DECREASE SPECIFIC RANGES BY 10%		

Figure 7-17 (Sheet 16)

CRUISE
27,000 FEET

ANTI-ICE SYSTEMS OFF **TWO ENGINES**

WT. LBS.	TEMP	RAT DEG. C	FAN PERCENT RPM	FUEL FLOW LBS/HR	KIAS	IND. MACH	KTAS	NAUTICAL MILES/100 LBS. FUEL 100 KT. HEADWIND	50 KT. HEADWIND	ZERO WIND	50 KT. TAILWIND	100 KT. TAILWIND
35000.	ISA+20°C	9	(1) 85.3	2514	297	.74	460	14.3	16.3	18.3	20.3	22.3
	-18°C	7	84.1	2355	285	.710	443	14.6	16.7	18.8	20.9	23.1
		4	82.4	2149	268	.670	418	14.8	17.1	19.5	21.8	24.1
		2	81.1	2010	256	.640	400	14.9	17.4	19.9	22.4	24.9
		0	(2) 79.4	1844	239	.60	374	14.9	17.6	20.3	23.0	25.7
	ISA+10°C	3	(1) 86.4	2852	324	.80	488	13.6	15.4	17.1	18.9	20.6
	-28°C	-1	84.2	2525	303	.750	459	14.2	16.2	18.2	20.2	22.1
		-4	82.1	2238	281	.700	428	14.7	16.9	19.1	21.4	23.6
		-8	80.0	2001	260	.650	398	14.9	17.4	19.9	22.4	24.9
		-11	(2) 77.9	1793	238	.60	366	14.9	17.6	20.4	23.2	26.0
	ISA+ 0°C	-5	(1) 87.3	3149	344	.84	505	12.9	14.4	16.0	17.6	19.2
	-38°C	-9	84.3	2709	320	.790	473	13.8	15.6	17.5	19.3	21.2
		-14	81.3	2285	290	.720	432	14.5	16.7	18.9	21.1	23.3
		-18	78.8	1992	264	.660	396	14.8	17.4	19.9	22.4	24.9
		-22	(2) 76.4	1746	238	.60	359	14.8	17.7	20.6	23.4	26.3
	ISA-10°C	-17	(1) 85.5	3043	343	.84	493	12.9	14.6	16.2	17.9	19.5
	-48°C	-21	82.0	2566	316	.780	457	13.9	15.9	17.8	19.8	21.7
		-25	79.6	2222	290	.720	422	14.5	16.7	19.0	21.2	23.5
		-29	77.2	1937	264	.660	387	14.8	17.4	20.0	22.6	25.1
		-32	(2) 74.7	1696	238	.60	351	14.8	17.7	20.7	23.6	26.6
34000.	ISA+20°C	9	(1) 85.2	2517	298	.74	462	14.4	16.4	18.4	20.3	22.3
	-18°C	7	83.9	2339	285	.710	443	14.7	16.8	19.0	21.1	23.2
		4	82.2	2133	268	.670	418	14.9	17.3	19.6	22.0	24.3
		2	80.5	1950	251	.630	393	15.1	17.6	20.2	22.7	25.3
		-1	(2) 78.9	1799	236	.59	370	15.0	17.8	20.6	23.4	26.1
	ISA+10°C	3	(1) 86.4	2859	325	.80	490	13.6	15.4	17.1	18.9	20.6
	-28°C	-1	84.1	2511	303	.750	459	14.3	16.3	18.3	20.3	22.3
		-4	81.9	2224	281	.700	428	14.8	17.0	19.3	21.5	23.8
		-8	79.8	1985	260	.650	398	15.0	17.5	20.0	22.6	25.1
		-11	(2) 77.3	1748	235	.59	362	15.0	17.8	20.7	23.6	26.4
	ISA+ 0°C	-5	(1) 87.3	3144	344	.85	505	12.9	14.5	16.1	17.7	19.3
	-38°C	-10	83.7	2625	316	.780	467	14.0	15.9	17.8	19.7	21.6
		-14	81.1	2271	290	.720	432	14.6	16.8	19.0	21.2	23.4
		-18	78.6	1976	264	.660	396	15.0	17.5	20.0	22.6	25.1
		-22	(2) 75.8	1702	235	.59	355	15.0	17.9	20.8	23.8	26.7
	ISA-10°C	-17	(1) 85.4	3039	343	.84	494	13.0	14.6	16.2	17.9	19.5
	-48°C	-21	81.9	2554	316	.780	457	14.0	15.9	17.9	19.9	21.8
		-25	79.5	2208	290	.720	422	14.6	16.9	19.1	21.4	23.7
		-29	77.0	1922	264	.660	387	14.9	17.5	20.1	22.7	25.3
		-33	(2) 74.2	1653	235	.59	347	14.9	17.9	21.0	24.0	27.0
32000.	ISA+20°C	10	(1) 85.2	2526	301	.75	466	14.5	16.5	18.4	20.4	22.4
	-18°C	7	83.6	2310	285	.710	443	14.9	17.0	19.2	21.4	23.5
		4	81.4	2053	264	.660	412	15.2	17.6	20.1	22.5	24.9
		1	79.6	1873	247	.620	387	15.3	18.0	20.7	23.3	26.0
		-1	(2) 77.6	1702	229	.58	360	15.3	18.2	21.2	24.1	27.0
	ISA+10°C	3	(1) 86.3	2851	326	.80	491	13.7	15.5	17.2	19.0	20.7
	-28°C	-1	83.8	2483	303	.750	459	14.5	16.5	18.5	20.5	22.5
		-5	81.1	2145	277	.690	422	15.0	17.4	19.7	22.0	24.4
		-8	79.0	1909	256	.640	392	15.3	17.9	20.5	23.1	25.8
		-12	(2) 76.2	1658	229	.58	353	15.3	18.3	21.3	24.3	27.3
	ISA+ 0°C	-5	(1) 87.3	3154	345	.85	507	12.9	14.5	16.1	17.7	19.3
	-38°C	-10	83.4	2601	316	.780	467	14.1	16.0	18.0	19.9	21.8
		-15	80.4	2189	285	.710	426	14.9	17.2	19.4	21.7	24.0
		-19	77.8	1901	260	.650	390	15.2	17.9	20.5	23.1	25.8
		-23	(2) 74.6	1614	229	.58	346	15.2	18.3	21.4	24.5	27.6
	ISA-10°C	-16	(1) 85.4	3048	345	.85	496	13.0	14.6	16.3	17.9	19.5
	-48°C	-21	81.7	2530	316	.780	457	14.1	16.1	18.1	20.0	22.0
		-26	78.7	2128	285	.710	416	14.9	17.2	19.6	21.9	24.3
		-29	76.2	1850	260	.650	381	15.2	17.9	20.6	23.3	26.0
		-34	(2) 73.1	1567	229	.58	338	15.2	18.4	21.6	24.7	27.9
30000.	ISA+20°C	10	(1) 85.2	2527	303	.75	468	14.6	16.6	18.5	20.5	22.5
	-18°C	7	83.3	2284	285	.710	443	15.0	17.2	19.4	21.6	23.8
		4	81.0	2023	264	.660	412	15.4	17.9	20.4	22.8	25.3
		1	78.7	1798	243	.610	381	15.6	18.4	21.2	24.0	26.7
		-3	(2) 76.2	1602	222	.56	349	15.6	18.7	21.8	24.9	28.0
	ISA+10°C	3	(1) 86.3	2856	327	.81	493	13.8	15.5	17.3	19.0	20.8
	-28°C	-1	83.5	2457	303	.750	459	14.6	16.6	18.7	20.7	22.8
		-5	80.8	2118	277	.690	422	15.2	17.6	19.9	22.3	24.7
		-10	77.7	1793	247	.620	379	15.6	18.4	21.2	24.0	26.7
		-13	(2) 74.8	1564	222	.56	343	15.5	18.7	21.9	25.1	28.3
	ISA+ 0°C	-5	(1) 87.3	3153	346	.85	508	12.9	14.5	16.1	17.7	19.3
	-38°C	-10	83.2	2578	316	.780	467	14.3	16.2	18.1	20.1	22.0
		-15	80.1	2164	285	.710	426	15.0	17.4	19.7	22.0	24.3
		-20	76.6	1787	251	.630	378	15.5	18.3	21.1	23.9	26.7
		-24	(2) 73.2	1519	222	.56	335	15.5	18.8	22.1	25.4	28.7
	ISA-10°C	-16	(1) 85.4	3047	345	.85	496	13.0	14.7	16.3	17.9	19.6
	-48°C	-21	81.5	2508	316	.780	457	14.2	16.2	18.2	20.2	22.2
		-26	78.4	2104	285	.710	416	15.0	17.4	19.8	22.2	24.5
		-31	75.0	1738	251	.630	370	15.5	18.4	21.3	24.1	27.0
		-34	(2) 71.7	1476	222	.56	328	15.4	18.8	22.2	25.6	29.0

Figure 7-17 (Sheet 17)

CRUISE
27,000 FEET

ANTI-ICE SYSTEMS OFF | **TWO ENGINES**

WT. LBS.	TEMP	RAT DEG. C	FAN PERCENT RPM	FUEL FLOW LBS/HR	KIAS	IND. MACH	KTAS	NAUTICAL MILES/100 LBS. FUEL 100 KT. HEADWIND	50 KT. HEADWIND	ZERO WIND	50 KT. TAILWIND	100 KT. TAILWIND
28000.	ISA+20°C -18°C	11	(1) 85.1	2526	304	.75	471	14.7	16.7	18.6	20.6	22.6
		7	82.6	2204	281	.700	437	15.3	17.6	19.8	22.1	24.4
		3	80.3	1948	260	.650	406	15.7	18.3	20.8	23.4	26.0
		0	77.8	1725	239	.600	375	15.9	18.8	21.7	24.6	27.5
		-3	(2) 74.8	1516	216	.55	340	15.8	19.1	22.4	25.7	29.0
	ISA+10°C -28°C	4	(1) 86.2	2860	329	.81	495	13.8	15.6	17.3	19.1	20.8
		-1	83.3	2432	303	.750	459	14.8	16.8	18.9	20.9	23.0
		-6	80.1	2042	273	.680	416	15.5	17.9	20.4	22.8	25.3
		-10	76.8	1722	243	.610	373	15.9	18.8	21.7	24.6	27.5
		-14	(2) 73.4	1479	216	.55	334	15.8	19.2	22.6	26.0	29.3
	ISA+ 0°C -38°C	-4	(1) 87.3	3158	347	.85	509	13.0	14.5	16.1	17.7	19.3
		-10	83.0	2556	316	.780	467	14.4	16.3	18.3	20.2	22.2
		-15	79.4	2089	281	.700	420	15.3	17.7	20.1	22.5	24.9
		-20	75.8	1717	247	.620	372	15.8	18.7	21.7	24.6	27.5
		-25	(2) 71.9	1437	216	.55	327	15.8	19.2	22.7	26.2	29.7
	ISA-10°C -48°C	-16	(1) 85.4	3056	346	.85	498	13.0	14.6	16.3	17.9	19.6
		-21	81.3	2486	316	.780	457	14.4	16.4	18.4	20.4	22.4
		-26	77.8	2031	281	.700	411	15.3	17.8	20.2	22.7	25.1
		-31	74.2	1670	247	.620	364	15.8	18.8	21.8	24.8	27.8
		-35	(2) 70.4	1397	216	.55	320	15.7	19.3	22.9	26.4	30.0
26000.	ISA+20°C -18°C	11	(1) 85.1	2529	306	.76	473	14.8	16.7	18.7	20.7	22.7
		7	82.3	2180	281	.700	437	15.5	17.8	20.1	22.3	24.6
		3	79.9	1922	260	.650	406	15.9	18.5	21.1	23.7	26.3
		-1	76.8	1653	235	.590	368	16.2	19.3	22.3	25.3	28.3
		-4	(2) 73.2	1427	209	.53	330	16.1	19.6	23.2	26.7	30.2
	ISA+10°C -28°C	4	(1) 86.3	2867	330	.81	497	13.9	15.6	17.3	19.1	20.8
		-1	83.1	2409	303	.750	459	14.9	17.0	19.1	21.1	23.2
		-6	79.4	1968	268	.670	410	15.8	18.3	20.8	23.4	25.9
		-11	75.9	1651	239	.600	367	16.2	19.2	22.2	25.3	28.3
		-15	(2) 71.8	1390	209	.53	324	16.1	19.7	23.3	26.9	30.5
	ISA+ 0°C -38°C	-4	(1) 87.2	3157	347	.85	510	13.0	14.6	16.1	17.7	19.3
		-11	82.4	2469	311	.770	461	14.6	16.7	18.7	20.7	22.7
		-16	78.7	2015	277	.690	414	15.6	18.0	20.5	23.0	25.5
		-21	74.9	1649	243	.610	366	16.1	19.1	22.2	25.2	28.2
		-25	(2) 70.4	1352	209	.53	317	16.0	19.7	23.4	27.1	30.8
	ISA-10°C -48°C	-16	(1) 85.4	3057	347	.85	498	13.0	14.7	16.3	17.9	19.6
		-22	80.7	2402	311	.770	451	14.6	16.7	18.8	20.9	23.0
		-27	77.1	1960	277	.690	405	15.5	18.1	20.7	23.2	25.8
		-32	73.3	1604	243	.610	358	16.1	19.2	22.3	25.4	28.5
		-36	(2) 69.0	1316	209	.53	310	16.0	19.8	23.6	27.4	31.2
24000.	ISA+20°C -18°C	11	(1) 85.1	2538	308	.76	476	14.8	16.8	18.8	20.7	22.7
		7	82.1	2158	281	.700	437	15.6	17.9	20.3	22.6	24.9
		2	79.1	1850	256	.640	400	16.2	18.9	21.6	24.3	27.0
		-1	75.7	1583	230	.580	362	16.6	19.7	22.9	26.0	29.2
		-5	(2) 71.6	1343	203	.51	321	16.4	20.2	23.9	27.6	31.3
	ISA+10°C -28°C	4	(1) 86.2	2869	331	.82	499	13.9	15.6	17.4	19.1	20.9
		-2	82.4	2326	298	.740	453	15.2	17.3	19.5	21.6	23.8
		-6	79.1	1945	268	.670	410	15.9	18.5	21.1	23.6	26.2
		-11	74.9	1582	235	.590	361	16.5	19.7	22.8	26.0	29.1
		-16	(2) 70.2	1305	203	.51	314	16.4	20.2	24.0	27.9	31.7
	ISA+ 0°C -38°C	-4	(1) 87.2	3158	347	.85	510	13.0	14.6	16.2	17.7	19.3
		-11	82.2	2449	311	.770	461	14.8	16.8	18.8	20.9	22.9
		-17	78.0	1943	273	.680	408	15.8	18.4	21.0	23.6	26.1
		-22	73.9	1581	239	.600	360	16.4	19.6	22.7	25.9	29.1
		-26	(2) 68.7	1267	202	.51	307	16.3	20.2	24.2	28.1	32.1
	ISA-10°C -48°C	-16	(1) 85.4	3062	347	.85	499	13.0	14.7	16.3	17.9	19.6
		-22	80.5	2383	311	.770	451	14.8	16.8	18.9	21.0	23.1
		-28	76.4	1890	273	.680	399	15.8	18.5	21.1	23.7	26.4
		-32	72.4	1538	239	.600	352	16.4	19.6	22.9	26.1	29.4
		-37	(2) 67.3	1235	203	.51	300	16.2	20.3	24.3	28.4	32.4

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

ANTI-ICE SYSTEMS ON		
MAX. FAN %RPM		
-28°C	-38°C	-48°C
82.4	83.7	82.2
INCREASE FUEL FLOWS AND DECREASE SPECIFIC RANGES BY 10%		

Figure 7-17 (Sheet 18)

CRUISE
29,000 FEET

ANTI-ICE SYSTEMS OFF **TWO ENGINES**

WT. LBS.	TEMP	RAT DEG. C	FAN PERCENT RPM	FUEL FLOW LBS/HR	KIAS	IND. MACH	KTAS	NAUTICAL MILES/100 LBS. FUEL 100 KT. HEADWIND	50 KT. HEADWIND	ZERO WIND	50 KT. TAILWIND	100 KT. TAILWIND
35000.	ISA+20°C -22°C	7	(1) 86.4	2517	298	.77	477	15.0	17.0	18.9	20.9	22.9
		5	85.2	2347	286	.740	458	15.3	17.4	19.5	21.7	23.8
		2	83.6	2140	269	.700	434	15.6	17.9	20.3	22.6	24.9
		-1	82.0	1962	253	.660	409	15.7	18.3	20.8	23.4	25.9
		-3	(2) 80.5	1821	238	.62	386	15.7	18.5	21.2	24.0	26.7
	ISA+10°C -32°C	1	(1) 87.7	2844	322	.83	501	14.1	15.9	17.6	19.4	21.2
		-3	85.2	2505	303	.780	473	14.9	16.9	18.9	20.9	22.9
		-7	83.2	2229	282	.730	443	15.4	17.6	19.9	22.1	24.4
		-10	81.2	1991	261	.680	413	15.7	18.2	20.7	23.2	25.8
		-14	(2) 79.0	1774	238	.62	379	15.7	18.5	21.3	24.2	27.0
	ISA+ 0°C -42°C	-8	(1) 88.7	3139	340	.87	515	13.2	14.8	16.4	18.0	19.6
		-12	84.9	2630	315	.810	481	14.5	16.4	18.3	20.2	22.1
		-16	82.3	2272	290	.750	446	15.2	17.4	19.6	21.8	24.0
		-20	79.9	1980	265	.690	410	15.7	18.2	20.7	23.2	25.8
		-24	(2) 77.4	1725	238	.62	371	15.7	18.6	21.5	24.4	27.3
	ISA-10°C -52°C	-19	(1) 86.7	3027	339	.87	503	13.3	15.0	16.6	18.3	19.9
		-23	83.1	2556	315	.810	470	14.5	16.4	18.4	20.4	22.3
		-28	80.5	2209	290	.750	436	15.2	17.5	19.7	22.0	24.3
		-31	78.2	1927	265	.690	401	15.6	18.2	20.8	23.4	26.0
		-35	(2) 75.8	1675	238	.62	362	15.7	18.6	21.6	24.6	27.6
34000.	ISA+20°C -22°C	8	(1) 86.4	2521	300	.77	479	15.0	17.0	19.0	21.0	23.0
		5	85.0	2330	286	.740	458	15.4	17.5	19.7	21.8	24.0
		2	83.4	2122	269	.700	434	15.7	18.1	20.4	22.8	25.1
		-1	81.7	1944	253	.660	409	15.9	18.5	21.0	23.6	26.2
		-3	(2) 80.0	1777	235	.62	382	15.9	18.7	21.5	24.3	27.1
	ISA+10°C -32°C	1	(1) 87.6	2844	323	.83	503	14.2	15.9	17.7	19.4	21.2
		-3	85.0	2490	303	.780	473	15.0	17.0	19.0	21.0	23.0
		-7	83.0	2213	282	.730	443	15.5	17.8	20.0	22.3	24.5
		-11	80.5	1932	257	.670	407	15.9	18.5	21.0	23.6	26.2
		-14	(2) 78.4	1726	235	.62	374	15.9	18.8	21.7	24.5	27.4
	ISA+ 0°C -42°C	-8	(1) 88.6	3131	340	.87	515	13.3	14.8	16.4	18.0	19.6
		-12	84.7	2617	315	.810	481	14.6	16.5	18.4	20.3	22.2
		-17	81.7	2204	286	.740	440	15.4	17.7	19.9	22.2	24.5
		-21	79.3	1921	261	.680	404	15.8	18.4	21.0	23.6	26.2
		-25	(2) 76.9	1679	235	.62	366	15.8	18.8	21.8	24.8	27.7
	ISA-10°C -52°C	-19	(1) 86.8	3033	339	.87	503	13.3	14.9	16.6	18.2	19.9
		-23	83.0	2543	315	.810	470	14.6	16.5	18.5	20.5	22.4
		-28	80.0	2143	286	.740	430	15.4	17.7	20.1	22.4	24.7
		-32	77.6	1868	261	.680	395	15.8	18.5	21.2	23.8	26.5
		-36	(2) 75.2	1630	235	.62	358	15.8	18.9	21.9	25.0	28.1
32000.	ISA+20°C -22°C	8	(1) 86.4	2531	303	.78	483	15.1	17.1	19.1	21.1	23.0
		5	84.7	2299	286	.740	458	15.6	17.8	19.9	22.1	24.3
		2	82.6	2042	265	.690	427	16.0	18.5	20.9	23.4	25.8
		-1	80.9	1868	249	.650	403	16.2	18.9	21.6	24.2	26.9
		-4	(2) 78.8	1681	229	.60	372	16.2	19.2	22.1	25.1	28.1
	ISA+10°C -32°C	1	(1) 87.6	2855	325	.83	505	14.2	15.9	17.7	19.5	21.2
		-3	84.8	2462	303	.780	473	15.2	17.2	19.2	21.3	23.3
		-7	82.2	2130	278	.720	437	15.8	18.2	20.5	22.9	25.2
		-11	79.7	1858	253	.660	401	16.2	18.9	21.6	24.2	26.9
		-15	(2) 77.3	1633	228	.60	364	16.2	19.2	22.3	25.3	28.4
	ISA+ 0°C -42°C	-8	(1) 88.6	3134	340	.87	516	13.3	14.9	16.5	18.0	19.6
		-13	84.0	2524	311	.800	475	14.9	16.8	18.8	20.8	22.8
		-17	81.4	2175	286	.740	440	15.6	17.9	20.2	22.5	24.8
		-22	78.5	1848	257	.670	398	16.1	18.8	21.5	24.2	26.9
		-26	(2) 75.7	1590	229	.60	356	16.1	19.3	22.4	25.6	28.7
	ISA-10°C -52°C	-19	(1) 86.7	3032	340	.87	504	13.3	15.0	16.6	18.3	19.9
		-24	82.3	2453	311	.800	465	14.9	16.9	18.9	21.0	23.0
		-28	79.7	2114	286	.740	430	15.6	18.0	20.3	22.7	25.1
		-33	76.9	1797	257	.670	389	16.1	18.9	21.7	24.4	27.2
		-36	(2) 74.2	1546	229	.60	349	16.1	19.3	22.6	25.8	29.0
30000.	ISA+20°C -22°C	8	(1) 86.4	2531	304	.78	485	15.2	17.2	19.2	21.2	23.1
		5	84.4	2269	286	.740	458	15.8	18.0	20.2	22.4	24.6
		2	82.2	2012	265	.690	427	16.3	18.8	21.2	23.7	26.2
		-2	80.0	1794	245	.640	397	16.5	19.3	22.1	24.9	27.7
		-5	(2) 77.5	1585	222	.58	361	16.5	19.6	22.8	26.0	29.1
	ISA+10°C -32°C	1	(1) 87.6	2857	326	.84	507	14.2	16.0	17.7	19.5	21.2
		-3	84.5	2437	303	.780	473	15.3	17.4	19.4	21.5	23.5
		-8	81.5	2050	273	.710	431	16.1	18.6	21.0	23.5	25.9
		-12	78.9	1786	249	.650	395	16.5	19.3	22.1	24.9	27.7
		-16	(2) 76.1	1547	223	.58	355	16.5	19.7	22.9	26.2	29.4
	ISA+ 0°C -42°C	-8	(1) 88.6	3131	340	.87	516	13.3	14.9	16.5	18.1	19.7
		-13	83.8	2499	311	.800	475	15.0	17.0	19.0	21.0	23.0
		-18	80.7	2095	282	.730	434	15.9	18.3	20.7	23.1	25.5
		-22	77.7	1777	253	.660	392	16.4	19.3	22.1	24.9	27.7
		-27	(2) 74.5	1501	222	.58	347	16.4	19.8	23.1	26.4	29.8
	ISA-10°C -52°C	-19	(1) 86.7	3035	340	.87	505	13.3	15.0	16.6	18.3	19.9
		-24	82.0	2430	311	.800	465	15.0	17.1	19.1	21.2	23.2
		-29	79.0	2038	282	.730	424	15.9	18.4	20.8	23.3	25.7
		-33	76.1	1729	253	.660	384	16.4	19.3	22.2	25.1	28.0
		-37	(2) 72.9	1459	222	.58	339	16.4	19.8	23.2	26.7	30.1

Figure 7-17 (Sheet 19)

CRUISE
29,000 FEET

ANTI-ICE SYSTEMS OFF **TWO ENGINES**

WT. LBS.	TEMP	RAT DEG. C	FAN PERCENT RPM	FUEL FLOW LBS/HR	KIAS	IND. MACH	KTAS	NAUTICAL MILES/100 LBS. FUEL: 100 KT. HEADWIND	50 KT. HEADWIND	ZERO WIND	50 KT. TAILWIND	100 KT. TAILWIND
28000.	ISA+20°C -22°C	9	(1) 86.3	2533	306	.79	488	15.3	17.3	19.3	21.2	23.2
		4	83.6	2185	282	.730	452	16.1	18.4	20.7	23.0	25.3
		1	81.4	1937	261	.680	421	16.6	19.2	21.7	24.3	26.9
		-3	78.7	1683	237	.620	384	16.9	19.9	22.8	25.8	28.8
		-6	(2) 76.0	1485	214	.56	350	16.8	20.2	23.5	26.9	30.3
	ISA+10°C -32°C	2	(1) 87.5	2863	328	.84	509	14.3	16.0	17.8	19.5	21.3
		-4	83.8	2350	298	.770	467	15.6	17.8	19.9	22.0	24.1
		-8	81.1	2025	273	.710	431	16.3	18.8	21.3	23.8	26.2
		-13	78.1	1716	245	.640	389	16.8	19.7	22.6	25.6	28.5
		-17	(2) 74.6	1451	215	.57	344	16.8	20.2	23.7	27.1	30.6
	ISA+ 0°C -42°C	-7	(1) 88.7	3146	341	.87	517	13.3	14.8	16.4	18.0	19.6
		-13	83.6	2476	311	.800	475	15.2	17.2	19.2	21.2	23.2
		-18	79.9	2017	278	.720	428	16.2	18.7	21.2	23.7	26.2
		-23	76.5	1670	245	.640	380	16.8	19.8	22.8	25.8	28.8
		-28	(2) 73.0	1407	214	.56	335	16.7	20.3	23.8	27.4	31.0
	ISA-10°C -52°C	-19	(1) 86.7	3035	341	.87	505	13.3	15.0	16.6	18.3	19.9
		-24	81.8	2407	311	.800	465	15.2	17.2	19.3	21.4	23.5
		-29	78.3	1962	278	.720	418	16.2	18.8	21.3	23.9	26.4
		-34	74.9	1623	245	.640	372	16.8	19.8	22.9	26.0	29.1
		-38	(2) 71.4	1363	214	.56	327	16.7	20.3	24.0	27.7	31.3
26000.	ISA+20°C -22°C	9	(1) 86.3	2538	307	.79	490	15.4	17.3	19.3	21.3	23.3
		4	83.4	2159	282	.730	452	16.3	18.6	20.9	23.3	25.6
		0	80.6	1864	257	.670	415	16.9	19.6	22.3	24.9	27.6
		-4	77.8	1614	233	.610	378	17.2	20.3	23.4	26.5	29.6
		-7	(2) 74.6	1400	209	.55	340	17.2	20.7	24.3	27.9	31.5
	ISA+10°C -32°C	2	(1) 87.5	2870	329	.84	511	14.3	16.1	17.8	19.5	21.3
		-4	83.6	2326	298	.770	467	15.8	17.9	20.1	22.2	24.4
		-9	80.4	1953	269	.700	425	16.6	19.2	21.8	24.3	26.9
		-13	77.2	1648	241	.630	382	17.1	20.2	23.2	26.2	29.3
		-18	(2) 73.2	1365	209	.55	334	17.1	20.8	24.5	28.1	31.8
	ISA+ 0°C -42°C	-7	(1) 88.6	3142	341	.87	517	13.3	14.9	16.5	18.1	19.6
		-14	82.9	2388	307	.790	469	15.5	17.6	19.7	21.7	23.8
		-19	79.2	1946	273	.710	422	16.5	19.1	21.7	24.2	26.8
		-24	75.7	1604	241	.630	374	17.1	20.2	23.3	26.5	29.6
		-28	(2) 71.6	1325	208	.55	326	17.1	20.8	24.6	28.4	32.2
	ISA-10°C -52°C	-19	(1) 86.7	3029	341	.87	505	13.4	15.0	16.7	18.3	20.0
		-25	81.1	2321	307	.790	459	15.5	17.6	19.8	21.9	24.1
		-30	77.5	1893	273	.710	413	16.5	19.2	21.8	24.4	27.1
		-35	74.1	1559	241	.630	366	17.1	20.3	23.5	26.7	29.9
		-39	(2) 70.1	1287	208	.55	319	17.0	20.9	24.8	28.7	32.5
24000.	ISA+20°C -22°C	9	(1) 86.3	2538	309	.79	492	15.4	17.4	19.4	21.4	23.3
		4	83.1	2137	282	.730	452	16.5	18.8	21.2	23.5	25.8
		0	80.3	1839	257	.670	415	17.1	19.8	22.6	25.3	28.0
		-4	76.8	1546	229	.600	372	17.6	20.8	24.0	27.3	30.5
		-8	(2) 72.9	1313	202	.53	330	17.5	21.3	25.1	28.9	32.7
	ISA+10°C -32°C	2	(1) 87.5	2872	330	.84	512	14.3	16.1	17.8	19.6	21.3
		-4	83.4	2305	298	.770	467	15.9	18.1	20.3	22.4	24.6
		-9	79.7	1882	265	.690	419	16.9	19.6	22.3	24.9	27.6
		-14	75.8	1542	233	.610	370	17.5	20.8	24.0	27.3	30.5
		-19	(2) 71.5	1275	201	.53	323	17.5	21.4	25.3	29.2	33.1
	ISA+ 0°C -42°C	-7	(1) 88.6	3143	342	.87	518	13.3	14.9	16.5	18.1	19.7
		-14	82.7	2368	307	.790	469	15.6	17.7	19.8	21.9	24.0
		-20	78.5	1877	269	.700	416	16.8	19.5	22.2	24.8	27.5
		-25	74.8	1539	237	.620	369	17.4	20.7	23.9	27.2	30.4
		-29	(2) 70.0	1242	202	.53	316	17.4	21.4	25.4	29.5	33.5
	ISA-10°C -52°C	-19	(1) 86.7	3034	341	.87	506	13.4	15.0	16.7	18.3	20.0
		-25	80.9	2301	307	.790	459	15.6	17.8	19.9	22.1	24.3
		-31	76.8	1826	269	.700	407	16.8	19.5	22.3	25.0	27.8
		-35	73.2	1496	237	.620	360	17.4	20.7	24.1	27.4	30.8
		-40	(2) 68.6	1210	202	.53	310	17.3	21.5	25.6	29.7	33.9

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

ANTI-ICE SYSTEMS ON		
MAX. FAN %RPM		
-32°C	-42°C	-52°C
83.5	84.8	83.2
INCREASE FUEL FLOWS AND DECREASE SPECIFIC RANGES BY 10%		

Figure 7-17 (Sheet 20)

CRUISE
31,000 FEET

ANTI-ICE SYSTEMS OFF **TWO ENGINES**

WT. LBS.	TEMP	RAT DEG. C	FAN PERCENT RPM	FUEL FLOW LBS/HR	KIAS	IND. MACH	KTAS	NAUTICAL MILES/100 LBS. FUEL: 100 KT. HEADWIND	50 KT. HEADWIND	ZERO WIND	50 KT. TAILWIND	100 KT. TAILWIND
35000.	ISA+20°C -26°C	5	(1) 87.5	2498	297	.80	491	15.6	17.6	19.6	21.6	23.6
		2	85.9	2280	282	.760	467	16.1	18.3	20.5	22.7	24.9
		0	84.7	2133	270	.730	448	16.3	18.7	21.0	23.4	25.7
		-3	83.2	1957	254	.690	424	16.5	19.1	21.7	24.2	26.8
		-6	(2) 81.7	1801	238	.65	399	16.6	19.4	22.2	24.9	27.7
	ISA+10°C -36°C	-2	(1) 88.8	2790	318	.85	511	14.7	16.5	18.3	20.1	21.9
		-6	85.9	2434	298	.800	481	15.7	17.7	19.8	21.8	23.9
		-10	83.8	2166	278	.750	451	16.2	18.5	20.8	23.1	25.5
		-13	81.9	1944	258	.700	421	16.5	19.1	21.7	24.2	26.8
		-16	(2) 80.1	1754	238	.65	391	16.6	19.4	22.3	25.2	28.0
	ISA+ 0°C -46°C	-11	(1) 89.9	3123	333	.89	521	13.5	15.1	16.7	18.3	19.9
		-15	85.9	2561	310	.830	488	15.2	17.1	19.1	21.0	23.0
		-19	82.8	2201	286	.770	453	16.1	18.3	20.6	22.9	25.1
		-23	80.6	1931	262	.710	418	16.5	19.1	21.7	24.2	26.8
		-27	(2) 78.5	1702	238	.65	382	16.6	19.5	22.5	25.4	28.3
	ISA-10°C -56°C	-23	(1) 87.9	3007	332	.89	508	13.6	15.2	16.9	18.6	20.2
		-27	84.1	2486	310	.830	477	15.2	17.2	19.2	21.2	23.2
		-31	81.1	2140	286	.770	443	16.0	18.4	20.7	23.0	25.4
		-35	78.9	1876	262	.710	409	16.5	19.1	21.8	24.4	27.1
		-38	(2) 76.8	1655	238	.65	374	16.6	19.6	22.6	25.6	28.6
34000.	ISA+20°C -26°C	5	(1) 87.4	2492	298	.80	492	15.7	17.7	19.7	21.7	23.7
		2	85.7	2262	282	.760	467	16.2	18.4	20.6	22.9	25.1
		-1	84.1	2068	266	.720	442	16.5	19.0	21.4	23.8	26.2
		-4	82.6	1896	250	.680	418	16.8	19.4	22.0	24.7	27.3
		-6	(2) 81.1	1751	234	.64	394	16.8	19.6	22.5	25.3	28.2
	ISA+10°C -36°C	-2	(1) 88.8	2787	319	.85	512	14.8	16.6	18.4	20.2	22.0
		-6	85.7	2418	298	.800	481	15.8	17.8	19.9	22.0	24.0
		-10	83.6	2149	278	.750	451	16.3	18.7	21.0	23.3	25.7
		-13	81.7	1925	258	.700	421	16.7	19.3	21.9	24.5	27.1
		-17	(2) 79.6	1706	235	.64	386	16.8	19.7	22.6	25.6	28.5
	ISA+ 0°C -46°C	-11	(1) 89.9	3123	333	.89	521	13.5	15.1	16.7	18.3	19.9
		-15	85.7	2547	310	.830	488	15.2	17.2	19.2	21.1	23.1
		-19	82.7	2185	286	.770	453	16.2	18.5	20.7	23.0	25.3
		-23	80.4	1913	262	.710	418	16.6	19.2	21.9	24.5	27.1
		-28	(2) 77.9	1659	235	.64	378	16.7	19.8	22.8	25.8	28.8
	ISA-10°C -56°C	-22	(1) 87.9	3018	333	.89	509	13.5	15.2	16.9	18.5	20.2
		-27	83.9	2473	310	.830	477	15.3	17.3	19.3	21.3	23.3
		-31	80.9	2124	286	.770	443	16.2	18.5	20.9	23.2	25.6
		-35	78.7	1859	262	.710	409	16.6	19.3	22.0	24.7	27.4
		-39	(2) 76.3	1612	235	.64	370	16.7	19.8	22.9	26.0	29.1
32000.	ISA+20°C -26°C	6	(1) 87.4	2501	300	.81	495	15.8	17.8	19.8	21.8	23.8
		2	85.3	2229	282	.760	467	16.5	18.7	20.9	23.2	25.4
		-1	83.7	2033	266	.720	442	16.8	19.3	21.8	24.2	26.7
		-4	81.7	1819	246	.670	412	17.1	19.9	22.6	25.4	28.1
		-7	(2) 79.9	1658	228	.62	384	17.1	20.1	23.2	26.2	29.2
	ISA+10°C -36°C	-2	(1) 88.7	2789	320	.86	514	14.8	16.6	18.4	20.2	22.0
		-6	85.4	2390	298	.800	481	16.0	18.0	20.1	22.2	24.3
		-10	82.9	2068	274	.740	445	16.7	19.1	21.5	23.9	26.4
		-14	80.9	1847	254	.690	415	17.1	19.8	22.5	25.2	27.9
		-18	(2) 78.4	1615	228	.62	376	17.1	20.2	23.3	26.4	29.5
	ISA+ 0°C -46°C	-11	(1) 89.8	3118	333	.89	521	13.5	15.1	16.7	18.3	19.9
		-16	84.7	2450	306	.820	482	15.6	17.7	19.7	21.7	23.8
		-20	82.0	2106	282	.760	448	16.5	18.9	21.3	23.6	26.0
		-25	79.2	1796	254	.690	406	17.1	19.8	22.6	25.4	28.2
		-29	(2) 76.8	1570	228	.62	368	17.1	20.3	23.5	26.6	29.8
	ISA-10°C -56°C	-22	(1) 87.9	3019	333	.89	509	13.6	15.2	16.9	18.5	20.2
		-27	82.9	2380	306	.820	472	15.6	17.7	19.8	21.9	24.0
		-31	80.2	2047	282	.760	438	16.5	18.9	21.4	23.8	26.3
		-36	77.5	1746	254	.690	397	17.0	19.9	22.8	25.6	28.5
		-39	(2) 75.2	1527	229	.63	360	17.1	20.3	23.6	26.9	30.2
30000.	ISA+20°C -26°C	6	(1) 87.4	2509	303	.81	499	15.9	17.9	19.9	21.9	23.9
		2	85.0	2198	282	.760	467	16.7	19.0	21.2	23.5	25.8
		-1	82.9	1952	262	.710	436	17.2	19.8	22.3	24.9	27.5
		-5	80.8	1747	242	.660	406	17.5	20.4	23.2	26.1	28.9
		-8	(2) 78.7	1566	222	.61	374	17.5	20.7	23.9	27.1	30.3
	ISA+10°C -36°C	-1	(1) 88.8	2797	322	.86	516	14.9	16.7	18.4	20.2	22.0
		-6	85.1	2363	298	.800	481	16.1	18.2	20.4	22.5	24.6
		-10	82.5	2037	274	.740	445	16.9	19.4	21.9	24.3	26.8
		-15	79.6	1736	246	.670	403	17.5	20.3	23.2	26.1	29.0
		-19	(2) 77.2	1524	222	.61	366	17.5	20.7	24.0	27.3	30.6
	ISA+ 0°C -46°C	-11	(1) 89.9	3124	334	.89	522	13.5	15.1	16.7	18.3	19.9
		-16	84.4	2423	306	.820	482	15.8	17.8	19.9	22.0	24.0
		-21	81.2	2029	278	.750	442	16.8	19.3	21.8	24.2	26.7
		-25	78.4	1725	250	.680	400	17.4	20.3	23.2	26.1	29.0
		-30	(2) 75.6	1482	222	.61	358	17.4	20.8	24.2	27.5	30.9
	ISA-10°C -56°C	-22	(1) 87.8	3009	333	.89	510	13.6	15.3	16.9	18.6	20.3
		-27	82.6	2356	306	.820	472	15.8	17.9	20.0	22.1	24.3
		-32	79.5	1972	278	.750	432	16.8	19.4	21.9	24.4	27.0
		-36	76.7	1677	250	.680	392	17.4	20.4	23.4	26.3	29.3
		-40	(2) 74.0	1439	222	.61	350	17.4	20.9	24.3	27.8	31.3

Figure 7-17 (Sheet 21)

CRUISE
31,000 FEET

ANTI-ICE SYSTEMS OFF **TWO ENGINES**

WT. LBS.	TEMP	RAT DEG. C	FAN PERCENT RPM	FUEL FLOW LBS/HR	KIAS	IND. MACH	KTAS	NAUTICAL MILES/100 LBS. FUEL 100 KT. HEADWIND	50 KT. HEADWIND	ZERO WIND	50 KT. TAILWIND	100 KT. TAILWIND
28000.	ISA+20°C -26°C	7	(1) 87.4	2514	304	.82	501	16.0	17.9	19.9	21.9	23.9
		2	84.7	2169	282	.760	467	16.9	19.2	21.5	23.8	26.1
		-1	82.5	1921	262	.710	436	17.5	20.1	22.7	25.3	27.9
		-5	79.9	1676	238	.650	399	17.9	20.9	23.8	26.8	29.8
		-9	(2) 77.4	1469	215	.59	362	17.8	21.2	24.7	28.1	31.5
	ISA+10°C -36°C	-1	(1) 88.7	2796	322	.86	517	14.9	16.7	18.5	20.3	22.1
		-6	84.9	2337	298	.800	481	16.3	18.4	20.6	22.7	24.9
		-11	81.7	1960	270	.730	439	17.3	19.9	22.4	25.0	27.5
		-16	78.8	1667	242	.660	397	17.8	20.8	23.8	26.8	29.8
		-20	(2) 75.9	1434	215	.59	356	17.8	21.3	24.8	28.3	31.8
	ISA+ 0°C -46°C	-11	(1) 89.9	3132	334	.89	523	13.5	15.1	16.7	18.3	19.9
		-16	84.1	2400	306	.820	482	15.9	18.0	20.1	22.2	24.3
		-22	80.5	1953	274	.740	436	17.2	19.7	22.3	24.9	27.4
		-26	77.6	1658	246	.670	395	17.8	20.8	23.8	26.8	29.8
		-31	(2) 74.3	1391	215	.59	347	17.8	21.4	25.0	28.6	32.2
	ISA-10°C -56°C	-22	(1) 87.9	3020	334	.89	510	13.6	15.2	16.9	18.6	20.2
		-27	82.4	2332	306	.820	472	15.9	18.1	20.2	22.4	24.5
		-33	78.8	1899	274	.740	426	17.2	19.8	22.4	25.1	27.7
		-37	75.9	1612	246	.670	386	17.7	20.8	23.9	27.0	30.1
		-41	(2) 72.7	1353	215	.59	340	17.7	21.4	25.1	28.8	32.5
26000.	ISA+20°C -26°C	7	(1) 87.4	2515	306	.82	503	16.0	18.0	20.0	22.0	24.0
		2	84.4	2143	282	.760	467	17.1	19.5	21.8	24.1	26.5
		-2	81.7	1849	258	.700	430	17.9	20.6	23.3	26.0	28.7
		-7	78.6	1571	230	.630	387	18.3	21.5	24.6	27.8	31.0
		-10	(2) 75.8	1373	207	.57	350	18.2	21.9	25.5	29.1	32.8
	ISA+10°C -36°C	-1	(1) 88.7	2802	323	.86	518	14.9	16.7	18.5	20.3	22.0
		-7	84.1	2250	294	.790	475	16.7	18.9	21.1	23.3	25.6
		-12	81.0	1885	266	.720	433	17.7	20.3	23.0	25.6	28.3
		-16	77.9	1600	238	.650	391	18.2	21.3	24.4	27.6	30.7
		-21	(2) 74.4	1338	207	.57	343	18.2	21.9	25.7	29.4	33.1
	ISA+ 0°C -46°C	-11	(1) 89.9	3129	334	.89	523	13.5	15.1	16.7	18.3	19.9
		-17	83.4	2309	302	.810	477	16.3	18.5	20.6	22.8	25.0
		-22	79.7	1880	270	.730	430	17.5	20.2	22.9	25.5	28.2
		-27	76.3	1556	238	.650	383	18.2	21.4	24.6	27.8	31.0
		-32	(2) 72.8	1301	207	.57	336	18.1	22.0	25.8	29.7	33.5
	ISA-10°C -56°C	-22	(1) 87.8	3011	334	.89	510	13.6	15.3	17.0	18.6	20.3
		-28	81.6	2245	302	.810	466	16.3	18.5	20.8	23.0	25.2
		-33	78.1	1827	270	.730	420	17.5	20.3	23.0	25.7	28.5
		-38	74.7	1512	238	.650	374	18.1	21.5	24.8	28.1	31.4
		-42	(2) 71.3	1264	208	.57	329	18.1	22.0	26.0	30.0	33.9
24000.	ISA+20°C -26°C	7	(1) 87.3	2520	307	.82	505	16.1	18.1	20.0	22.0	24.0
		2	84.1	2118	282	.760	467	17.3	19.7	22.0	24.4	26.8
		-3	80.9	1780	254	.690	424	18.2	21.0	23.8	26.6	29.4
		-7	77.7	1505	227	.620	381	18.7	22.0	25.3	28.6	32.0
		-11	(2) 74.3	1288	201	.55	340	18.6	22.5	26.4	30.3	34.2
	ISA+10°C -36°C	-1	(1) 88.7	2798	323	.86	518	14.9	16.7	18.5	20.3	22.1
		-7	83.9	2227	294	.790	475	16.8	19.1	21.3	23.6	25.8
		-12	80.2	1817	262	.710	427	18.0	20.8	23.5	26.3	29.0
		-18	76.6	1499	230	.630	379	18.6	22.0	25.3	28.6	32.0
		-22	(2) 72.7	1251	200	.55	332	18.6	22.6	26.6	30.6	34.6
	ISA+ 0°C -46°C	-10	(1) 89.9	3130	335	.89	524	13.5	15.1	16.7	18.3	19.9
		-17	83.2	2287	302	.810	477	16.5	18.7	20.8	23.0	25.2
		-23	79.0	1810	266	.720	424	17.9	20.7	23.4	26.2	28.9
		-28	75.5	1493	234	.640	377	18.5	21.9	25.2	28.6	31.9
		-33	(2) 71.3	1216	201	.55	325	18.5	22.6	26.7	30.9	35.0
	ISA-10°C -56°C	-22	(1) 87.8	3013	334	.89	511	13.6	15.3	17.0	18.6	20.3
		-28	81.4	2223	302	.810	466	16.5	18.7	21.0	23.2	25.5
		-34	77.3	1759	266	.720	415	17.9	20.7	23.6	26.4	29.2
		-39	73.9	1451	234	.640	369	18.5	22.0	25.4	28.8	32.3
		-43	(2) 69.7	1182	201	.55	318	18.5	22.7	26.9	31.2	35.4

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

ANTI-ICE SYSTEMS ON		
MAX. FAN %RPM		
-36°C	-46°C	-56°C
84.3	85.8	84.2
INCREASE FUEL FLOWS AND DECREASE SPECIFIC RANGES BY 10%		

Figure 7-17 (Sheet 22)

CRUISE
33,000 FEET

ANTI-ICE SYSTEMS OFF **TWO ENGINES**

WT. LBS.	TEMP	RAT DEG. C	FAN PERCENT RPM	FUEL FLOW LBS/HR	KIAS	IND. MACH	KTAS	NAUTICAL MILES/100 LBS. FUEL 100 KT. HEADWIND	50 KT. HEADWIND	ZERO WIND	50 KT. TAILWIND	100 KT. TAILWIND
35000.	ISA+20°C -30°C	2	(1) 88.5	2421	292	.82	498	16.4	18.5	20.6	22.6	24.7
		-1	86.5	2210	277	.780	475	17.0	19.2	21.5	23.8	26.0
		-4	85.1	2033	262	.740	451	17.2	19.7	22.2	24.6	27.1
		-7	83.7	1875	246	.700	426	17.4	20.1	22.8	25.4	28.1
		-9	(2) 82.5	1747	233	.66	404	17.4	20.3	23.1	26.0	28.9
	ISA+10°C -40°C	-5	(1) 89.8	2735	311	.87	517	15.2	17.1	18.9	20.7	22.5
		-9	87.0	2368	293	.820	489	16.4	18.5	20.6	22.7	24.9
		-13	84.5	2103	273	.770	459	17.1	19.5	21.8	24.2	26.6
		-16	82.7	1895	254	.720	429	17.4	20.0	22.7	25.3	27.9
		-20	(2) 80.9	1701	233	.66	396	17.4	20.4	23.3	26.2	29.2
	ISA+ 0°C -50°C	-15	(1) 90.8	3052	323	.90	522	13.8	15.5	17.1	18.7	20.4
		-19	86.2	2426	300	.840	489	16.0	18.1	20.2	22.2	24.3
		-23	83.1	2085	277	.780	455	17.0	19.4	21.8	24.2	26.6
		-27	81.3	1880	258	.730	426	17.3	20.0	22.7	25.3	28.0
		-30	(2) 79.3	1667	235	.67	390	17.4	20.4	23.4	26.4	29.4
	ISA-10°C -60°C	-26	(1) 88.7	2940	322	.90	510	13.9	15.6	17.3	19.0	20.7
		-30	84.4	2356	300	.840	478	16.1	18.2	20.3	22.4	24.5
		-34	81.3	2026	277	.780	445	17.0	19.5	22.0	24.4	26.9
		-38	79.6	1826	258	.730	416	17.3	20.1	22.8	25.5	28.3
		-41	(2) 77.6	1621	235	.67	382	17.4	20.5	23.6	26.6	29.7
34000.	ISA+20°C -30°C	2	(1) 88.4	2421	293	.82	499	16.5	18.6	20.6	22.7	24.8
		-1	86.3	2193	277	.780	475	17.1	19.4	21.7	23.9	26.2
		-4	84.8	2014	262	.740	451	17.4	19.9	22.4	24.9	27.4
		-7	83.4	1853	246	.700	426	17.6	20.3	23.0	25.7	28.4
		-9	(2) 82.1	1712	231	.66	402	17.6	20.6	23.5	26.4	29.3
	ISA+10°C -40°C	-5	(1) 89.8	2740	312	.87	518	15.3	17.1	18.9	20.7	22.6
		-9	86.7	2351	293	.820	489	16.5	18.7	20.8	22.9	25.0
		-13	84.2	2085	273	.770	459	17.2	19.6	22.0	24.4	26.8
		-17	82.1	1838	250	.710	424	17.6	20.3	23.0	25.8	28.5
		-20	(2) 80.4	1663	231	.66	393	17.6	20.6	23.6	26.7	29.7
	ISA+ 0°C -50°C	-15	(1) 90.8	3048	323	.90	523	13.9	15.5	17.2	18.8	20.4
		-19	86.1	2410	300	.840	489	16.2	18.2	20.3	22.4	24.5
		-23	82.9	2069	277	.780	455	17.2	19.6	22.0	24.4	26.8
		-27	80.7	1823	254	.720	420	17.6	20.3	23.0	25.8	28.5
		-31	(2) 78.8	1616	231	.66	385	17.6	20.7	23.8	26.9	30.0
	ISA-10°C -60°C	-26	(1) 88.8	2944	323	.90	511	13.9	15.6	17.3	19.0	20.7
		-30	84.2	2340	300	.840	478	16.2	18.3	20.4	22.6	24.7
		-34	81.1	2010	277	.780	445	17.2	19.6	22.1	24.6	27.1
		-38	79.0	1771	254	.720	411	17.5	20.4	23.2	26.0	28.8
		-42	(2) 77.1	1572	231	.66	376	17.6	20.8	23.9	27.1	30.3
32000.	ISA+20°C -30°C	3	(1) 88.4	2431	295	.83	503	16.6	18.6	20.7	22.7	24.8
		-1	85.9	2160	277	.780	475	17.4	19.7	22.0	24.3	26.6
		-4	84.4	1976	262	.740	451	17.8	20.3	22.8	25.3	27.9
		-7	82.9	1813	246	.700	426	18.0	20.8	23.5	26.3	29.0
		-10	(2) 81.1	1639	228	.65	397	18.1	21.1	24.2	27.2	30.3
	ISA+10°C -40°C	-5	(1) 89.7	2740	313	.87	520	15.3	17.2	19.0	20.8	22.6
		-9	86.3	2320	293	.820	489	16.8	18.9	21.1	23.2	25.4
		-13	83.5	2006	269	.760	453	17.6	20.1	22.6	25.1	27.6
		-17	81.6	1800	250	.710	424	18.0	20.8	23.5	26.3	29.1
		-21	(2) 79.5	1593	228	.65	388	18.1	21.2	24.4	27.5	30.6
	ISA+ 0°C -50°C	-14	(1) 90.8	3055	324	.90	524	13.9	15.5	17.2	18.8	20.4
		-19	85.7	2378	300	.840	489	16.4	18.5	20.6	22.7	24.8
		-23	82.5	2036	277	.780	455	17.4	19.9	22.3	24.8	27.3
		-27	80.3	1787	254	.720	420	17.9	20.7	23.5	26.3	29.1
		-31	(2) 77.9	1551	228	.65	380	18.1	21.3	24.5	27.7	31.0
	ISA-10°C -60°C	-26	(1) 88.7	2941	324	.90	512	14.0	15.7	17.4	19.1	20.8
		-30	83.9	2309	300	.840	478	16.4	18.6	20.7	22.9	25.0
		-34	80.7	1979	277	.780	445	17.4	20.0	22.5	25.0	27.5
		-38	78.5	1736	254	.720	411	17.9	20.8	23.7	26.5	29.4
		-42	(2) 76.2	1506	228	.65	371	18.0	21.4	24.7	28.0	31.3
30000.	ISA+20°C -30°C	3	(1) 88.4	2443	297	.83	507	16.6	18.7	20.7	22.8	24.8
		0	86.0	2179	281	.790	481	17.5	19.8	22.1	24.4	26.7
		-4	84.0	1941	262	.740	451	18.1	20.6	23.2	25.8	28.4
		-7	82.0	1735	243	.690	420	18.5	21.3	24.2	27.1	30.0
		-11	(2) 79.8	1545	221	.63	386	18.5	21.7	25.0	28.2	31.4
	ISA+10°C -40°C	-5	(1) 89.8	2750	314	.88	521	15.3	17.1	19.0	20.8	22.6
		-9	85.8	2292	293	.820	489	17.0	19.1	21.3	23.5	25.7
		-13	83.1	1972	269	.760	453	17.9	20.4	23.0	25.5	28.1
		-18	80.8	1726	246	.700	418	18.4	21.3	24.2	27.1	30.0
		-22	(2) 78.2	1502	221	.63	378	18.5	21.8	25.1	28.5	31.8
	ISA+ 0°C -50°C	-14	(1) 90.8	3059	325	.90	525	13.9	15.5	17.2	18.8	20.4
		-19	85.4	2348	300	.840	489	16.6	18.7	20.8	23.0	25.1
		-24	81.8	1961	273	.770	449	17.8	20.4	22.9	25.5	28.0
		-28	79.1	1677	246	.700	409	18.4	21.4	24.4	27.3	30.3
		-32	(2) 76.6	1460	221	.63	369	18.5	21.9	25.3	28.7	32.2
	ISA-10°C -60°C	-26	(1) 88.7	2946	324	.90	513	14.0	15.7	17.4	19.1	20.8
		-30	83.6	2280	300	.840	478	16.6	18.8	21.0	23.2	25.4
		-35	80.0	1906	273	.770	439	17.8	20.4	23.0	25.7	28.3
		-39	77.4	1630	246	.700	399	18.4	21.4	24.5	27.6	30.6
		-43	(2) 75.0	1419	222	.63	362	18.4	21.9	25.5	29.0	32.5

Figure 7-17 (Sheet 23)

CRUISE
33,000 FEET

ANTI-ICE SYSTEMS OFF | **TWO ENGINES**

WT. LBS.	TEMP	RAT DEG. C	FAN PERCENT RPM	FUEL FLOW LBS/HR	KIAS	IND. MACH	KTAS	NAUTICAL MILES/100 LBS. FUEL 100 KT. HEADWIND	50 KT. HEADWIND	ZERO WIND	50 KT. TAILWIND	100 KT. TAILWIND
28000.	ISA+20°C	4	(1) 88.4	2449	299	.84	510	16.7	18.8	20.8	22.9	24.9
	-30°C	-1	85.2	2096	277	.780	475	17.9	20.3	22.7	25.1	27.4
		-4	83.2	1864	258	.730	445	18.5	21.2	23.9	26.5	29.2
		-9	80.7	1628	235	.670	408	18.9	22.0	25.1	28.1	31.2
		-12	(2) 78.6	1453	215	.62	375	18.9	22.4	25.8	29.2	32.7
	ISA+10°C	-5	(1) 89.7	2744	315	.88	522	15.4	17.2	19.0	20.8	22.7
	-40°C	-10	85.0	2202	289	.810	483	17.4	19.7	21.9	24.2	26.5
		-14	82.3	1898	266	.750	447	18.3	20.9	23.6	26.2	28.8
		-19	79.5	1618	239	.680	406	18.9	22.0	25.1	28.2	31.3
		-23	(2) 77.0	1414	215	.62	367	18.9	22.5	26.0	29.5	33.1
	ISA+ 0°C	-14	(1) 90.7	3051	325	.90	525	13.9	15.6	17.2	18.9	20.5
	-50°C	-20	84.4	2261	296	.830	484	17.0	19.2	21.4	23.6	25.8
		-25	81.0	1888	269	.760	443	18.2	20.8	23.5	26.1	28.8
		-29	78.2	1607	243	.690	403	18.8	22.0	25.1	28.2	31.3
		-33	(2) 75.4	1373	215	.61	359	18.9	22.5	26.1	29.8	33.4
	ISA-10°C	-26	(1) 88.7	2939	324	.90	513	14.0	15.7	17.4	19.1	20.8
	-60°C	-31	82.6	2196	296	.830	473	17.0	19.2	21.5	23.8	26.1
		-36	79.3	1834	269	.760	433	18.2	20.9	23.6	26.4	29.1
		-40	76.5	1561	243	.690	394	18.8	22.0	25.2	28.4	31.6
		-44	(2) 73.7	1332	215	.61	351	18.8	22.6	26.3	30.1	33.8
26000.	ISA+20°C	4	(1) 88.3	2454	301	.84	512	16.8	18.8	20.9	22.9	24.9
	-30°C	-1	84.9	2068	277	.780	475	18.1	20.6	23.0	25.4	27.8
		-5	82.3	1789	254	.720	439	18.9	21.7	24.5	27.3	30.1
		-9	79.8	1561	231	.660	402	19.4	22.6	25.8	29.0	32.2
		-13	(2) 77.1	1359	208	.60	363	19.4	23.0	26.7	30.4	34.1
	ISA+10°C	-5	(1) 89.8	2753	315	.88	523	15.4	17.2	19.0	20.8	22.6
	-40°C	-10	84.7	2177	289	.810	483	17.6	19.9	22.2	24.5	26.8
		-15	81.5	1825	262	.740	441	18.7	21.4	24.2	26.9	29.7
		-19	78.6	1552	235	.670	400	19.3	22.5	25.7	29.0	32.2
		-24	(2) 75.6	1322	207	.60	355	19.3	23.1	26.9	30.7	34.5
	ISA+ 0°C	-14	(1) 90.7	3052	325	.90	526	13.9	15.6	17.2	18.9	20.5
	-50°C	-20	84.0	2237	296	.830	484	17.2	19.4	21.6	23.9	26.1
		-25	80.3	1817	266	.750	438	18.6	21.3	24.1	26.8	29.6
		-30	77.0	1509	235	.670	391	19.3	22.6	25.9	29.2	32.5
		-35	(2) 74.0	1285	208	.60	348	19.3	23.2	27.1	30.9	34.8
	ISA-10°C	-26	(1) 88.7	2939	325	.90	513	14.1	15.8	17.5	19.2	20.9
	-60°C	-31	82.2	2174	296	.830	473	17.1	19.5	21.8	24.1	26.4
		-36	78.5	1765	266	.750	428	18.6	21.4	24.2	27.1	29.9
		-41	75.7	1498	239	.680	388	19.2	22.5	25.9	29.2	32.6
		-45	(2) 72.4	1250	208	.60	340	19.2	23.2	27.2	31.2	35.2
24000.	ISA+20°C	4	(1) 88.3	2461	303	.85	515	16.8	18.9	20.9	22.9	25.0
	-30°C	-1	84.6	2043	277	.780	475	18.4	20.8	23.3	25.7	28.1
		-6	81.5	1719	250	.710	433	19.3	22.3	25.2	28.1	31.0
		-10	78.9	1495	228	.650	396	19.8	23.1	26.5	29.8	33.2
		-14	(2) 75.6	1266	200	.58	351	19.8	23.7	27.7	31.6	35.6
	ISA+10°C	-4	(1) 89.7	2749	316	.88	523	15.4	17.2	19.0	20.9	22.7
	-40°C	-11	83.9	2095	285	.800	477	18.0	20.4	22.8	25.2	27.5
		-16	80.8	1754	258	.730	435	19.1	22.0	24.8	27.7	30.5
		-21	77.3	1454	228	.650	388	19.8	23.2	26.7	30.1	33.5
		-25	(2) 74.0	1229	200	.57	343	19.7	23.8	27.9	32.0	36.0
	ISA+ 0°C	-14	(1) 90.7	3051	325	.90	526	14.0	15.6	17.2	18.9	20.5
	-50°C	-20	83.2	2151	293	.820	478	17.6	19.9	22.2	24.5	26.9
		-26	79.5	1748	262	.740	432	19.0	21.8	24.7	27.6	30.4
		-31	76.1	1447	231	.660	385	19.7	23.2	26.6	30.1	33.5
		-36	(2) 72.5	1194	200	.57	335	19.7	23.9	28.1	32.3	36.4
	ISA-10°C	-26	(1) 88.7	2951	325	.90	514	14.0	15.7	17.4	19.1	20.8
	-60°C	-32	81.4	2091	293	.820	467	17.6	20.0	22.3	24.7	27.1
		-37	77.8	1698	262	.740	422	19.0	21.9	24.9	27.8	30.7
		-42	74.5	1405	231	.660	376	19.7	23.2	26.8	30.4	33.9
		-46	(2) 70.9	1164	200	.58	329	19.6	23.9	28.2	32.5	36.8

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

ANTI-ICE SYSTEMS ON		
MAX. FAN %RPM		
-40°C	-50°C	-60°C
85.0	86.4	84.8
INCREASE FUEL FLOWS AND DECREASE SPECIFIC RANGES BY 10%		

Figure 7-17 (Sheet 24)

CRUISE
35,000 FEET

ANTI-ICE SYSTEMS OFF **TWO ENGINES**

WT. LBS.	TEMP	RAT DEG. C	FAN PERCENT RPM	FUEL FLOW LBS/HR	KIAS	IND. MACH	KTAS	NAUTICAL MILES/100 LBS. FUEL				
								100 KT. HEADWIND	50 KT. HEADWIND	ZERO WIND	50 KT. TAILWIND	100 KT. TAILWIND
35000.	ISA+20°C	-1	(1) 89.2	2327	284	.83	501	17.2	19.4	21.5	23.7	25.8
	-34°C	-4	87.5	2145	272	.800	483	17.9	20.2	22.5	24.8	27.2
		-6	86.2	2018	261	.770	465	18.1	20.6	23.0	25.5	28.0
		-9	84.9	1868	246	.730	441	18.3	20.9	23.6	26.3	29.0
		-11	(2) 83.8	1752	234	.70	420	18.3	21.1	24.0	26.8	29.7
	ISA+10°C	-9	(1) 90.5	2633	301	.88	517	15.8	17.7	19.6	21.5	23.4
	-44°C	-13	87.4	2255	283	.830	490	17.3	19.5	21.7	23.9	26.2
		-16	85.3	2038	268	.790	467	18.0	20.5	22.9	25.4	27.8
		-19	83.5	1848	250	.740	437	18.3	21.0	23.7	26.4	29.1
		-22	(2) 82.2	1709	235	.70	412	18.3	21.2	24.1	27.1	30.0
	ISA+ 0°C	-19	(1) 91.2	2909	310	.90	520	14.4	16.1	17.9	19.6	21.3
	-54°C	-23	86.6	2313	291	.850	490	16.9	19.0	21.2	23.4	25.5
		-26	84.0	2021	272	.800	462	17.9	20.4	22.9	25.4	27.8
		-30	82.0	1829	254	.750	434	18.2	21.0	23.7	26.4	29.2
		-33	(2) 80.5	1663	235	.70	404	18.3	21.3	24.3	27.3	30.3
	ISA-10°C	-31	(1) 89.1	2801	310	.90	507	14.5	16.3	18.1	19.9	21.7
	-64°C	-34	84.7	2245	291	.850	479	16.9	19.1	21.3	23.6	25.8
		-38	82.2	1962	272	.800	452	17.9	20.5	23.0	25.6	28.1
		-41	80.2	1776	254	.750	424	18.2	21.0	23.8	26.7	29.5
		-44	(2) 78.7	1610	234	.70	394	18.2	21.4	24.5	27.6	30.7
34000.	ISA+20°C	-1	(1) 89.2	2335	285	.84	504	17.3	19.4	21.6	23.7	25.9
	-34°C	-4	87.3	2128	272	.800	483	18.0	20.3	22.7	25.0	27.4
		-7	85.6	1959	257	.760	459	18.3	20.9	23.4	26.0	28.5
		-9	84.6	1846	246	.730	441	18.5	21.2	23.9	26.6	29.3
		-12	(2) 83.2	1700	230	.69	415	18.5	21.4	24.4	27.3	30.3
	ISA+10°C	-9	(1) 90.4	2635	302	.88	519	15.9	17.8	19.7	21.6	23.5
	-44°C	-13	87.2	2237	283	.830	490	17.4	19.7	21.9	24.1	26.4
		-16	85.0	2019	268	.790	467	18.2	20.6	23.1	25.6	28.1
		-19	83.2	1827	250	.740	437	18.5	21.2	23.9	26.7	29.4
		-23	(2) 81.6	1656	231	.69	407	18.5	21.5	24.6	27.6	30.6
	ISA+ 0°C	-19	(1) 91.2	2914	311	.90	521	14.4	16.2	17.9	19.6	21.3
	-54°C	-23	86.4	2291	291	.850	490	17.0	19.2	21.4	23.6	25.8
		-26	83.8	2004	272	.800	462	18.1	20.6	23.1	25.6	28.1
		-30	81.8	1810	254	.750	434	18.4	21.2	24.0	26.7	29.5
		-33	(2) 79.9	1615	232	.69	399	18.5	21.6	24.7	27.8	30.9
	ISA-10°C	-30	(1) 89.1	2809	311	.90	508	14.5	16.3	18.1	19.9	21.7
	-64°C	-34	84.5	2223	291	.850	479	17.1	19.3	21.6	23.8	26.0
		-38	82.0	1946	272	.800	452	18.1	20.6	23.2	25.8	28.3
		-41	79.7	1724	250	.740	418	18.4	21.3	24.2	27.1	30.0
		-44	(2) 78.1	1564	231	.69	389	18.5	21.7	24.9	28.1	31.3
32000.	ISA+20°C	-1	(1) 89.2	2339	288	.84	508	17.4	19.6	21.7	23.8	26.0
	-34°C	-4	86.7	2095	272	.800	483	18.3	20.7	23.1	25.4	27.8
		-7	85.1	1920	257	.760	459	18.7	21.3	23.9	26.5	29.1
		-10	83.4	1732	239	.710	429	19.0	21.9	24.8	27.6	30.5
		-13	(2) 82.0	1594	223	.67	403	19.0	22.1	25.3	28.4	31.5
	ISA+10°C	-9	(1) 90.5	2647	303	.88	521	15.9	17.8	19.7	21.6	23.5
	-44°C	-13	86.8	2200	283	.830	490	17.7	20.0	22.3	24.5	26.8
		-16	84.1	1943	265	.780	461	18.6	21.2	23.7	26.3	28.9
		-21	82.0	1717	243	.720	426	19.0	21.9	24.8	27.7	30.6
		-24	(2) 80.3	1551	224	.67	395	19.0	22.2	25.4	28.7	31.9
	ISA+ 0°C	-18	(1) 91.1	2911	312	.91	523	14.5	16.2	18.0	19.7	21.4
	-54°C	-23	86.0	2253	291	.850	490	17.3	19.6	21.8	24.0	26.2
		-27	82.7	1925	268	.790	457	18.5	21.1	23.7	26.3	28.9
		-31	80.6	1702	246	.730	422	18.9	21.9	24.8	27.7	30.7
		-35	(2) 78.6	1509	224	.67	386	19.0	22.3	25.6	28.9	32.2
	ISA-10°C	-30	(1) 89.0	2806	312	.91	510	14.6	16.4	18.2	20.0	21.7
	-64°C	-34	84.1	2186	291	.850	479	17.3	19.6	21.9	24.2	26.5
		-38	80.9	1870	268	.790	446	18.5	21.2	23.9	26.5	29.2
		-42	78.8	1653	246	.730	412	18.9	21.9	24.9	28.0	31.0
		-46	(2) 76.9	1467	224	.67	378	18.9	22.3	25.8	29.2	32.6
30000.	ISA+20°C	0	(1) 89.1	2348	290	.85	512	17.5	19.7	21.8	23.9	26.1
	-34°C	-4	86.3	2062	272	.800	483	18.6	21.0	23.4	25.8	28.3
		-7	84.6	1883	257	.760	459	19.1	21.7	24.4	27.0	29.7
		-10	82.8	1691	239	.710	429	19.4	22.4	25.4	28.3	31.3
		-14	(2) 81.0	1520	220	.66	397	19.5	22.8	26.1	29.4	32.7
	ISA+10°C	-8	(1) 90.5	2651	305	.89	523	16.0	17.9	19.7	21.6	23.5
	-44°C	-13	86.4	2167	283	.830	490	18.0	20.3	22.6	24.9	27.2
		-17	83.3	1867	261	.770	455	19.0	21.7	24.4	27.1	29.7
		-21	81.5	1678	243	.720	426	19.4	22.4	25.4	28.3	31.3
		-25	(2) 79.4	1480	220	.66	389	19.5	22.9	26.3	29.7	33.0
	ISA+ 0°C	-18	(1) 91.1	2918	313	.91	524	14.5	16.3	18.0	19.7	21.4
	-54°C	-23	85.6	2218	291	.850	490	17.6	19.9	22.1	24.4	26.6
		-28	81.9	1853	265	.780	451	18.9	21.6	24.3	27.0	29.7
		-32	79.8	1631	243	.720	416	19.4	22.5	25.5	28.6	31.7
		-35	(2) 77.6	1436	220	.66	380	19.5	23.0	26.5	29.9	33.4
	ISA-10°C	-30	(1) 89.1	2817	313	.91	512	14.6	16.4	18.2	19.9	21.7
	-64°C	-34	83.8	2152	291	.850	479	17.6	19.9	22.3	24.6	26.9
		-39	80.1	1800	265	.780	440	18.9	21.7	24.5	27.2	30.0
		-43	78.0	1583	243	.720	407	19.4	22.5	25.7	28.8	32.0
		-46	(2) 75.9	1391	220	.66	371	19.5	23.0	26.6	30.2	33.8

Figure 7-17 (Sheet 25)

CRUISE
35,000 FEET

ANTI-ICE SYSTEMS OFF **TWO ENGINES**

WT. LBS.	TEMP	RAT DEG. C	FAN PERCENT RPM	FUEL FLOW LBS/HR	KIAS	IND. MACH	KTAS	NAUTICAL MILES/100 LBS. FUEL 100 KT. HEADWIND	50 KT. HEADWIND	ZERO WIND	50 KT. TAILWIND	100 KT. TAILWIND
28000.	ISA+20°C -34°C	0	(1) 89.1	2354	292	.85	515	17.6	19.8	21.9	24.0	26.1
		-4	85.9	2032	272	.800	483	18.9	21.3	23.8	26.2	28.7
		-7	83.8	1806	254	.750	453	19.5	22.3	25.1	27.8	30.6
		-11	81.9	1617	235	.700	423	20.0	23.1	26.1	29.2	32.3
		-15	(2) 79.7	1432	214	.64	387	20.0	23.5	27.0	30.5	34.0
	ISA+10°C -44°C	-8	(1) 90.4	2654	306	.89	525	16.0	17.9	19.8	21.7	23.5
		-13	85.9	2138	283	.830	490	18.3	20.6	22.9	25.3	27.6
		-17	82.9	1835	261	.770	455	19.4	22.1	24.8	27.5	30.3
		-22	80.2	1573	235	.700	414	20.0	23.1	26.3	29.5	32.7
		-26	(2) 78.0	1391	214	.64	379	20.0	23.6	27.2	30.8	34.4
	ISA+ 0°C -54°C	-18	(1) 91.1	2919	314	.91	525	14.6	16.3	18.0	19.7	21.4
		-24	84.7	2128	287	.840	485	18.1	20.4	22.8	25.1	27.5
		-28	81.5	1823	265	.780	451	19.2	22.0	24.7	27.5	30.2
		-32	78.9	1562	239	.710	410	19.9	23.1	26.3	29.5	32.7
		-36	(2) 76.4	1351	214	.64	370	20.0	23.7	27.4	31.1	34.8
	ISA-10°C -64°C	-30	(1) 89.0	2811	313	.91	512	14.7	16.4	18.2	20.0	21.8
		-35	82.9	2066	287	.840	474	18.1	20.5	22.9	25.3	27.8
		-39	79.7	1770	265	.780	440	19.2	22.1	24.9	27.7	30.5
		-43	77.2	1517	239	.710	401	19.8	23.1	26.4	29.7	33.0
		-47	(2) 74.8	1316	214	.64	363	19.9	23.7	27.5	31.3	35.1
26000.	ISA+20°C -34°C	1	(1) 89.1	2362	294	.86	518	17.7	19.8	21.9	24.1	26.2
		-4	85.6	2004	272	.800	483	19.1	21.6	24.1	26.6	29.1
		-8	83.0	1733	250	.740	447	20.0	22.9	25.8	28.7	31.6
		-12	80.6	1514	228	.680	411	20.5	23.8	27.1	30.4	33.7
		-16	(2) 78.3	1344	208	.62	376	20.5	24.3	28.0	31.7	35.4
	ISA+10°C -44°C	-8	(1) 90.4	2649	306	.89	525	16.0	17.9	19.8	21.7	23.6
		-14	84.8	2052	280	.820	484	18.7	21.2	23.6	26.0	28.5
		-18	82.1	1764	257	.760	449	19.8	22.6	25.5	28.3	31.1
		-23	79.3	1504	232	.690	408	20.5	23.8	27.1	30.5	33.8
		-27	(2) 76.7	1306	207	.62	368	20.5	24.3	28.2	32.0	35.8
	ISA+ 0°C -54°C	-18	(1) 91.1	2923	314	.91	526	14.6	16.3	18.0	19.7	21.4
		-24	84.3	2101	287	.840	485	18.3	20.7	23.1	25.5	27.8
		-28	80.8	1753	261	.770	445	19.7	22.5	25.4	28.2	31.1
		-33	78.0	1495	235	.700	405	20.4	23.7	27.1	30.4	33.8
		-37	(2) 75.1	1269	207	.62	360	20.5	24.4	28.3	32.3	36.2
	ISA-10°C -64°C	-30	(1) 89.0	2811	314	.91	513	14.7	16.5	18.2	20.0	21.8
		-35	82.5	2040	287	.840	474	18.3	20.8	23.2	25.7	28.1
		-40	79.0	1703	261	.770	435	19.7	22.6	25.5	28.5	31.4
		-44	76.3	1451	235	.700	395	20.4	23.8	27.2	30.7	34.1
		-48	(2) 73.4	1231	207	.62	351	20.4	24.5	28.5	32.6	36.7
24000.	ISA+20°C -34°C	1	(1) 89.1	2362	295	.86	519	17.8	19.9	22.0	24.1	26.2
		-4	85.2	1977	272	.800	483	19.4	21.9	24.4	27.0	29.5
		-9	82.1	1662	246	.730	441	20.5	23.5	26.5	29.5	32.6
		-13	79.6	1450	225	.670	405	21.0	24.5	27.9	31.4	34.8
		-17	(2) 76.8	1252	200	.60	363	21.0	25.0	29.0	33.0	37.0
	ISA+10°C -44°C	-8	(1) 90.4	2653	306	.89	526	16.0	17.9	19.8	21.7	23.6
		-14	84.5	2026	280	.820	484	19.0	21.4	23.9	26.4	28.8
		-19	81.3	1695	254	.750	443	20.3	23.2	26.2	29.1	32.1
		-23	78.4	1441	228	.680	402	21.0	24.4	27.9	31.4	34.8
		-28	(2) 75.3	1216	200	.60	356	21.0	25.1	29.2	33.3	37.5
	ISA+ 0°C -54°C	-18	(1) 91.1	2924	314	.91	526	14.6	16.3	18.0	19.7	21.4
		-24	84.0	2079	287	.840	485	18.5	20.9	23.3	25.7	28.1
		-29	80.0	1686	257	.760	439	20.1	23.1	26.1	29.0	32.0
		-34	76.7	1400	228	.680	393	20.9	24.5	28.1	31.7	35.2
		-39	(2) 73.7	1181	200	.60	347	21.0	25.2	29.4	33.7	37.9
	ISA-10°C -64°C	-30	(1) 89.0	2813	314	.91	513	14.7	16.5	18.2	20.0	21.8
		-36	81.5	1965	283	.830	468	18.7	21.3	23.8	26.4	28.9
		-40	78.2	1638	257	.760	429	20.1	23.2	26.2	29.3	32.3
		-45	75.1	1359	228	.680	384	20.9	24.6	28.3	31.9	35.6
		-49	(2) 72.0	1145	200	.60	339	20.9	25.3	29.6	34.0	38.4

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

ANTI-ICE SYSTEMS ON		
MAX. FAN %RPM		
-44°C	-54°C	-64°C
85.5	86.6	85.0
INCREASE FUEL FLOWS AND DECREASE SPECIFIC RANGES BY 10%		

Figure 7-17 (Sheet 26)

CRUISE
37,000 FEET

ANTI-ICE SYSTEMS OFF **TWO ENGINES**

WT. LBS.	TEMP	RAT DEG. C	FAN PERCENT RPM	FUEL FLOW LBS/HR	KIAS	IND. MACH	KTAS	NAUTICAL MILES/100 LBS. FUEL 100 KT. HEADWIND	50 KT. HEADWIND	ZERO WIND	50 KT. TAILWIND	100 KT. TAILWIND
35000.	ISA+20°C -37°C	-4	(1) 89.5	2180	271	.83	499	18.3	20.6	22.9	25.2	27.5
		-5	89.0	2121	267	.820	492	18.5	20.9	23.2	25.6	27.9
		-6	88.1	2019	260	.800	481	18.9	21.3	23.8	26.3	28.8
		-9	86.6	1864	246	.760	457	19.1	21.8	24.5	27.2	29.9
		-11	(2) 85.6	1769	235	.73	439	19.2	22.0	24.8	27.6	30.5
	ISA+10°C -47°C	-12	(1) 90.6	2448	287	.88	514	16.9	18.9	21.0	23.0	25.1
		-15	88.2	2170	274	.840	493	18.1	20.4	22.7	25.0	27.3
		-16	87.3	2059	267	.820	482	18.6	21.0	23.4	25.8	28.3
		-17	86.4	1960	260	.800	470	18.9	21.5	24.0	26.6	29.1
		-22	(2) 83.9	1719	235	.73	430	19.2	22.1	25.0	27.9	30.8
	ISA+ 0°C -57°C	-21	(1) 91.7	2752	296	.90	517	15.2	17.0	18.8	20.6	22.4
		-25	87.5	2235	281	.860	493	17.6	19.8	22.1	24.3	26.5
		-27	85.4	1996	267	.820	471	18.6	21.1	23.6	26.1	28.6
		-29	84.6	1900	260	.800	460	18.9	21.6	24.2	26.8	29.5
		-33	(2) 82.2	1674	236	.73	421	19.2	22.2	25.2	28.2	31.1
	ISA-10°C -67°C	-33	(1) 89.5	2649	296	.90	504	15.3	17.2	19.0	20.9	22.8
		-36	85.6	2167	281	.860	482	17.6	19.9	22.2	24.5	26.9
		-39	83.6	1936	267	.820	460	18.6	21.2	23.8	26.4	28.9
		-40	82.7	1844	260	.800	449	18.9	21.6	24.4	27.1	29.8
		-44	(2) 80.4	1621	236	.73	411	19.2	22.3	25.3	28.4	31.5
34000.	ISA+20°C -37°C	-4	(1) 89.4	2175	272	.83	501	18.4	20.7	23.0	25.3	27.6
		-5	88.8	2096	267	.820	492	18.7	21.1	23.5	25.9	28.3
		-6	87.8	1994	260	.800	481	19.1	21.6	24.1	26.6	29.1
		-9	86.2	1842	246	.760	457	19.4	22.1	24.8	27.5	30.2
		-12	(2) 84.9	1715	232	.72	433	19.4	22.3	25.2	28.1	31.1
	ISA+10°C -47°C	-12	(1) 90.7	2453	288	.88	515	16.9	19.0	21.0	23.0	25.1
		-15	88.0	2147	274	.840	493	18.3	20.6	23.0	25.3	27.6
		-16	87.0	2034	267	.820	482	18.8	21.2	23.7	26.1	28.6
		-17	86.0	1936	260	.800	470	19.1	21.7	24.3	26.9	29.5
		-23	(2) 83.2	1671	232	.72	425	19.4	22.4	25.4	28.4	31.4
	ISA+ 0°C -57°C	-21	(1) 91.7	2755	297	.90	518	15.2	17.0	18.8	20.6	22.4
		-25	87.3	2212	281	.860	493	17.8	20.0	22.3	24.6	26.8
		-27	85.2	1973	267	.820	471	18.8	21.4	23.9	26.4	29.0
		-29	84.2	1877	260	.800	460	19.2	21.8	24.5	27.2	29.8
		-34	(2) 81.5	1624	233	.72	416	19.4	22.5	25.6	28.7	31.8
	ISA-10°C -67°C	-33	(1) 89.5	2652	297	.90	506	15.3	17.2	19.1	21.0	22.8
		-36	85.4	2144	281	.860	482	17.8	20.1	22.5	24.8	27.1
		-39	83.3	1914	267	.820	460	18.8	21.4	24.0	26.7	29.3
		-40	82.4	1821	260	.800	449	19.2	21.9	24.7	27.4	30.2
		-45	(2) 79.7	1576	233	.72	406	19.4	22.6	25.8	28.9	32.1
32000.	ISA+20°C -37°C	-3	(1) 89.4	2182	275	.84	505	18.6	20.9	23.2	25.5	27.7
		-5	88.2	2054	267	.820	492	19.1	21.5	24.0	26.4	28.8
		-6	87.1	1949	260	.800	481	19.5	22.1	24.7	27.2	29.8
		-9	85.5	1799	246	.760	457	19.8	22.6	25.4	28.2	30.9
		-13	(2) 83.5	1603	224	.70	420	19.9	23.1	26.2	29.3	32.4
	ISA+10°C -47°C	-11	(1) 90.7	2461	289	.88	518	17.0	19.0	21.0	23.1	25.1
		-15	87.5	2104	274	.840	493	18.7	21.1	23.4	25.8	28.2
		-16	86.5	1994	267	.820	482	19.2	21.7	24.2	26.7	29.2
		-17	85.4	1892	260	.800	470	19.6	22.2	24.9	27.5	30.2
		-24	(2) 81.9	1565	225	.70	412	20.0	23.2	26.4	29.5	32.7
	ISA+ 0°C -57°C	-21	(1) 91.6	2758	299	.91	521	15.3	17.1	18.9	20.7	22.5
		-25	86.8	2167	281	.860	493	18.2	20.5	22.8	25.1	27.4
		-27	84.7	1933	267	.820	471	19.2	21.8	24.4	27.0	29.5
		-29	83.6	1835	260	.800	460	19.6	22.3	25.1	27.8	30.5
		-35	(2) 80.2	1521	225	.70	403	19.9	23.2	26.5	29.8	33.1
	ISA-10°C -67°C	-33	(1) 89.5	2655	298	.91	508	15.4	17.3	19.1	21.0	22.9
		-36	84.9	2101	281	.860	482	18.2	20.6	22.9	25.3	27.7
		-39	82.8	1876	267	.820	460	19.2	21.9	24.5	27.2	29.9
		-40	81.8	1782	260	.800	449	19.6	22.4	25.2	28.0	30.8
		-46	(2) 78.4	1473	225	.70	393	19.9	23.3	26.7	30.1	33.5
30000.	ISA+20°C -37°C	-2	(1) 89.4	2195	278	.85	510	18.7	21.0	23.3	25.5	27.8
		-5	87.7	2017	267	.820	492	19.5	21.9	24.4	26.9	29.4
		-6	86.5	1915	260	.800	481	19.9	22.5	25.1	27.7	30.3
		-9	84.9	1760	246	.760	457	20.3	23.1	26.0	28.8	31.6
		-15	(2) 82.3	1504	218	.68	409	20.5	23.8	27.2	30.5	33.8
	ISA+10°C -47°C	-11	(1) 90.6	2459	291	.89	520	17.1	19.1	21.2	23.2	25.2
		-15	87.0	2065	274	.840	493	19.0	21.5	23.9	26.3	28.7
		-16	86.0	1957	267	.820	482	19.5	22.1	24.6	27.2	29.7
		-17	84.8	1859	260	.800	470	19.9	22.6	25.3	28.0	30.7
		-26	(2) 80.6	1462	218	.68	400	20.5	23.9	27.4	30.8	34.2
	ISA+ 0°C -57°C	-21	(1) 91.6	2761	300	.91	523	15.3	17.1	18.9	20.8	22.6
		-25	86.3	2123	281	.860	493	18.5	20.9	23.2	25.6	28.0
		-27	84.2	1898	267	.820	471	19.6	22.2	24.8	27.5	30.1
		-29	83.1	1804	260	.800	460	20.0	22.7	25.5	28.3	31.0
		-36	(2) 78.9	1421	218	.68	391	20.5	24.0	27.5	31.0	34.6
	ISA-10°C -67°C	-32	(1) 89.5	2665	300	.91	510	15.4	17.3	19.1	21.0	22.9
		-36	84.4	2059	281	.860	482	18.5	21.0	23.4	25.8	28.3
		-39	82.4	1842	267	.820	460	19.6	22.3	25.0	27.7	30.4
		-40	81.3	1751	260	.800	449	19.9	22.8	25.6	28.5	31.4
		-47	(2) 77.2	1380	218	.68	382	20.5	24.1	27.7	31.3	35.0

Figure 7-17 (Sheet 27)

CRUISE
37,000 FEET

ANTI-ICE SYSTEMS OFF **TWO ENGINES**

WT. LBS.	TEMP	RAT DEG. C	FAN PERCENT RPM	FUEL FLOW LBS/HR	KIAS	IND. MACH	KTAS	NAUTICAL MILES/100 LBS. FUEL: 100 KT. HEADWIND	50 KT. HEADWIND	ZERO WIND	50 KT. TAILWIND	100 KT. TAILWIND
28000.	ISA+20°C	-2	(1) 89.3	2193	280	.86	514	18.9	21.2	23.4	25.7	28.0
	-37°C	-5	87.2	1981	267	.820	492	19.8	22.3	24.9	27.4	29.9
		-6	86.0	1883	260	.800	481	20.2	22.9	25.5	28.2	30.8
		-9	84.4	1722	246	.760	457	20.7	23.6	26.5	29.4	32.3
		-16	(2) 81.0	1412	212	.66	398	21.1	24.7	28.2	31.8	35.3
	ISA+10°C	-11	(1) 90.6	2472	293	.89	523	17.1	19.1	21.2	23.2	25.2
	-47°C	-15	86.6	2030	274	.840	493	19.4	21.8	24.3	26.8	29.2
		-16	85.5	1924	267	.820	482	19.8	22.4	25.0	27.6	30.2
		-17	84.2	1827	260	.800	470	20.3	23.0	25.7	28.5	31.2
		-27	(2) 79.4	1371	212	.66	390	21.1	24.8	28.4	32.1	35.7
	ISA+ 0°C	-20	(1) 91.6	2772	302	.92	525	15.3	17.1	18.9	20.7	22.5
	-57°C	-25	85.9	2083	281	.860	493	18.9	21.3	23.7	26.1	28.5
		-27	83.7	1865	267	.820	471	19.9	22.6	25.3	27.9	30.6
		-29	82.5	1773	260	.800	460	20.3	23.1	25.9	28.8	31.6
		-38	(2) 77.6	1326	211	.66	379	21.1	24.8	28.6	32.4	36.2
	ISA-10°C	-32	(1) 89.5	2668	301	.91	512	15.5	17.3	19.2	21.1	22.9
	-67°C	-36	84.0	2021	281	.860	482	18.9	21.4	23.8	26.3	28.8
		-39	81.9	1811	267	.820	460	19.9	22.7	25.4	28.2	30.9
		-40	80.7	1721	260	.800	449	20.3	23.2	26.1	29.0	31.9
		-48	(2) 75.9	1287	211	.66	371	21.0	24.9	28.8	32.7	36.6
26000.	ISA+20°C	-1	(1) 89.3	2203	283	.86	518	19.0	21.2	23.5	25.8	28.1
	-37°C	-5	86.6	1951	267	.820	492	20.1	22.7	25.2	27.8	30.4
		-6	85.6	1852	260	.800	481	20.5	23.2	25.9	28.6	31.3
		-9	83.9	1686	246	.760	457	21.2	24.1	27.1	30.1	33.0
		-17	(2) 79.8	1332	207	.65	390	21.8	25.5	29.3	33.0	36.8
	ISA+10°C	-10	(1) 90.6	2475	294	.90	525	17.2	19.2	21.2	23.2	25.2
	-47°C	-15	86.2	1998	274	.840	493	19.7	22.2	24.7	27.2	29.7
		-16	84.9	1893	267	.820	482	20.2	22.8	25.5	28.1	30.7
		-17	83.8	1798	260	.800	470	20.6	23.4	26.2	28.9	31.7
		-27	(2) 78.1	1294	207	.65	381	21.7	25.6	29.5	33.3	37.2
	ISA+ 0°C	-20	(1) 91.6	2766	302	.92	526	15.4	17.2	19.0	20.8	22.6
	-57°C	-25	85.5	2049	281	.860	493	19.2	21.6	24.1	26.5	29.0
		-27	83.2	1837	267	.820	471	20.2	22.9	25.7	28.4	31.1
		-29	82.1	1745	260	.800	460	20.6	23.5	26.4	29.2	32.1
		-38	(2) 76.4	1255	207	.65	372	21.7	25.7	29.7	33.7	37.6
	ISA-10°C	-32	(1) 89.5	2672	302	.92	513	15.5	17.3	19.2	21.1	22.9
	-67°C	-36	83.6	1988	281	.860	482	19.2	21.7	24.2	26.8	29.3
		-39	81.4	1784	267	.820	460	20.2	23.0	25.8	28.6	31.4
		-40	80.2	1694	260	.800	449	20.6	23.6	26.5	29.5	32.4
		-49	(2) 74.8	1221	207	.65	365	21.7	25.8	29.9	34.0	38.0
24000.	ISA+20°C	-1	(1) 89.3	2206	284	.87	520	19.0	21.3	23.6	25.8	28.1
	-37°C	-5	86.2	1922	267	.820	492	20.4	23.0	25.6	28.2	30.8
		-6	85.2	1823	260	.800	481	20.9	23.6	26.4	29.1	31.9
		-9	83.4	1653	246	.760	457	21.6	24.6	27.6	30.7	33.7
		-18	(2) 78.3	1242	200	.63	377	22.3	26.4	30.4	34.4	38.4
	ISA+10°C	-10	(1) 90.5	2470	294	.90	526	17.2	19.2	21.3	23.3	25.3
	-47°C	-15	85.7	1970	274	.840	493	20.0	22.5	25.0	27.6	30.1
		-16	84.4	1866	267	.820	482	20.5	23.1	25.8	28.5	31.2
		-17	83.5	1769	260	.800	470	20.9	23.8	26.6	29.4	32.2
		-29	(2) 76.7	1208	200	.63	370	22.3	26.5	30.6	34.7	38.9
	ISA+ 0°C	-20	(1) 91.6	2776	302	.92	526	15.4	17.2	19.0	20.8	22.6
	-57°C	-25	85.1	2021	281	.860	493	19.5	21.9	24.4	26.9	29.4
		-27	82.7	1810	267	.820	471	20.5	23.3	26.0	28.8	31.6
		-29	81.7	1718	260	.800	460	20.9	23.9	26.8	29.7	32.6
		-39	(2) 75.0	1170	200	.63	361	22.3	26.5	30.8	35.1	39.4
	ISA-10°C	-32	(1) 89.5	2673	302	.92	513	15.5	17.3	19.2	21.1	22.9
	-67°C	-36	83.3	1961	281	.860	482	19.5	22.0	24.6	27.1	29.7
		-39	80.9	1757	267	.820	460	20.5	23.3	26.2	29.0	31.9
		-40	79.9	1668	260	.800	449	20.9	23.9	26.9	29.9	32.9
		-50	(2) 73.4	1138	200	.63	353	22.2	26.6	31.0	35.4	39.8

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

ANTI-ICE SYSTEMS ON		
MAX. FAN %RPM		
-47°C	-57°C	-67°C
85.4	86.8	85.2
INCREASE FUEL FLOWS AND DECREASE SPECIFIC RANGES BY 10%		

Figure 7-17 (Sheet 28)

CRUISE
39,000 FEET

ANTI-ICE SYSTEMS OFF **TWO ENGINES**

WT. LBS.	TEMP	RAT DEG. C	FAN PERCENT RPM	FUEL FLOW LBS/HR	KIAS	IND. MACH	KTAS	NAUTICAL MILES/100 LBS. FUEL: 100 KT. HEADWIND	50 KT. HEADWIND	ZERO WIND	50 KT. TAILWIND	100 KT. TAILWIND
35000.	ISA+20°C	-6	(1) 89.2	1935	248	.80	481	19.7	22.3	24.9	27.5	30.0
	-37°C	-6	89.2	1931	248	.800	481	19.7	22.3	24.9	27.5	30.1
		-8	88.4	1847	241	.780	469	20.0	22.7	25.4	28.1	30.8
		-9	87.9	1785	235	.760	457	20.0	22.8	25.6	28.4	31.2
		-9	(2) 87.7	1772	233	.76	454	20.0	22.8	25.6	28.4	31.3
	ISA+10°C	-13	(1) 90.4	2196	269	.86	505	18.5	20.7	23.0	25.3	27.6
	-47°C	-15	89.2	2069	262	.840	493	19.0	21.4	23.8	26.3	28.7
		-16	88.2	1963	255	.820	482	19.4	22.0	24.5	27.1	29.6
		-17	87.4	1874	248	.800	470	19.8	22.4	25.1	27.8	30.4
		-21	(2) 86.0	1722	233	.76	445	20.0	22.9	25.8	28.7	31.6
	ISA+ 0°C	-22	(1) 91.4	2474	279	.89	511	16.6	18.6	20.6	22.7	24.7
	-57°C	-25	88.4	2123	268	.860	493	18.5	20.9	23.2	25.6	27.9
		-27	86.4	1903	255	.820	471	19.5	22.1	24.8	27.4	30.0
		-29	85.6	1816	248	.800	460	19.8	22.6	25.3	28.1	30.8
		-31	(2) 84.3	1678	234	.76	437	20.1	23.0	26.0	29.0	32.0
	ISA-10°C	-34	(1) 89.3	2376	279	.89	498	16.7	18.8	21.0	23.1	25.2
	-67°C	-36	86.5	2057	268	.860	482	18.6	21.0	23.4	25.9	28.3
		-39	84.5	1845	255	.820	460	19.5	22.2	24.9	27.6	30.4
		-40	83.7	1762	248	.800	449	19.8	22.6	25.5	28.3	31.2
		-43	(2) 82.4	1629	234	.76	427	20.0	23.1	26.2	29.3	32.3
34000.	ISA+20°C	-6	(1) 89.2	1942	251	.81	486	19.9	22.4	25.0	27.6	30.2
	-37°C	-6	88.8	1902	248	.800	481	20.0	22.6	25.3	27.9	30.5
		-8	88.0	1820	241	.780	469	20.2	23.0	25.7	28.5	31.2
		-9	87.5	1758	235	.760	457	20.3	23.1	26.0	28.8	31.7
		-10	(2) 87.1	1724	231	.75	450	20.3	23.2	26.1	29.0	31.9
	ISA+10°C	-13	(1) 90.4	2200	270	.87	508	18.5	20.8	23.1	25.4	27.6
	-47°C	-15	88.9	2041	262	.840	493	19.3	21.7	24.2	26.6	29.1
		-16	87.9	1936	255	.820	482	19.7	22.3	24.9	27.5	30.0
		-17	87.0	1846	248	.800	470	20.1	22.8	25.5	28.2	30.9
		-21	(2) 85.4	1674	231	.75	440	20.3	23.3	26.3	29.3	32.3
	ISA+ 0°C	-22	(1) 91.4	2478	280	.89	512	16.6	18.7	20.7	22.7	24.7
	-57°C	-25	88.1	2094	268	.860	493	18.8	21.2	23.6	26.0	28.3
		-27	86.1	1877	255	.820	471	19.8	22.4	25.1	27.8	30.4
		-29	85.2	1789	248	.800	460	20.1	22.9	25.7	28.5	31.3
		-32	(2) 83.7	1631	232	.75	432	20.4	23.4	26.5	29.6	32.6
	ISA-10°C	-34	(1) 89.2	2376	280	.89	499	16.8	18.9	21.0	23.1	25.2
	-67°C	-36	86.2	2029	268	.860	482	18.8	21.3	23.8	26.2	28.7
		-39	84.2	1819	255	.820	460	19.8	22.5	25.3	28.0	30.8
		-40	83.4	1735	248	.800	449	20.1	23.0	25.9	28.8	31.6
		-43	(2) 81.9	1583	232	.75	422	20.3	23.5	26.7	29.8	33.0
32000.	ISA+20°C	-5	(1) 89.1	1950	255	.82	493	20.2	22.7	25.3	27.9	30.4
	-37°C	-6	88.1	1848	248	.800	481	20.6	23.3	26.0	28.7	31.4
		-8	87.3	1771	241	.780	469	20.8	23.6	26.5	29.3	32.1
		-9	86.6	1707	235	.760	457	20.9	23.8	26.8	29.7	32.6
		-11	(2) 85.7	1632	226	.73	441	20.9	24.0	27.0	30.1	33.2
	ISA+10°C	-12	(1) 90.3	2210	273	.87	512	18.6	20.9	23.2	25.4	27.7
	-47°C	-15	88.2	1987	262	.840	493	19.8	22.3	24.8	27.3	29.9
		-16	87.2	1884	255	.820	482	20.3	22.9	25.6	28.2	30.9
		-17	86.4	1794	248	.800	470	20.6	23.4	26.2	29.0	31.8
		-22	(2) 84.0	1584	226	.73	432	20.9	24.1	27.3	30.4	33.6
	ISA+ 0°C	-22	(1) 91.3	2476	282	.90	515	16.8	18.8	20.8	22.8	24.9
	-57°C	-25	87.5	2044	268	.860	493	19.2	21.7	24.1	26.6	29.0
		-27	85.4	1827	255	.820	471	20.3	23.1	25.8	28.5	31.3
		-29	84.6	1739	248	.800	460	20.7	23.6	26.4	29.3	32.2
		-33	(2) 82.4	1542	226	.74	423	21.0	24.2	27.4	30.7	33.9
	ISA-10°C	-33	(1) 89.3	2388	282	.90	503	16.9	19.0	21.1	23.2	25.3
	-67°C	-36	85.6	1981	268	.860	482	19.3	21.8	24.3	26.9	29.4
		-39	83.6	1771	255	.820	460	20.3	23.2	26.0	28.8	31.6
		-40	82.7	1687	248	.800	449	20.7	23.7	26.6	29.6	32.5
		-44	(2) 80.5	1494	226	.74	413	20.9	24.3	27.6	31.0	34.3
30000.	ISA+20°C	-4	(1) 89.0	1957	259	.83	499	20.4	23.0	25.5	28.1	30.6
	-37°C	-6	87.4	1800	248	.800	481	21.1	23.9	26.7	29.5	32.3
		-8	86.6	1728	241	.780	469	21.3	24.2	27.1	30.0	32.9
		-9	85.7	1663	235	.760	457	21.4	24.5	27.5	30.5	33.5
		-13	(2) 84.2	1517	218	.71	426	21.5	24.8	28.1	31.4	34.7
	ISA+10°C	-12	(1) 90.3	2213	275	.88	515	18.8	21.0	23.3	25.5	27.8
	-47°C	-15	87.6	1940	262	.840	493	20.3	22.9	25.4	28.0	30.6
		-16	86.7	1838	255	.820	482	20.8	23.5	26.2	28.9	31.6
		-17	85.7	1747	248	.800	470	21.2	24.1	26.9	29.8	32.6
		-23	(2) 82.6	1480	219	.71	419	21.6	24.9	28.3	31.7	35.1
	ISA+ 0°C	-21	(1) 91.4	2489	284	.91	519	16.8	18.8	20.8	22.8	24.9
	-57°C	-25	87.0	1998	268	.860	493	19.7	22.2	24.7	27.2	29.7
		-27	84.8	1782	255	.820	471	20.8	23.6	26.4	29.2	32.0
		-29	83.9	1694	248	.800	460	21.2	24.2	27.1	30.1	33.0
		-34	(2) 80.8	1441	219	.71	410	21.5	25.0	28.5	31.9	35.4
	ISA-10°C	-33	(1) 89.2	2391	284	.90	506	17.0	19.1	21.2	23.2	25.3
	-67°C	-36	85.1	1936	268	.860	482	19.7	22.3	24.9	27.5	30.1
		-39	83.0	1729	255	.820	460	20.8	23.7	26.6	29.5	32.4
		-40	82.0	1644	248	.800	449	21.2	24.3	27.3	30.4	33.4
		-46	(2) 79.0	1395	219	.71	400	21.5	25.1	28.7	32.3	35.9

Figure 7-17 (Sheet 29)

CRUISE
39,000 FEET

ANTI-ICE SYSTEMS OFF **TWO ENGINES**

WT. LBS.	TEMP	RAT DEG. C	FAN PERCENT RPM	FUEL FLOW LBS/HR	KIAS	IND. MACH	KTAS	NAUTICAL MILES/100 LBS. FUEL: 100 KT. HEADWIND	50 KT. HEADWIND	ZERO WIND	50 KT. TAILWIND	100 KT. TAILWIND
28000.	ISA+20°C	-3	(1) 89.0	1962	262	.84	505	20.6	23.2	25.7	28.3	30.8
	-37°C	-6	86.7	1761	248	.800	481	21.6	24.4	27.3	30.1	33.0
		-8	85.8	1689	241	.780	469	21.8	24.8	27.8	30.7	33.7
		-9	85.1	1622	235	.760	457	22.0	25.1	28.1	31.2	34.3
		-14	(2) 82.8	1413	210	.69	413	22.2	25.7	29.3	32.8	36.3
	ISA+10°C	-11	(1) 90.3	2222	277	.88	518	18.8	21.1	23.3	25.6	27.8
	-47°C	-15	87.1	1900	262	.840	493	20.7	23.3	26.0	28.6	31.2
		-16	86.1	1800	255	.820	482	21.2	24.0	26.8	29.5	32.3
		-17	85.0	1709	248	.800	470	21.7	24.6	27.5	30.4	33.4
		-25	(2) 81.2	1379	211	.69	406	22.2	25.8	29.5	33.1	36.7
	ISA+ 0°C	-21	(1) 91.3	2493	286	.91	521	16.9	18.9	20.9	22.9	24.9
	-57°C	-25	86.4	1954	268	.860	493	20.1	22.7	25.3	27.8	30.4
		-27	84.3	1745	255	.820	471	21.3	24.1	27.0	29.9	32.7
		-29	83.2	1658	248	.800	460	21.7	24.7	27.7	30.7	33.8
		-36	(2) 79.4	1339	211	.69	397	22.2	25.9	29.6	33.4	37.1
	ISA-10°C	-33	(1) 89.1	2389	285	.91	508	17.1	19.2	21.3	23.4	25.5
	-67°C	-36	84.5	1894	268	.860	482	20.2	22.8	25.4	28.1	30.7
		-39	82.5	1693	255	.820	460	21.3	24.2	27.2	30.1	33.1
		-40	81.4	1609	248	.800	449	21.7	24.8	27.9	31.0	34.1
		-47	(2) 77.7	1299	211	.69	388	22.1	26.0	29.8	33.7	37.5
26000.	ISA+20°C	-2	(1) 88.9	1968	265	.85	509	20.8	23.3	25.9	28.4	31.0
	-37°C	-6	86.1	1728	248	.800	481	22.0	24.9	27.8	30.7	33.6
		-8	85.2	1652	241	.780	469	22.3	25.3	28.4	31.4	34.4
		-9	84.5	1583	235	.760	457	22.5	25.7	28.8	32.0	35.2
		-15	(2) 81.3	1311	203	.67	400	22.9	26.7	30.5	34.3	38.2
	ISA+10°C	-11	(1) 90.3	2226	278	.89	521	18.9	21.2	23.4	25.7	27.9
	-47°C	-15	86.7	1863	262	.840	493	21.1	23.8	26.5	29.2	31.8
		-16	85.5	1765	255	.820	482	21.6	24.5	27.3	30.1	33.0
		-17	84.3	1677	248	.800	470	22.1	25.1	28.0	31.0	34.0
		-26	(2) 79.7	1276	203	.67	392	22.9	26.8	30.7	34.7	38.6
	ISA+ 0°C	-21	(1) 91.2	2487	287	.91	523	17.0	19.0	21.0	23.1	25.1
	-57°C	-25	85.9	1912	268	.860	493	20.6	23.2	25.8	28.4	31.0
		-27	83.8	1711	255	.820	471	21.7	24.6	27.5	30.5	33.4
		-29	82.6	1627	248	.800	460	22.1	25.2	28.3	31.3	34.4
		-37	(2) 78.0	1244	204	.67	384	22.9	26.9	30.9	34.9	38.9
	ISA-10°C	-32	(1) 89.1	2392	287	.91	511	17.2	19.3	21.3	23.4	25.5
	-67°C	-36	84.0	1854	268	.860	482	20.6	23.3	26.0	28.7	31.4
		-39	81.9	1661	255	.820	460	21.7	24.7	27.7	30.7	33.7
		-40	80.8	1579	248	.800	449	22.1	25.3	28.4	31.6	34.8
		-48	(2) 76.2	1199	203	.66	373	22.8	27.0	31.1	35.3	39.5
24000.	ISA+20°C	-2	(1) 88.9	1973	267	.86	514	21.0	23.5	26.0	28.6	31.1
	-37°C	-6	85.6	1696	248	.800	481	22.4	25.4	28.3	31.3	34.2
		-8	84.7	1617	241	.780	469	22.8	25.9	29.0	32.1	35.2
		-9	83.9	1547	235	.760	457	23.1	26.3	29.5	32.8	36.0
		-16	(2) 80.1	1239	199	.65	393	23.7	27.7	31.7	35.8	39.8
	ISA+10°C	-11	(1) 90.1	2220	280	.89	523	19.1	21.3	23.6	25.8	28.1
	-47°C	-15	86.2	1829	262	.840	493	21.5	24.2	27.0	29.7	32.4
		-16	84.9	1733	255	.820	482	22.0	24.9	27.8	30.7	33.6
		-17	83.9	1647	248	.800	470	22.5	25.5	28.6	31.6	34.6
		-27	(2) 78.5	1208	200	.66	386	23.7	27.8	31.9	36.1	40.2
	ISA+ 0°C	-20	(1) 91.2	2488	288	.91	524	17.1	19.1	21.1	23.1	25.1
	-57°C	-25	85.5	1876	268	.860	493	21.0	23.6	26.3	29.0	31.6
		-27	83.2	1681	255	.820	471	22.1	25.0	28.0	31.0	34.0
		-29	82.1	1598	248	.800	460	22.5	25.6	28.8	31.9	35.0
		-38	(2) 76.8	1170	199	.65	376	23.6	27.9	32.2	36.4	40.7
	ISA-10°C	-32	(1) 89.2	2403	288	.91	512	17.1	19.2	21.3	23.4	25.5
	-67°C	-36	83.6	1820	268	.860	482	21.0	23.7	26.5	29.2	32.0
		-39	81.4	1632	255	.820	460	22.1	25.1	28.2	31.2	34.3
		-40	80.3	1551	248	.800	449	22.5	25.7	28.9	32.2	35.4
		-49	(2) 75.1	1134	199	.65	367	23.6	28.0	32.4	36.8	41.2

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

ANTI-ICE SYSTEMS ON		
MAX. FAN %RPM		
-47°C	-57°C	-67°C
84.7	86.2	84.6
INCREASE FUEL FLOWS AND DECREASE SPECIFIC RANGES BY 10%		

Figure 7-17 (Sheet 30)

CRUISE
41,000 FEET

ANTI-ICE SYSTEMS OFF — **TWO ENGINES**

WT. LBS.	TEMP	RAT DEG. C	FAN PERCENT RPM	FUEL FLOW LBS/HR	KIAS	IND. MACH	KTAS	NAUTICAL MILES/100 LBS. FUEL: 100 KT. HEADWIND	50 KT. HEADWIND	ZERO WIND	50 KT. TAILWIND	100 KT. TAILWIND
35000.	ISA+10°C	-15	(1) 90.1	1957	248	.83	490	19.9	22.5	25.0	27.6	30.1
		-16	89.4	1889	243	.820	482	20.2	22.8	25.5	28.1	30.8
		-18	88.7	1807	237	.800	470	20.5	23.2	26.0	28.8	31.5
		-19	(2) 87.9	1732	230	.78	459	20.7	23.6	26.5	29.4	32.3
	ISA+ 0°C -57°C	-23	(1) 91.1	2217	262	.88	504	18.2	20.5	22.7	25.0	27.2
		-25	89.6	2045	256	.860	493	19.2	21.7	24.1	26.6	29.0
		-27	87.6	1831	243	.820	471	20.2	23.0	25.7	28.4	31.2
		-29	86.8	1751	237	.800	460	20.5	23.4	26.2	29.1	32.0
		-30	(2) 86.1	1679	230	.78	449	20.8	23.7	26.7	29.7	32.7
	ISA-10°C -67°C	-35	(1) 89.0	2137	262	.88	491	18.3	20.6	23.0	25.3	27.7
		-36	87.6	1981	256	.860	482	19.3	21.8	24.3	26.8	29.4
		-39	85.7	1774	243	.820	460	20.3	23.1	25.9	28.7	31.6
		-40	84.9	1696	237	.800	449	20.6	23.5	26.5	29.4	32.4
		-41	(2) 84.2	1630	231	.78	439	20.8	23.8	26.9	30.0	33.0
34000.	ISA+10°C -47°C	-14	(1) 90.1	1964	250	.84	494	20.1	22.6	25.2	27.7	30.3
		-15	90.0	1952	250	.840	493	20.1	22.7	25.3	27.8	30.4
		-16	89.0	1858	243	.820	482	20.5	23.2	25.9	28.6	31.3
		-18	88.2	1775	237	.800	470	20.8	23.7	26.5	29.3	32.1
		-19	(2) 87.4	1696	230	.78	458	21.1	24.1	27.0	30.0	32.9
	ISA+ 0°C -57°C	-23	(1) 91.1	2223	264	.88	505	18.2	20.5	22.7	25.0	27.2
		-25	89.2	2009	256	.860	493	19.6	22.1	24.6	27.0	29.5
		-27	87.2	1801	243	.820	471	20.6	23.4	26.1	28.9	31.7
		-29	86.4	1720	237	.800	460	20.9	23.8	26.7	29.6	32.5
		-30	(2) 85.6	1643	230	.78	448	21.2	24.2	27.2	30.3	33.3
	ISA-10°C -67°C	-35	(1) 89.0	2139	263	.88	493	18.4	20.7	23.0	25.4	27.7
		-36	87.2	1946	256	.860	482	19.6	22.2	24.8	27.3	29.9
		-39	85.3	1743	243	.820	460	20.6	23.5	26.4	29.3	32.1
		-40	84.5	1667	237	.800	449	20.9	23.9	26.9	29.9	32.9
		-41	(2) 83.7	1594	230	.78	437	21.2	24.3	27.4	30.6	33.7
32000.	ISA+20°C	-7	(1) 88.8	1735	234	.79	475	21.6	24.5	27.4	30.3	33.2
		-8	88.4	1693	230	.780	468	21.8	24.7	27.7	30.6	33.6
		-9	(2) 87.9	1638	224	.76	457	21.8	24.8	27.9	30.9	34.0
	ISA+10°C -47°C	-13	(1) 90.0	1977	255	.86	502	20.3	22.9	25.4	27.9	30.4
		-15	89.2	1892	250	.840	493	20.8	23.4	26.1	28.7	31.3
		-16	88.2	1798	243	.820	482	21.2	24.0	26.8	29.6	32.3
		-18	87.4	1716	237	.800	470	21.6	24.5	27.4	30.3	33.2
		-20	(2) 86.1	1586	224	.76	446	21.8	25.0	28.1	31.3	34.4
	ISA+ 0°C -57°C	-23	(1) 91.1	2228	266	.89	509	18.4	20.6	22.8	25.1	27.3
		-25	88.4	1943	256	.860	493	20.2	22.8	25.4	28.0	30.5
		-27	86.4	1742	243	.820	471	21.3	24.2	27.0	29.9	32.8
		-29	85.6	1663	237	.800	460	21.6	24.6	27.6	30.6	33.6
		-31	(2) 84.3	1543	224	.76	438	21.9	25.1	28.4	31.6	34.8
	ISA-10°C -67°C	-34	(1) 88.9	2138	265	.89	496	18.5	20.9	23.2	25.5	27.9
		-36	86.5	1882	256	.860	482	20.3	22.9	25.6	28.3	30.9
		-39	84.5	1688	243	.820	460	21.3	24.3	27.2	30.2	33.2
		-40	83.7	1612	237	.800	449	21.6	24.7	27.8	30.9	34.0
		-42	(2) 82.5	1500	225	.76	428	21.9	25.2	28.5	31.9	35.2
30000.	ISA+20°C -37°C	-6	(1) 88.8	1749	240	.81	485	22.0	24.9	27.8	30.6	33.5
		-6	88.4	1711	237	.800	480	22.2	25.1	28.1	31.0	33.9
		-8	87.6	1640	230	.780	468	22.5	25.5	28.6	31.6	34.7
		-9	87.0	1582	224	.760	456	22.5	25.7	28.8	32.0	35.2
		-10	(2) 86.5	1540	219	.74	447	22.5	25.8	29.0	32.3	35.5
	ISA+10°C -47°C	-13	(1) 90.0	1987	258	.87	508	20.5	23.0	25.6	28.1	30.6
		-15	88.5	1837	250	.840	493	21.4	24.1	26.8	29.6	32.3
		-16	87.5	1743	243	.820	482	21.9	24.8	27.6	30.5	33.4
		-18	86.6	1661	237	.800	470	22.3	25.3	28.3	31.3	34.3
		-21	(2) 84.7	1492	218	.74	437	22.6	25.9	29.3	32.6	36.0
	ISA+ 0°C -57°C	-22	(1) 91.0	2229	268	.89	513	18.5	20.8	23.0	25.2	27.5
		-25	87.7	1887	256	.860	493	20.8	23.5	26.1	28.8	31.4
		-27	85.6	1689	243	.820	471	21.9	24.9	27.9	30.8	33.8
		-29	84.8	1610	237	.800	460	22.3	25.4	28.5	31.6	34.8
		-32	(2) 83.1	1457	220	.75	429	22.6	26.0	29.5	32.9	36.3
	ISA-10°C -67°C	-34	(1) 89.0	2150	267	.89	500	18.6	20.9	23.3	25.6	27.9
		-36	85.8	1827	256	.860	482	20.9	23.6	26.4	29.1	31.8
		-39	83.8	1638	243	.820	460	22.0	25.0	28.1	31.1	34.2
		-40	83.0	1562	237	.800	449	22.3	25.5	28.7	31.9	35.1
		-43	(2) 81.3	1412	219	.75	419	22.6	26.1	29.7	33.2	36.7

Figure 7-17 (Sheet 31)

CRUISE
41,000 FEET

ANTI-ICE SYSTEMS OFF **TWO ENGINES**

WT. LBS.	TEMP	RAT DEG. C	FAN PERCENT RPM	FUEL FLOW LBS/HR	KIAS	IND. MACH	KTAS	NAUTICAL MILES/100 LBS. FUEL 100 KT. HEADWIND	50 KT. HEADWIND	ZERO WIND	50 KT. TAILWIND	100 KT. TAILWIND
28000.	ISA+20°C -37°C	-5	(1) 88.7	1755	244	.82	493	22.4	25.3	28.1	31.0	33.8
		-6	87.6	1660	237	.800	480	22.9	25.9	28.9	31.9	34.9
		-8	86.8	1593	230	.780	468	23.1	26.3	29.4	32.5	35.7
		-9	86.0	1535	224	.760	456	23.2	26.5	29.7	33.0	36.2
		-12	(2) 84.8	1435	211	.72	433	23.2	26.7	30.2	33.7	37.2
	ISA+10°C -47°C	-12	(1) 89.9	1990	261	.87	512	20.7	23.2	25.7	28.2	30.7
		-15	87.8	1787	250	.840	493	22.0	24.8	27.6	30.4	33.2
		-16	86.8	1694	243	.820	482	22.5	25.5	28.4	31.4	34.3
		-18	85.8	1611	237	.800	470	23.0	26.1	29.2	32.3	35.4
		-23	(2) 83.1	1391	211	.72	424	23.3	26.9	30.5	34.1	37.7
	ISA+ 0°C -57°C	-22	(1) 91.0	2241	270	.90	516	18.6	20.8	23.0	25.3	27.5
		-25	87.1	1840	256	.860	493	21.4	24.1	26.8	29.5	32.2
		-27	85.0	1642	243	.820	471	22.6	25.6	28.7	31.7	34.8
		-29	84.1	1562	237	.800	460	23.0	26.2	29.4	32.6	35.8
		-34	(2) 81.4	1356	212	.72	416	23.3	27.0	30.7	34.4	38.1
	ISA-10°C -67°C	-33	(1) 88.9	2147	269	.90	503	18.8	21.1	23.4	25.8	28.1
		-36	85.2	1782	256	.860	482	21.4	24.2	27.0	29.8	32.6
		-39	83.1	1592	243	.820	460	22.6	25.7	28.9	32.0	35.2
		-40	82.2	1516	237	.800	449	23.0	26.3	29.6	32.9	36.2
		-45	(2) 79.5	1314	212	.72	406	23.3	27.1	30.9	34.7	38.5
26000.	ISA+20°C -37°C	-4	(1) 88.6	1763	247	.83	500	22.7	25.5	28.3	31.2	34.0
		-6	86.8	1617	237	.800	480	23.5	26.6	29.7	32.8	35.9
		-8	85.9	1552	230	.780	468	23.7	27.0	30.2	33.4	36.6
		-9	85.2	1493	224	.760	456	23.9	27.2	30.6	33.9	37.3
		-14	(2) 83.2	1322	203	.70	418	24.0	27.8	31.6	35.4	39.2
	ISA+10°C -47°C	-12	(1) 89.8	1992	263	.88	515	20.9	23.4	25.9	28.4	30.9
		-15	87.2	1744	250	.840	493	22.5	25.4	28.3	31.1	34.0
		-16	86.2	1653	243	.820	482	23.1	26.1	29.1	32.2	35.2
		-18	85.1	1569	237	.800	470	23.6	26.8	30.0	33.1	36.3
		-24	(2) 81.6	1290	204	.70	410	24.1	27.9	31.8	35.7	39.6
	ISA+ 0°C -57°C	-21	(1) 91.0	2239	272	.91	519	18.7	21.0	23.2	25.4	27.7
		-25	86.5	1794	256	.860	493	21.9	24.7	27.5	30.3	33.1
		-27	84.4	1603	243	.820	471	23.1	26.3	29.4	32.5	35.6
		-29	83.3	1522	237	.800	460	23.6	26.9	30.2	33.5	36.8
		-35	(2) 79.8	1253	204	.70	401	24.0	28.0	32.0	36.0	40.0
	ISA-10°C -67°C	-33	(1) 88.9	2153	271	.91	506	18.9	21.2	23.5	25.8	28.2
		-36	84.6	1739	256	.860	482	21.9	24.8	27.7	30.6	33.4
		-39	82.5	1554	243	.820	460	23.2	26.4	29.6	32.8	36.0
		-40	81.5	1477	237	.800	449	23.6	27.0	30.4	33.8	37.2
		-46	(2) 78.0	1215	204	.70	392	24.0	28.1	32.2	36.3	40.5
24000.	ISA+20°C -37°C	-3	(1) 88.6	1771	251	.84	505	22.9	25.7	28.5	31.4	34.2
		-6	86.1	1584	237	.800	480	24.0	27.2	30.3	33.5	36.6
		-8	85.3	1515	230	.780	468	24.3	27.6	30.9	34.2	37.5
		-9	84.5	1453	224	.760	456	24.5	28.0	31.4	34.8	38.3
		-15	(2) 81.6	1218	195	.67	403	24.9	29.0	33.1	37.2	41.3
	ISA+10°C -47°C	-11	(1) 89.8	1997	264	.88	518	21.0	23.5	26.0	28.5	31.0
		-15	86.7	1707	250	.840	493	23.0	26.0	28.9	31.8	34.7
		-16	85.6	1617	243	.820	482	23.6	26.7	29.8	32.9	36.0
		-18	84.3	1537	237	.800	470	24.1	27.3	30.6	33.8	37.1
		-26	(2) 79.9	1187	196	.67	395	24.9	29.1	33.3	37.5	41.7
	ISA+ 0°C -57°C	-21	(1) 90.9	2240	273	.91	522	18.8	21.1	23.3	25.5	27.8
		-25	85.9	1751	256	.860	493	22.5	25.3	28.2	31.0	33.9
		-27	83.8	1567	243	.820	471	23.7	26.9	30.0	33.2	36.4
		-29	82.6	1491	237	.800	460	24.1	27.5	30.8	34.2	37.5
		-37	(2) 78.2	1152	196	.67	386	24.8	29.2	33.5	37.9	42.2
	ISA-10°C -67°C	-32	(1) 88.9	2160	273	.91	509	18.9	21.3	23.6	25.9	28.2
		-36	84.0	1698	256	.860	482	22.5	25.4	28.4	31.3	34.3
		-39	82.0	1521	243	.820	460	23.7	26.9	30.2	33.5	36.8
		-40	80.8	1447	237	.800	449	24.1	27.6	31.0	34.5	37.9
		-48	(2) 76.5	1120	196	.67	378	24.8	29.3	33.7	38.2	42.7

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

ANTI-ICE SYSTEMS ON MAX. FAN %RPM		
-47°C	-57°C	-67°C
84.1	85.5	84.0
INCREASE FUEL FLOWS AND DECREASE SPECIFIC RANGES BY 10%		

Figure 7-17 (Sheet 32)

CRUISE
43,000 FEET

ANTI-ICE SYSTEMS OFF **TWO ENGINES**

WT. LBS.	TEMP	RAT DEG. C	FAN PERCENT RPM	FUEL FLOW LBS/HR	KIAS	IND. MACH	KTAS	NAUTICAL MILES/100 LBS. FUEL 100 KT. HEADWIND	50 KT. HEADWIND	ZERO WIND	50 KT. TAILWIND	100 KT. TAILWIND
35000.	ISA+ 0°C -57°C	-25	(1) 90.9	1994	245	.86	494	19.7	22.2	24.7	27.3	29.8
		-26	89.8	1870	238	.840	482	20.4	23.1	25.8	28.4	31.1
		-27	88.9	1781	232	.820	471	20.8	23.6	26.4	29.2	32.0
		-29	88.2	1705	226	.800	459	21.1	24.0	26.9	29.9	32.8
		-30	(2) 87.7	1648	221	.78	450	21.2	24.3	27.3	30.3	33.4
	ISA-10°C -67°C	-36	(1) 88.8	1916	244	.86	480	19.9	22.5	25.1	27.7	30.3
		-37	87.8	1812	238	.840	470	20.4	23.2	26.0	28.7	31.5
		-39	87.0	1725	232	.820	460	20.8	23.7	26.6	29.5	32.4
		-40	86.3	1651	226	.800	448	21.1	24.1	27.2	30.2	33.2
		-41	(2) 85.8	1596	221	.78	440	21.3	24.4	27.5	30.7	33.8
34000.	ISA+10°C	-17	(1) 89.9	1745	228	.81	473	21.4	24.2	27.1	30.0	32.8
		-18	89.6	1723	226	.800	470	21.5	24.4	27.3	30.2	33.1
		-19	(2) 89.1	1669	221	.79	461	21.7	24.7	27.6	30.6	33.6
	ISA+ 0°C -57°C	-24	(1) 90.9	1995	247	.87	496	19.9	22.4	24.9	27.4	29.9
		-26	89.3	1833	238	.840	482	20.8	23.5	26.3	29.0	31.7
		-27	88.5	1746	232	.820	471	21.2	24.1	26.9	29.8	32.7
		-29	87.8	1670	226	.800	459	21.5	24.5	27.5	30.5	33.5
		-30	(2) 87.2	1615	221	.78	451	21.7	24.8	27.9	31.0	34.1
	ISA-10°C -67°C	-36	(1) 88.8	1920	246	.86	484	20.0	22.6	25.2	27.8	30.4
		-37	87.4	1775	238	.840	470	20.9	23.7	26.5	29.3	32.1
		-39	86.6	1692	232	.820	460	21.3	24.2	27.2	30.1	33.1
		-40	85.9	1618	226	.800	448	21.5	24.6	27.7	30.8	33.9
		-41	(2) 85.3	1565	221	.79	440	21.7	24.9	28.1	31.3	34.5
32000.	ISA+10°C	-16	(1) 89.8	1762	235	.83	486	21.9	24.7	27.6	30.4	33.2
		-16	89.4	1730	232	.820	481	22.0	24.9	27.8	30.7	33.6
		-18	88.7	1656	226	.800	470	22.3	25.3	28.4	31.4	34.4
		-19	(2) 88.0	1592	220	.78	459	22.6	25.7	28.9	32.0	35.1
	ISA+ 0°C -57°C	-23	(1) 90.9	2008	250	.88	502	20.0	22.5	25.0	27.5	30.0
		-26	88.5	1763	238	.840	482	21.7	24.5	27.3	30.2	33.0
		-27	87.6	1678	232	.820	471	22.1	25.1	28.0	31.0	34.0
		-29	86.8	1604	226	.800	459	22.4	25.5	28.6	31.7	34.9
		-30	(2) 86.1	1542	220	.78	449	22.6	25.9	29.1	32.4	35.6
	ISA-10°C -67°C	-35	(1) 88.7	1927	249	.87	489	20.2	22.8	25.4	28.0	30.6
		-37	86.6	1707	238	.840	470	21.7	24.6	27.6	30.5	33.4
		-39	85.7	1625	232	.820	460	22.1	25.2	28.3	31.4	34.4
		-40	84.9	1553	226	.800	448	22.4	25.7	28.9	32.1	35.3
		-41	(2) 84.3	1497	221	.78	439	22.6	26.0	29.3	32.7	36.0
30000.	ISA+10°C -47°C	-14	(1) 89.7	1777	240	.85	496	22.3	25.1	27.9	30.7	33.5
		-15	89.5	1754	238	.840	493	22.4	25.2	28.1	30.9	33.8
		-16	88.6	1668	232	.820	481	22.9	25.9	28.9	31.9	34.9
		-18	87.7	1594	226	.800	470	23.2	26.3	29.5	32.6	35.7
		-19	(2) 86.7	1507	217	.77	454	23.5	26.8	30.1	33.4	36.8
	ISA+ 0°C -57°C	-23	(1) 90.8	2007	252	.88	506	20.2	22.7	25.2	27.7	30.2
		-26	87.6	1700	238	.840	482	22.5	25.4	28.3	31.3	34.2
		-27	86.7	1617	232	.820	471	22.9	26.0	29.1	32.2	35.3
		-29	85.9	1545	226	.800	459	23.3	26.5	29.7	33.0	36.2
		-31	(2) 84.9	1456	217	.77	443	23.5	27.0	30.4	33.8	37.3
	ISA-10°C -67°C	-35	(1) 88.7	1928	251	.88	493	20.4	23.0	25.6	28.2	30.8
		-37	85.7	1646	238	.840	470	22.5	25.5	28.6	31.6	34.7
		-39	84.8	1566	232	.820	460	23.0	26.2	29.3	32.5	35.7
		-40	84.0	1496	226	.800	448	23.3	26.6	30.0	33.3	36.7
		-42	(2) 83.1	1416	217	.77	433	23.5	27.1	30.6	34.1	37.7

Figure 7-17 (Sheet 33)

CRUISE
43,000 FEET

ANTI-ICE SYSTEMS OFF **TWO ENGINES**

WT. LBS.	TEMP	RAT DEG. C	FAN PERCENT RPM	FUEL FLOW LBS/HR	KIAS	IND. MACH	KTAS	NAUTICAL MILES/100 LBS. FUEL 100 KT. HEADWIND	50 KT. HEADWIND	ZERO WIND	50 KT. TAILWIND	100 KT. TAILWIND
28000.	ISA+20°C	-7	(1) 88.4	1568	225	.80	477	24.1	27.3	30.5	33.6	36.8
		-8	87.8	1517	220	.780	468	24.3	27.6	30.9	34.2	37.5
		-9	87.2	1465	213	.760	456	24.3	27.7	31.1	34.5	38.0
		-10	(2) 87.0	1442	211	.75	451	24.3	27.8	31.2	34.7	38.2
	ISA+10°C -47°C	-13	(1) 89.6	1785	244	.86	503	22.6	25.4	28.2	31.0	33.8
		-15	88.7	1697	238	.840	493	23.1	26.1	29.0	32.0	34.9
		-16	87.7	1610	232	.820	481	23.7	26.8	29.9	33.0	36.1
		-18	86.8	1536	226	.800	470	24.1	27.3	30.6	33.8	37.1
		-21	(2) 85.3	1404	211	.75	442	24.4	27.9	31.5	35.0	38.6
	ISA+ 0°C -57°C	-22	(1) 90.8	2013	254	.89	510	20.4	22.9	25.3	27.8	30.3
		-26	86.8	1645	238	.840	482	23.2	26.2	29.3	32.3	35.4
		-27	85.8	1561	232	.820	471	23.7	26.9	30.1	33.3	36.5
		-29	85.0	1489	226	.800	459	24.1	27.5	30.8	34.2	37.6
		-32	(2) 83.5	1363	211	.75	433	24.4	28.1	31.8	35.4	39.1
	ISA-10°C -67°C	-34	(1) 88.6	1932	254	.89	497	20.6	23.2	25.7	28.3	30.9
		-37	84.9	1592	238	.840	470	23.3	26.4	29.5	32.7	35.8
		-39	84.0	1512	232	.820	460	23.8	27.1	30.4	33.7	37.0
		-40	83.2	1443	226	.800	448	24.1	27.6	31.1	34.5	38.0
		-43	(2) 81.7	1323	211	.75	423	24.4	28.2	32.0	35.7	39.5
26000.	ISA+20°C -37°C	-5	(1) 88.3	1578	230	.81	488	24.6	27.7	30.9	34.1	37.2
		-6	87.7	1530	226	.800	480	24.8	28.1	31.4	34.6	37.9
		-8	86.9	1468	220	.780	468	25.1	28.5	31.9	35.3	38.7
		-9	86.2	1416	213	.760	456	25.2	28.7	32.2	35.7	39.3
		-11	(2) 85.3	1354	206	.73	441	25.2	28.9	32.6	36.3	39.9
	ISA+10°C -47°C	-13	(1) 89.6	1793	247	.87	509	22.8	25.6	28.4	31.2	34.0
		-15	87.9	1643	238	.840	493	23.9	26.9	30.0	33.0	36.1
		-16	86.9	1559	232	.820	481	24.5	27.7	30.9	34.1	37.3
		-18	86.0	1485	226	.800	470	24.9	28.3	31.6	35.0	38.4
		-22	(2) 83.5	1303	204	.73	429	25.2	29.1	32.9	36.7	40.6
	ISA+ 0°C -57°C	-22	(1) 90.7	2014	256	.90	514	20.6	23.0	25.5	28.0	30.5
		-26	86.0	1593	238	.840	482	24.0	27.1	30.2	33.4	36.5
		-27	85.1	1511	232	.820	471	24.5	27.8	31.1	34.4	37.8
		-29	84.2	1439	226	.800	459	25.0	28.4	31.9	35.4	38.9
		-33	(2) 81.9	1273	205	.73	422	25.3	29.2	33.1	37.1	41.0
	ISA-10°C -67°C	-34	(1) 88.6	1942	256	.90	502	20.7	23.2	25.8	28.4	31.0
		-37	84.2	1543	238	.840	470	24.0	27.2	30.5	33.7	37.0
		-39	83.2	1465	232	.820	460	24.5	28.0	31.4	34.8	38.2
		-40	82.4	1395	226	.800	448	25.0	28.6	32.1	35.7	39.3
		-44	(2) 80.0	1232	205	.73	411	25.2	29.3	33.3	37.4	41.5
24000.	ISA+20°C -37°C	-4	(1) 88.3	1588	234	.83	495	24.9	28.1	31.2	34.3	37.5
		-6	86.8	1483	226	.800	480	25.6	29.0	32.4	35.7	39.1
		-8	85.9	1425	220	.780	468	25.8	29.3	32.8	36.3	39.8
		-9	85.3	1373	213	.760	456	25.9	29.6	33.2	36.9	40.5
		-13	(2) 83.4	1232	196	.70	421	26.1	30.1	34.2	38.2	42.3
	ISA+10°C -47°C	-12	(1) 89.6	1800	250	.88	513	23.0	25.7	28.5	31.3	34.1
		-15	87.2	1599	238	.840	493	24.6	27.7	30.8	33.9	37.1
		-16	86.2	1516	232	.820	481	25.1	28.4	31.7	35.0	38.3
		-18	85.1	1439	226	.800	470	25.7	29.2	32.6	36.1	39.6
		-24	(2) 81.9	1202	197	.71	414	26.1	30.3	34.5	38.6	42.8
	ISA+ 0°C -57°C	-21	(1) 90.7	2020	259	.90	518	20.7	23.1	25.6	28.1	30.6
		-26	85.4	1551	238	.840	482	24.6	27.8	31.1	34.3	37.5
		-27	84.4	1469	232	.820	471	25.2	28.6	32.0	35.4	38.8
		-29	83.3	1394	226	.800	459	25.8	29.4	32.9	36.5	40.1
		-35	(2) 80.1	1168	197	.71	405	26.1	30.4	34.7	39.0	43.2
	ISA-10°C -67°C	-33	(1) 88.6	1949	258	.90	505	20.8	23.3	25.9	28.5	31.0
		-37	83.5	1503	238	.840	470	24.7	28.0	31.3	34.6	38.0
		-39	82.6	1425	232	.820	460	25.2	28.7	32.3	35.8	39.3
		-40	81.5	1353	226	.800	448	25.7	29.4	33.1	36.8	40.5
		-46	(2) 78.3	1132	197	.70	395	26.1	30.5	34.9	39.3	43.7

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

Figure 7-17 (Sheet 34)

CRUISE
45,000 FEET

ANTI-ICE SYSTEMS OFF **TWO ENGINES**

WT. LBS.	TEMP	RAT DEG. C	FAN PERCENT RPM	FUEL FLOW LBS/HR	KIAS	IND. MACH	KTAS	NAUTICAL MILES/100 LBS. FUEL 100 KT. HEADWIND	50 KT. HEADWIND	ZERO WIND	50 KT. TAILWIND	100 KT. TAILWIND
35000.	ISA+ 0°C	-27	(1) 90.7	1784	224	.83	475	21.1	23.9	26.7	29.5	32.3
		-28	90.4	1747	221	.820	470	21.2	24.1	26.9	29.8	32.6
		-29	89.7	1676	215	.800	459	21.4	24.4	27.4	30.4	33.4
		-30	(2) 89.2	1622	210	.78	449	21.5	24.6	27.7	30.7	33.8
	ISA-10°C	-38	(1) 88.6	1711	223	.83	462	21.2	24.1	27.0	29.9	32.8
		-39	88.4	1692	221	.820	459	21.2	24.2	27.1	30.1	33.1
		-40	87.8	1623	215	.800	448	21.5	24.5	27.6	30.7	33.8
		-41	(2) 87.3	1573	210	.78	439	21.5	24.7	27.9	31.1	34.2
34000.	ISA+ 0°C	-26	(1) 90.7	1789	227	.84	481	21.3	24.1	26.9	29.7	32.5
		-28	89.9	1708	221	.820	470	21.7	24.6	27.5	30.5	33.4
		-29	89.2	1637	215	.800	459	21.9	25.0	28.0	31.1	34.1
		-30	(2) 88.6	1577	210	.78	448	22.0	25.2	28.4	31.6	34.7
	ISA-10°C	-38	(1) 88.6	1719	226	.84	468	21.4	24.3	27.2	30.1	33.1
		-39	88.0	1654	221	.820	459	21.7	24.7	27.8	30.8	33.8
		-40	87.3	1585	215	.800	448	22.0	25.1	28.3	31.4	34.6
		-41	(2) 86.8	1533	210	.78	438	22.1	25.3	28.6	31.9	35.1
33000.	ISA+ 0°C -57°C	-26	(1) 90.6	1792	229	.85	485	21.5	24.3	27.1	29.9	32.7
		-26	90.3	1753	227	.840	481	21.8	24.6	27.5	30.3	33.2
		-28	89.4	1668	221	.820	470	22.2	25.2	28.2	31.2	34.2
		-29	88.7	1600	215	.800	459	22.4	25.6	28.7	31.8	34.9
		-30	(2) 88.1	1542	210	.78	448	22.6	25.8	29.1	32.3	35.6
	ISA-10°C -67°C	-37	(1) 88.5	1721	229	.84	473	21.6	24.5	27.5	30.4	33.3
		-38	88.3	1698	227	.840	470	21.8	24.8	27.7	30.6	33.6
		-39	87.5	1615	221	.820	459	22.2	25.3	28.4	31.5	34.6
		-40	86.8	1549	215	.800	448	22.5	25.7	28.9	32.2	35.4
		-41	(2) 86.2	1493	210	.78	438	22.6	26.0	29.3	32.7	36.0
32000.	ISA+ 0°C -57°C	-25	(1) 90.6	1799	232	.86	491	21.7	24.5	27.3	30.1	32.8
		-26	89.8	1714	227	.840	481	22.2	25.2	28.1	31.0	33.9
		-28	88.9	1633	221	.820	470	22.7	25.7	28.8	31.9	34.9
		-29	88.2	1564	215	.800	459	22.9	26.1	29.3	32.5	35.7
		-30	(2) 87.7	1517	211	.79	450	23.1	26.4	29.7	33.0	36.3
	ISA-10°C -67°C	-37	(1) 88.5	1728	231	.85	478	21.8	24.7	27.6	30.5	33.4
		-38	87.8	1660	227	.840	470	22.3	25.3	28.3	31.3	34.3
		-39	87.0	1581	221	.820	459	22.7	25.9	29.0	32.2	35.4
		-40	86.3	1515	215	.800	448	23.0	26.3	29.6	32.9	36.2
		-41	(2) 85.8	1470	211	.79	440	23.1	26.5	29.9	33.3	36.7
30000.	ISA+10°C	-17	(1) 89.4	1576	218	.81	475	23.8	27.0	30.2	33.3	36.5
		-18	89.0	1542	215	.800	469	24.0	27.2	30.4	33.7	36.9
		-19	(2) 88.4	1489	211	.78	460	24.2	27.5	30.9	34.3	37.6
	ISA+ 0°C -57°C	-24	(1) 90.5	1800	236	.87	497	22.1	24.8	27.6	30.4	33.2
		-26	88.8	1641	227	.840	481	23.2	26.3	29.3	32.4	35.4
		-28	88.0	1563	221	.820	470	23.7	26.9	30.1	33.3	36.5
		-29	87.2	1494	215	.800	459	24.0	27.4	30.7	34.1	37.4
		-30	(2) 86.6	1443	211	.78	450	24.2	27.7	31.2	34.6	38.1
	ISA-10°C -67°C	-36	(1) 88.4	1732	235	.87	485	22.2	25.1	28.0	30.9	33.8
		-38	86.9	1589	227	.840	470	23.3	26.4	29.6	32.7	35.9
		-39	86.1	1514	221	.820	459	23.7	27.0	30.3	33.6	36.9
		-40	85.3	1447	215	.800	448	24.1	27.5	31.0	34.4	37.9
		-41	(2) 84.7	1399	211	.78	440	24.3	27.9	31.4	35.0	38.6
28000.	ISA+10°C -47°C	-15	(1) 89.3	1591	225	.83	488	24.4	27.5	30.7	33.8	36.9
		-16	88.8	1546	221	.820	481	24.6	27.9	31.1	34.3	37.6
		-18	88.0	1478	215	.800	469	25.0	28.4	31.8	35.1	38.5
		-19	(2) 87.2	1417	210	.78	458	25.3	28.8	32.3	35.9	39.4
	ISA+ 0°C -57°C	-23	(1) 90.5	1806	239	.88	503	22.3	25.1	27.8	30.6	33.4
		-26	87.9	1574	227	.840	481	24.2	27.4	30.6	33.8	36.9
		-28	87.0	1497	221	.820	470	24.7	28.1	31.4	34.7	38.1
		-29	86.2	1432	215	.800	459	25.1	28.6	32.0	35.5	39.0
		-30	(2) 85.4	1373	210	.78	448	25.3	29.0	32.6	36.3	39.9
	ISA-10°C -67°C	-35	(1) 88.4	1742	239	.88	491	22.4	25.3	28.2	31.0	33.9
		-38	86.0	1524	227	.840	470	24.3	27.6	30.8	34.1	37.4
		-39	85.1	1450	221	.820	459	24.8	28.2	31.7	35.1	38.6
		-40	84.3	1387	215	.800	448	25.1	28.7	32.3	35.9	39.5
		-41	(2) 83.6	1332	210	.78	438	25.4	29.1	32.9	36.6	40.4

Figure 7-17 (Sheet 35)

CRUISE
45,000 FEET

ANTI-ICE SYSTEMS OFF — **TWO ENGINES**

WT. LBS.	TEMP	RAT DEG. C	FAN PERCENT RPM	FUEL FLOW LBS/HR	KIAS	IND. MACH	KTAS	NAUTICAL MILES/100 LBS. FUEL: 100 KT. HEADWIND	50 KT. HEADWIND	ZERO WIND	50 KT. TAILWIND	100 KT. TAILWIND
26000.	ISA+20°C	-8	(1) 87.9	1396	209	.78	467	26.3	29.8	33.4	37.0	40.6
		-9	87.4	1354	204	.760	456	26.3	30.0	33.7	37.3	41.0
		-9	(2) 87.4	1350	203	.76	455	26.3	30.0	33.7	37.4	41.1
	ISA+10°C -47°C	-14	(1) 89.3	1604	230	.85	498	24.8	27.9	31.0	34.1	37.3
		-16	87.8	1487	221	.820	481	25.6	29.0	32.3	35.7	39.1
		-18	87.0	1419	215	.800	469	26.0	29.6	33.1	36.6	40.1
		-20	85.7	1313	204	.760	446	26.3	30.2	34.0	37.8	41.6
		-21	(2) 85.7	1311	203	.76	445	26.3	30.1	34.0	37.8	41.6
	ISA+ 0°C -57°C	-23	(1) 90.5	1815	241	.89	508	22.5	25.2	28.0	30.7	33.5
		-26	87.0	1517	227	.840	481	25.1	28.4	31.7	35.0	38.3
		-28	86.0	1440	221	.820	470	25.7	29.2	32.7	36.1	39.6
		-29	85.2	1375	215	.800	459	26.1	29.7	33.4	37.0	40.6
		-32	(2) 83.9	1270	203	.76	435	26.4	30.3	34.3	38.2	42.1
	ISA-10°C -67°C	-34	(1) 88.4	1747	241	.89	495	22.6	25.5	28.3	31.2	34.1
		-38	85.1	1468	227	.840	470	25.2	28.6	32.0	35.4	38.8
		-39	84.1	1394	221	.820	459	25.8	29.4	32.9	36.5	40.1
		-40	83.3	1332	215	.800	448	26.1	29.9	33.7	37.4	41.2
		-43	(2) 82.1	1237	204	.76	427	26.4	30.4	34.5	38.5	42.6
24000.	ISA+20°C -37°C	-6	(1) 87.8	1410	216	.80	480	27.0	30.5	34.1	37.6	41.2
		-6	87.8	1407	215	.800	480	27.0	30.5	34.1	37.6	41.2
		-8	87.0	1350	209	.780	468	27.2	30.9	34.6	38.3	42.0
		-9	86.3	1302	204	.760	456	27.3	31.2	35.0	38.8	42.7
		-11	(2) 85.7	1260	198	.74	444	27.3	31.3	35.2	39.2	43.2
	ISA+10°C -47°C	-13	(1) 89.2	1608	234	.86	505	25.2	28.3	31.4	34.5	37.6
		-16	86.9	1433	221	.820	481	26.6	30.1	33.6	37.0	40.5
		-18	86.0	1365	215	.800	469	27.1	30.7	34.4	38.0	41.7
		-20	84.6	1263	204	.760	446	27.4	31.4	35.3	39.3	43.2
		-22	(2) 83.9	1218	197	.74	434	27.4	31.5	35.6	39.7	43.8
	ISA+ 0°C -57°C	-22	(1) 90.3	1814	244	.89	512	22.7	25.5	28.2	31.0	33.7
		-26	86.1	1462	227	.840	481	26.1	29.5	32.9	36.3	39.8
		-28	85.1	1389	221	.820	470	26.6	30.2	33.8	37.4	41.0
		-29	84.3	1323	215	.800	459	27.1	30.9	34.7	38.5	42.3
		-33	(2) 82.3	1188	198	.74	426	27.4	31.7	35.9	40.1	44.3
	ISA-10°C -67°C	-34	(1) 88.3	1747	243	.89	499	22.9	25.7	28.6	31.4	34.3
		-38	84.2	1416	227	.840	470	26.1	29.7	33.2	36.7	40.3
		-39	83.3	1346	221	.820	459	26.7	30.4	34.1	37.8	41.6
		-40	82.4	1282	215	.800	448	27.2	31.1	35.0	38.9	42.8
		-44	(2) 80.5	1150	198	.74	415	27.4	31.8	36.1	40.5	44.8

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

Figure 7-17 (Sheet 36)

CRUISE
47000 FEET

ANTI-ICE SYSTEMS OFF **TWO ENGINES**

WT. LBS.	TEMP	RAT DEG. C	FAN PERCENT RPM	FUEL FLOW LBS/HR	KIAS	IND. MACH	KTAS	NAUTICAL MILES/100 LBS. FUEL: 100 KT. HEADWIND	50 KT. HEADWIND	ZERO WIND	50 KT. TAILWIND	100 KT. TAILWIND
30000.	ISA+ 0°C	-26	(1) 90.3	1616	218	.84	483	23.7	26.8	29.9	33.0	36.1
	-57°C	-26	90.1	1601	217	.840	481	23.8	26.9	30.1	33.2	36.3
		-28	89.3	1524	211	.820	470	24.3	27.5	30.8	34.1	37.4
		-29	88.7	1463	205	.800	459	24.5	27.9	31.4	34.8	38.2
		-30	(2) 88.0	1407	200	.78	447	24.7	28.2	31.8	35.3	38.9
	ISA-10°C	-38	(1) 88.2	1551	217	.84	470	23.9	27.1	30.3	33.5	36.7
		-39	87.4	1475	211	.820	459	24.3	27.7	31.1	34.5	37.9
		-40	86.7	1416	205	.800	448	24.6	28.1	31.6	35.2	38.7
		-41	(2) 86.1	1365	200	.78	438	24.7	28.4	32.0	35.7	39.4
29000.	ISA+ 0°C	-25	(1) 90.2	1618	220	.85	488	24.0	27.1	30.2	33.2	36.3
	-57°C	-26	89.6	1563	217	.840	481	24.4	27.6	30.8	34.0	37.2
		-28	88.8	1488	211	.820	470	24.9	28.2	31.6	34.9	38.3
		-29	88.1	1426	205	.800	459	25.2	28.7	32.2	35.7	39.2
		-30	(2) 87.6	1385	201	.79	451	25.3	28.9	32.5	36.1	39.8
	ISA-10°C	-37	(1) 88.1	1552	219	.85	475	24.1	27.4	30.6	33.8	37.0
	-67°C	-38	87.7	1513	217	.840	470	24.4	27.8	31.1	34.4	37.7
		-39	86.9	1441	211	.820	459	24.9	28.4	31.8	35.3	38.8
		-40	86.2	1380	205	.800	448	25.2	28.8	32.5	36.1	39.7
		-41	(2) 85.7	1341	201	.79	440	25.4	29.1	32.8	36.5	40.3
28000.	ISA+ 0°C	-25	(1) 90.2	1625	223	.86	493	24.2	27.3	30.3	33.4	36.5
	-57°C	-26	89.1	1524	217	.840	481	25.0	28.3	31.6	34.8	38.1
		-28	88.3	1453	211	.820	470	25.5	28.9	32.3	35.8	39.2
		-29	87.5	1390	205	.800	459	25.8	29.4	33.0	36.6	40.2
		-30	(2) 87.0	1353	202	.79	451	26.0	29.7	33.4	37.1	40.8
	ISA-10°C	-36	(1) 88.1	1559	222	.86	480	24.4	27.6	30.8	34.0	37.2
	-67°C	-38	87.2	1476	217	.840	470	25.1	28.4	31.8	35.2	38.6
		-39	86.4	1407	211	.820	459	25.5	29.1	32.6	36.2	39.7
		-40	85.6	1346	205	.800	448	25.8	29.6	33.3	37.0	40.7
		-41	(2) 85.1	1308	202	.79	441	26.0	29.9	33.7	37.5	41.3
27000.	ISA+10°C	-17	(1) 88.9	1407	206	.80	470	26.3	29.9	33.4	37.0	40.5
		-18	88.8	1400	205	.800	469	26.4	29.9	33.5	37.1	40.6
		-19	(2) 88.2	1356	201	.79	460	26.6	30.3	34.0	37.7	41.3
	ISA+ 0°C	-24	(1) 90.2	1625	225	.87	496	24.4	27.5	30.5	33.6	36.7
	-57°C	-26	88.6	1489	217	.840	481	25.6	29.0	32.3	35.7	39.0
		-28	87.7	1419	211	.820	470	26.1	29.6	33.1	36.6	40.2
		-29	86.9	1357	205	.800	459	26.4	30.1	33.8	37.5	41.2
		-30	(2) 86.4	1312	201	.78	450	26.7	30.5	34.3	38.1	41.9
	ISA-10°C	-36	(1) 88.1	1564	224	.87	484	24.5	27.7	30.9	34.1	37.3
	-67°C	-38	86.7	1442	217	.840	470	25.7	29.1	32.6	36.1	39.5
		-39	85.9	1373	211	.820	459	26.1	29.8	33.4	37.1	40.7
		-40	85.0	1313	205	.800	448	26.5	30.3	34.1	37.9	41.7
		-41	(2) 84.5	1271	201	.79	440	26.7	30.7	34.6	38.5	42.5
26000.	ISA+10°C	-17	(1) 88.8	1417	210	.82	478	26.7	30.2	33.8	37.3	40.8
		-18	88.2	1369	205	.800	469	27.0	30.6	34.3	37.9	41.6
		-19	(2) 87.5	1317	200	.78	459	27.2	31.0	34.8	38.6	42.4
	ISA+ 0°C	-24	(1) 90.1	1629	226	.87	500	24.5	27.6	30.7	33.7	36.8
	-57°C	-26	88.1	1456	217	.840	481	26.2	29.6	33.0	36.5	39.9
		-28	87.2	1385	211	.820	470	26.7	30.3	33.9	37.5	41.1
		-29	86.4	1326	205	.800	459	27.0	30.8	34.6	38.4	42.1
		-30	(2) 85.7	1276	200	.78	449	27.3	31.2	35.1	39.1	43.0
	ISA-10°C	-35	(1) 88.1	1568	226	.87	487	24.7	27.9	31.1	34.3	37.5
	-67°C	-38	86.2	1409	217	.840	470	26.3	29.8	33.4	36.9	40.5
		-39	85.3	1340	211	.820	459	26.8	30.5	34.2	38.0	41.7
		-40	84.5	1282	205	.800	448	27.1	31.0	34.9	38.8	42.7
		-41	(2) 83.9	1239	201	.78	439	27.4	31.4	35.4	39.5	43.5

Figure 7-17 (Sheet 37)

CRUISE
47000 FEET

ANTI-ICE SYSTEMS OFF **TWO ENGINES**

WT. LBS.	TEMP	RAT DEG. C	FAN PERCENT RPM	FUEL FLOW LBS/HR	KIAS	IND. MACH	KTAS	NAUTICAL MILES/100 LBS. FUEL 100 KT. HEADWIND	50 KT. HEADWIND	ZERO WIND	50 KT. TAILWIND	100 KT. TAILWIND
25000.	ISA+10°C -47°C	-16	(1) 88.9	1428	214	.83	486	27.0	30.5	34.0	37.5	41.0
		-16	88.5	1398	211	.820	481	27.2	30.8	34.4	37.9	41.5
		-18	87.6	1337	205	.800	469	27.6	31.3	35.1	38.8	42.5
		-19	86.9	1280	200	.780	457	27.9	31.8	35.7	39.6	43.6
		-19	(2) 86.8	1277	199	.78	456	27.9	31.8	35.7	39.7	43.6
	ISA+ 0°C -57°C	-23	(1) 90.1	1633	228	.88	503	24.7	27.7	30.8	33.8	36.9
		-26	87.5	1424	217	.840	481	26.8	30.3	33.8	37.3	40.8
		-28	86.6	1355	211	.820	470	27.3	31.0	34.7	38.4	42.0
		-29	85.8	1295	205	.800	459	27.7	31.5	35.4	39.3	43.1
		-30	(2) 85.0	1238	199	.78	446	28.0	32.0	36.1	40.1	44.1
	ISA-10°C -67°C	-35	(1) 88.0	1568	227	.88	490	24.9	28.1	31.2	34.4	37.6
		-38	85.6	1378	217	.840	470	26.8	30.5	34.1	37.7	41.4
		-39	84.7	1311	211	.820	459	27.4	31.2	35.0	38.8	42.6
		-40	83.9	1253	205	.800	448	27.8	31.7	35.7	39.7	43.7
		-41	(2) 83.2	1203	200	.78	437	28.0	32.2	36.4	40.5	44.7
24000.	ISA+10°C -47°C	-15	(1) 88.8	1430	216	.84	491	27.3	30.8	34.3	37.8	41.3
		-16	87.9	1369	211	.820	481	27.8	31.4	35.1	38.7	42.4
		-18	87.1	1307	205	.800	469	28.2	32.1	35.9	39.7	43.5
		-19	86.3	1253	200	.780	457	28.5	32.5	36.5	40.5	44.5
		-20	(2) 85.9	1220	195	.76	448	28.5	32.6	36.7	40.8	44.9
	ISA+ 0°C -57°C	-23	(1) 90.1	1636	229	.88	505	24.8	27.8	30.9	33.9	37.0
		-26	87.0	1395	217	.840	481	27.3	30.9	34.5	38.1	41.7
		-28	86.1	1327	211	.820	470	27.9	31.7	35.4	39.2	43.0
		-29	85.3	1266	205	.800	459	28.3	32.3	36.2	40.2	44.1
		-31	(2) 84.1	1182	195	.76	438	28.6	32.8	37.1	41.3	45.5
	ISA-10°C -67°C	-35	(1) 87.9	1566	229	.88	492	25.0	28.2	31.4	34.6	37.8
		-38	85.1	1350	217	.840	470	27.4	31.1	34.8	38.5	42.2
		-39	84.2	1284	211	.820	459	28.0	31.9	35.7	39.6	43.5
		-40	83.4	1227	205	.800	448	28.4	32.4	36.5	40.6	44.7
		-42	(2) 82.4	1152	196	.77	430	28.6	33.0	37.3	41.6	46.0

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

Figure 7-17 (Sheet 38)

CRUISE
49,000 FEET

ANTI-ICE SYSTEMS OFF — **TWO ENGINES**

WT. LBS.	TEMP	RAT DEG. C	FAN PERCENT RPM	FUEL FLOW LBS/HR	KIAS	IND. MACH	KTAS	NAUTICAL MILES/100 LBS. FUEL: 100 KT. HEADWIND	50 KT. HEADWIND	ZERO WIND	50 KT. TAILWIND	100 KT. TAILWIND
28000.	ISA+ 0°C	-27	(1) 89.9	1444	203	.83	474	25.9	29.3	32.8	36.2	39.7
		-28	89.6	1421	201	.820	470	26.0	29.5	33.0	36.6	40.1
		-29	89.0	1365	196	.800	458	26.3	29.9	33.6	37.2	40.9
		-30	(2) 88.5	1321	191	.78	448	26.4	30.2	33.9	37.7	41.5
	ISA-10°C	-39	(1) 87.8	1386	202	.82	460	26.0	29.6	33.2	36.8	40.4
		-39	87.7	1376	201	.820	459	26.1	29.7	33.3	37.0	40.6
		-40	87.1	1321	196	.800	448	26.3	30.1	33.9	37.7	41.5
		-41	(2) 86.5	1276	191	.78	437	26.4	30.4	34.3	38.2	42.1
27000.	ISA+ 0°C	-26	(1) 89.8	1449	207	.84	480	26.3	29.7	33.2	36.6	40.1
		-28	89.1	1383	201	.820	470	26.7	30.3	34.0	37.6	41.2
		-29	88.4	1327	196	.800	458	27.0	30.8	34.5	38.3	42.1
		-30	(2) 87.8	1279	191	.78	448	27.2	31.1	35.0	38.9	42.8
	ISA-10°C	-38	(1) 87.8	1392	206	.84	467	26.4	30.0	33.6	37.2	40.8
		-39	87.1	1339	201	.820	459	26.8	30.5	34.2	38.0	41.7
		-40	86.5	1284	196	.800	448	27.1	30.9	34.8	38.7	42.6
		-41	(2) 85.9	1240	191	.78	438	27.2	31.3	35.3	39.3	43.4
26000.	ISA+ 0°C -57°C	-25	(1) 89.8	1452	209	.85	486	26.6	30.0	33.5	36.9	40.4
		-26	89.3	1414	207	.840	481	26.9	30.5	34.0	37.5	41.1
		-28	88.5	1348	201	.820	470	27.4	31.1	34.8	38.6	42.3
		-29	87.8	1290	196	.800	458	27.8	31.6	35.5	39.4	43.3
		-30	(2) 87.3	1257	193	.79	451	27.9	31.9	35.9	39.9	43.9
	ISA-10°C -67°C	-37	(1) 87.8	1401	209	.85	474	26.7	30.3	33.8	37.4	41.0
		-38	87.4	1369	207	.840	470	27.0	30.6	34.3	37.9	41.6
		-39	86.6	1305	201	.820	459	27.5	31.3	35.1	39.0	42.8
		-40	85.9	1249	196	.800	448	27.8	31.8	35.8	39.8	43.8
		-41	(2) 85.4	1216	192	.79	440	28.0	32.1	36.2	40.3	44.5
25000.	ISA+ 0°C -57°C	-25	(1) 89.7	1456	212	.86	491	26.9	30.3	33.7	37.2	40.6
		-26	88.7	1377	207	.840	481	27.7	31.3	34.9	38.6	42.2
		-28	87.9	1313	201	.820	470	28.2	32.0	35.8	39.6	43.4
		-29	87.1	1255	196	.800	458	28.5	32.5	36.5	40.5	44.5
		-30	(2) 86.7	1223	193	.79	451	28.7	32.8	36.9	41.0	45.1
	ISA-10°C -67°C	-36	(1) 87.7	1402	212	.86	479	27.0	30.6	34.2	37.7	41.3
		-38	86.8	1332	207	.840	470	27.7	31.5	35.2	39.0	42.8
		-39	86.0	1270	201	.820	459	28.2	32.2	36.1	40.0	44.0
		-40	85.2	1214	196	.800	448	28.6	32.7	36.9	41.0	45.1
		-41	(2) 84.7	1179	192	.79	440	28.8	33.1	37.3	41.5	45.8
24000.	ISA+ 0°C -57°C	-24	(1) 89.7	1461	214	.87	496	27.1	30.5	33.9	37.4	40.8
		-26	88.2	1341	207	.840	481	28.4	32.1	35.9	39.6	43.3
		-28	87.3	1278	201	.820	470	28.9	32.8	36.7	40.6	44.5
		-29	86.5	1224	196	.800	458	29.3	33.3	37.4	41.5	45.6
		-30	(2) 85.9	1183	192	.78	449	29.5	33.8	38.0	42.2	46.4
	ISA-10°C -67°C	-36	(1) 87.6	1405	214	.87	483	27.3	30.8	34.4	38.0	41.5
		-38	86.2	1298	207	.840	470	28.5	32.3	36.2	40.0	43.9
		-39	85.4	1237	201	.820	459	29.0	33.0	37.1	41.1	45.2
		-40	84.6	1184	196	.800	448	29.3	33.6	37.8	42.0	46.2
		-41	(2) 84.1	1146	192	.78	439	29.6	34.0	38.3	42.7	47.1
23000.	ISA+ 0°C -57°C	-24	(1) 89.7	1465	216	.87	499	27.3	30.7	34.1	37.5	40.9
		-26	87.6	1309	207	.840	481	29.1	32.9	36.7	40.5	44.4
		-28	86.7	1247	201	.820	470	29.6	33.6	37.7	41.7	45.7
		-29	85.9	1193	196	.800	458	30.0	34.2	38.4	42.6	46.8
		-30	(2) 85.2	1146	191	.78	448	30.3	34.7	39.1	43.4	47.8
	ISA-10°C -67°C	-35	(1) 87.6	1408	216	.87	487	27.5	31.0	34.6	38.1	41.7
		-38	85.7	1267	207	.840	470	29.2	33.1	37.1	41.0	45.0
		-39	84.8	1206	201	.820	459	29.7	33.9	38.0	42.2	46.3
		-40	84.0	1154	196	.800	448	30.1	34.4	38.8	43.1	47.4
		-41	(2) 83.3	1111	191	.78	438	30.4	34.9	39.4	43.9	48.4

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

Figure 7-17 (Sheet 39)

CRUISE
51,000 FEET

ANTI-ICE SYSTEMS OFF **TWO ENGINES**

WT. LBS.	TEMP	RAT DEG. C	FAN PERCENT RPM	FUEL FLOW LBS/HR	KIAS	IND. MACH	KTAS	NAUTICAL MILES/100 LBS. FUEL 100 KT. HEADWIND	50 KT. HEADWIND	ZERO WIND	50 KT. TAILWIND	100 KT. TAILWIND
25000.	ISA+ 0°C	-27	(1) 89.3	1288	192	.82	470	28.8	32.6	36.5	40.4	44.3
		-29	88.6	1232	187	.800	458	29.1	33.1	37.2	41.3	45.3
		-30	(2) 88.1	1192	182	.78	448	29.2	33.4	37.6	41.8	46.0
	ISA-10°C	-39	(1) 87.2	1236	191	.82	457	28.9	32.9	37.0	41.0	45.1
		-40	86.7	1192	187	.800	447	29.1	33.3	37.5	41.7	45.9
		-41	(2) 86.2	1155	183	.78	438	29.3	33.6	37.9	42.3	46.6
24000.	ISA+ 0°C	-27	(1) 89.2	1292	196	.84	478	29.3	33.1	37.0	40.9	44.7
		-28	88.6	1245	192	.820	469	29.7	33.7	37.7	41.7	45.7
		-29	87.9	1194	187	.800	458	30.0	34.2	38.4	42.6	46.7
		-30	(2) 87.5	1164	184	.79	451	30.2	34.5	38.8	43.0	47.3
	ISA-10°C	-38	(1) 87.2	1244	195	.83	465	29.4	33.4	37.4	41.4	45.5
		-39	86.7	1206	192	.820	458	29.7	33.9	38.0	42.2	46.3
		-40	86.0	1155	187	.800	447	30.1	34.4	38.7	43.1	47.4
		-41	(2) 85.6	1126	184	.79	440	30.2	34.7	39.1	43.5	48.0
23000.	ISA+ 0°C -57°C	-26	(1) 89.2	1299	200	.85	485	29.7	33.5	37.4	41.2	45.1
		-26	88.8	1269	197	.840	481	30.0	33.9	37.9	41.8	45.8
		-28	88.0	1210	192	.820	469	30.5	34.7	38.8	42.9	47.1
		-29	87.2	1157	187	.800	458	31.0	35.3	39.6	43.9	48.2
		-30	(2) 86.7	1125	183	.79	450	31.1	35.6	40.0	44.5	48.9
	ISA-10°C -67°C	-37	(1) 87.1	1247	199	.85	472	29.9	33.9	37.9	41.9	45.9
		-38	86.9	1229	197	.840	469	30.1	34.1	38.2	42.3	46.3
		-39	86.1	1172	192	.820	458	30.6	34.9	39.1	43.4	47.7
		-40	85.3	1120	187	.800	447	31.0	35.5	39.9	44.4	48.9
		-41	(2) 84.8	1089	183	.79	440	31.2	35.8	40.4	45.0	49.6
22000.	ISA+ 0°C -57°C	-25	(1) 89.2	1306	202	.86	492	30.0	33.8	37.7	41.5	45.3
		-26	88.2	1232	197	.840	481	30.9	34.9	39.0	43.1	47.1
		-28	87.3	1175	192	.820	469	31.4	35.7	39.9	44.2	48.4
		-29	86.6	1126	187	.800	458	31.8	36.3	40.7	45.1	49.6
		-30	(2) 86.0	1091	183	.79	450	32.1	36.7	41.2	45.8	50.4
	ISA-10°C -67°C	-36	(1) 87.1	1255	202	.86	479	30.2	34.2	38.2	42.2	46.1
		-38	86.3	1194	197	.840	469	30.9	35.1	39.3	43.5	47.7
		-39	85.4	1138	192	.820	458	31.5	35.9	40.3	44.7	49.1
		-40	84.7	1089	187	.800	447	31.9	36.5	41.1	45.7	50.2
		-41	(2) 84.1	1057	183	.79	440	32.1	36.9	41.6	46.3	51.1

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

Figure 7-17 (Sheet 40)

CRUISE
5000 FEET

ANTI-ICE SYSTEMS OFF **ONE ENGINE**

WT. LBS.	TEMP	RAT DEG. C	FAN PERCENT RPM	FUEL FLOW LBS/HR	KIAS	IND. MACH	KTAS	NAUTICAL MILES/100 LBS. FUEL 100 KT. HEADWIND	50 KT. HEADWIND	ZERO WIND	50 KT. TAILWIND	100 KT. TAILWIND
35000.	ISA+10°C	25	(1) 80.2	1922	245	.40	268	8.8	11.4	14.0	16.6	19.2
	15°C	24	78.8	1827	236	.390	258	8.7	11.4	14.1	16.9	19.6
		23	(2) 78.1	1778	231	.38	253	8.6	11.4	14.2	17.0	19.9
	ISA+ 0°C	16	(1) 81.4	2080	263	.43	282	8.8	11.2	13.6	16.0	18.4
	5°C	14	79.3	1914	248	.410	267	8.7	11.3	13.9	16.6	19.2
		13	(2) 76.6	1732	231	.38	248	8.5	11.4	14.3	17.2	20.1
	ISA-10°C	5	(1) 79.9	2029	262	.43	277	8.7	11.2	13.6	16.1	18.6
	-5°C	4	77.9	1870	248	.410	262	8.7	11.3	14.0	16.7	19.4
		3	(2) 75.3	1695	231	.38	244	8.5	11.4	14.4	17.3	20.3
34000.	ISA+20°C	34	(1) 78.9	1792	230	.38	257	8.7	11.5	14.3	17.1	19.9
		34	(2) 78.4	1762	227	.38	253	8.7	11.5	14.4	17.2	20.0
	ISA+10°C	25	(1) 80.2	1920	246	.41	270	8.8	11.4	14.0	16.7	19.3
	15°C	24	78.5	1809	236	.390	258	8.8	11.5	14.3	17.0	19.8
		23	(2) 77.3	1732	228	.38	250	8.7	11.5	14.4	17.3	20.2
	ISA+ 0°C	16	(1) 81.4	2078	264	.43	283	8.8	11.2	13.6	16.0	18.5
	5°C	14	79.1	1898	248	.410	267	8.8	11.4	14.1	16.7	19.3
		13	(2) 75.9	1689	228	.38	245	8.6	11.5	14.5	17.5	20.4
	ISA-10°C	5	(1) 79.9	2029	264	.43	278	8.8	11.2	13.7	16.2	18.6
	-5°C	4	77.7	1854	248	.410	262	8.7	11.4	14.1	16.8	19.5
		3	(2) 74.5	1650	228	.38	241	8.5	11.5	14.6	17.6	20.6
32000.	ISA+20°C	34	(1) 78.9	1791	234	.39	260	8.9	11.7	14.5	17.3	20.1
	25°C	34	78.2	1753	230	.380	256	8.9	11.8	14.6	17.5	20.3
		33	(2) 77.1	1686	223	.37	249	8.8	11.8	14.7	17.7	20.7
	ISA+10°C	25	(1) 80.2	1927	250	.41	273	9.0	11.6	14.2	16.8	19.4
	15°C	24	78.0	1776	236	.390	258	8.9	11.7	14.6	17.4	20.2
		23	(2) 75.8	1649	223	.37	244	8.7	11.8	14.8	17.8	20.9
	ISA+ 0°C	16	(1) 81.4	2081	266	.44	286	8.9	11.3	13.7	16.1	18.5
	5°C	14	77.7	1800	242	.400	260	8.9	11.7	14.5	17.2	20.0
		13	(2) 74.5	1610	223	.37	240	8.7	11.8	14.9	18.0	21.1
	ISA-10°C	5	(1) 79.9	2025	265	.44	280	8.9	11.4	13.8	16.3	18.8
	-5°C	4	76.3	1759	242	.400	256	8.9	11.7	14.5	17.4	20.2
		2	(2) 73.2	1574	223	.37	235	8.6	11.8	15.0	18.1	21.3
30000.	ISA+20°C	34	(1) 78.9	1794	237	.39	264	9.1	11.9	14.7	17.5	20.3
	25°C	34	77.6	1720	230	.380	256	9.1	12.0	14.9	17.8	20.7
		33	(2) 75.6	1612	219	.36	244	8.9	12.0	15.1	18.2	21.3
	ISA+10°C	25	(1) 80.2	1923	252	.42	276	9.1	11.7	14.3	16.9	19.5
	15°C	24	77.4	1745	236	.390	258	9.1	11.9	14.8	17.7	20.5
		23	(2) 74.2	1568	218	.36	239	8.8	12.0	15.2	18.4	21.6
	ISA+ 0°C	16	(1) 81.3	2079	268	.44	288	9.0	11.4	13.8	16.3	18.7
	5°C	14	77.2	1771	242	.400	260	9.1	11.9	14.7	17.5	20.4
		12	(2) 73.0	1534	218	.36	235	8.8	12.0	15.3	18.6	21.8
	ISA-10°C	6	(1) 79.8	2026	267	.44	282	9.0	11.5	13.9	16.4	18.9
	-5°C	4	75.8	1730	242	.400	256	9.0	11.9	14.8	17.7	20.6
		2	(2) 71.6	1495	218	.36	230	8.7	12.0	15.4	18.7	22.1
28000.	ISA+20°C	34	(1) 78.8	1792	239	.40	267	9.3	12.1	14.9	17.7	20.5
	25°C	33	75.9	1627	224	.370	249	9.2	12.3	15.3	18.4	21.5
		32	(2) 73.3	1498	210	.35	234	8.9	12.3	15.6	18.9	22.3
	ISA+10°C	25	(1) 80.2	1927	254	.42	278	9.3	11.8	14.4	17.0	19.6
	15°C	23	75.8	1652	230	.380	252	9.2	12.2	15.2	18.3	21.3
		22	(2) 72.1	1467	210	.35	230	8.9	12.3	15.7	19.1	22.5
	ISA+ 0°C	16	(1) 81.3	2076	269	.44	290	9.1	11.5	13.9	16.4	18.8
	5°C	14	76.7	1744	242	.400	260	9.2	12.1	14.9	17.8	20.7
		12	(2) 70.9	1433	210	.35	226	8.8	12.3	15.8	19.2	22.7
	ISA-10°C	6	(1) 79.9	2029	269	.44	284	9.1	11.6	14.0	16.5	18.9
	-5°C	4	75.3	1704	242	.400	256	9.1	12.1	15.0	17.9	20.9
		2	(2) 69.5	1396	210	.35	221	8.7	12.3	15.8	19.4	23.0
26000.	ISA+20°C	35	(1) 78.8	1794	242	.40	269	9.4	12.2	15.0	17.8	20.6
	25°C	33	75.3	1598	224	.370	249	9.3	12.5	15.6	18.7	21.9
		32	(2) 70.9	1387	201	.33	224	8.9	12.5	16.1	19.7	23.3
	ISA+10°C	25	(1) 80.2	1931	257	.42	281	9.4	12.0	14.5	17.1	19.7
	15°C	23	75.2	1624	230	.380	252	9.3	12.4	15.5	18.6	21.7
		21	(2) 69.8	1356	201	.33	220	8.8	12.5	16.2	19.9	23.6
	ISA+ 0°C	16	(1) 81.0	2055	269	.44	290	9.2	11.7	14.1	16.5	19.0
	5°C	14	75.1	1652	236	.390	254	9.3	12.3	15.4	18.4	21.4
		11	(2) 68.6	1325	201	.33	216	8.8	12.5	16.3	20.1	23.8
	ISA-10°C	6	(1) 79.6	2007	269	.44	284	9.2	11.7	14.2	16.7	19.1
	-5°C	3	73.8	1613	236	.390	249	9.3	12.4	15.5	18.5	21.6
		1	(2) 67.3	1294	201	.33	212	8.7	12.5	16.4	20.3	24.1

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

Figure 7-18 (Sheet 1 of 12)

CRUISE
10,000 FEET

ANTI-ICE SYSTEMS OFF **ONE ENGINE**

WT. LBS.	TEMP	RAT DEG. C	FAN PERCENT RPM	FUEL FLOW LBS/HR	KIAS	IND. MACH	KTAS	NAUTICAL MILES/100 LBS. FUEL 100 KT. HEADWIND	50 KT. HEADWIND	ZERO WIND	50 KT. TAILWIND	100 KT. TAILWIND
35000.	ISA+10°C	15	(1) 81.9	1756	233	.42	274	9.9	12.8	15.6	18.5	21.3
		15	(2) 81.3	1714	228	.41	269	9.9	12.8	15.7	18.6	21.5
	ISA+ 0°C	6	(1) 82.9	1876	249	.45	288	10.0	12.7	15.4	18.0	20.7
	-5°C	5	81.2	1761	238	.430	275	9.9	12.8	15.6	18.5	21.3
		4	(2) 79.9	1673	228	.41	264	9.8	12.8	15.8	18.8	21.8
	ISA-10°C	-4	(1) 81.3	1831	249	.45	283	10.0	12.7	15.4	18.2	20.9
	-15°C	-5	79.7	1718	238	.430	270	9.9	12.8	15.7	18.6	21.5
		-6	(2) 78.4	1632	228	.41	259	9.8	12.8	15.9	19.0	22.0
34000.	ISA+10°C	15	(1) 81.9	1754	234	.42	276	10.1	12.9	15.8	18.6	21.5
	5°C	15	81.5	1730	232	.420	274	10.0	12.9	15.8	18.7	21.6
		14	(2) 80.6	1668	226	.41	266	9.9	12.9	15.9	18.9	21.9
	ISA+ 0°C	6	(1) 82.9	1880	251	.45	290	10.1	12.8	15.4	18.1	20.7
	-5°C	5	80.9	1744	238	.430	275	10.0	12.9	15.8	18.6	21.5
		4	(2) 79.2	1630	226	.41	261	9.9	13.0	16.0	19.1	22.2
	ISA-10°C	-4	(1) 81.3	1828	250	.45	284	10.1	12.8	15.5	18.3	21.0
	-15°C	-5	79.4	1702	238	.430	270	10.0	12.9	15.9	18.8	21.7
		-6	(2) 77.8	1590	226	.41	256	9.8	13.0	16.1	19.3	22.4
32000.	ISA+20°C	24	(1) 80.6	1622	220	.40	264	10.1	13.2	16.3	19.4	22.5
		24	(2) 80.5	1616	220	.40	264	10.1	13.2	16.3	19.4	22.5
	ISA+10°C	16	(1) 81.9	1759	238	.43	281	10.3	13.1	16.0	18.8	21.7
	5°C	15	81.0	1695	232	.420	274	10.2	13.2	16.1	19.1	22.0
		14	(2) 79.2	1580	220	.40	259	10.1	13.3	16.4	19.6	22.7
	ISA+ 0°C	6	(1) 82.9	1882	254	.46	293	10.3	12.9	15.6	18.2	20.9
	-5°C	5	80.4	1711	238	.430	275	10.2	13.2	16.1	19.0	21.9
		4	(2) 77.8	1540	220	.40	254	10.0	13.3	16.5	19.8	23.0
	ISA-10°C	-4	(1) 81.3	1834	253	.46	288	10.2	13.0	15.7	18.4	21.1
	-15°C	-5	78.9	1670	238	.430	270	10.2	13.2	16.2	19.2	22.2
		-7	(2) 76.4	1505	220	.40	250	10.0	13.3	16.6	19.9	23.3
30000.	ISA+20°C	25	(1) 80.6	1622	224	.41	269	10.4	13.5	16.6	19.7	22.7
	15°C	24	80.1	1590	221	.400	265	10.4	13.5	16.7	19.8	23.0
		24	(2) 79.0	1529	214	.39	257	10.3	13.6	16.8	20.1	23.4
	ISA+10°C	16	(1) 81.9	1761	241	.44	284	10.5	13.3	16.2	19.0	21.8
	5°C	15	79.6	1606	227	.410	267	10.4	13.5	16.6	19.7	22.9
		14	(2) 77.7	1492	214	.39	253	10.2	13.6	16.9	20.3	23.6
	ISA+ 0°C	7	(1) 82.8	1882	256	.46	296	10.4	13.1	15.7	18.4	21.0
	-5°C	5	79.9	1680	238	.430	275	10.4	13.4	16.4	19.4	22.3
		3	(2) 76.2	1453	214	.39	248	10.2	13.6	17.0	20.5	23.9
	ISA-10°C	-4	(1) 81.3	1837	256	.46	290	10.4	13.1	15.8	18.5	21.3
	-15°C	-5	78.5	1639	238	.430	270	10.4	13.4	16.5	19.5	22.6
		-7	(2) 74.8	1417	214	.39	243	10.1	13.6	17.1	20.7	24.2
28000.	ISA+20°C	25	(1) 80.7	1628	228	.41	274	10.7	13.7	16.8	19.9	22.9
	15°C	24	79.5	1556	221	.400	265	10.6	13.8	17.0	20.3	23.5
		23	(2) 77.3	1444	209	.38	251	10.4	13.9	17.4	20.8	24.3
	ISA+10°C	16	(1) 81.9	1760	244	.44	287	10.6	13.5	16.3	19.2	22.0
	5°C	15	79.1	1574	227	.410	267	10.6	13.8	17.0	20.1	23.3
		13	(2) 76.0	1411	209	.38	246	10.4	13.9	17.5	21.0	24.5
	ISA+ 0°C	7	(1) 82.8	1881	258	.47	298	10.5	13.2	15.9	18.5	21.2
	-5°C	5	78.6	1592	232	.420	269	10.6	13.7	16.9	20.0	23.2
		3	(2) 74.6	1375	209	.38	242	10.3	13.9	17.6	21.2	24.8
	ISA-10°C	-4	(1) 81.3	1836	258	.47	293	10.5	13.2	15.9	18.7	21.4
	-15°C	-6	77.2	1553	232	.420	264	10.5	13.8	17.0	20.2	23.4
		-7	(2) 73.3	1342	209	.38	237	10.2	13.9	17.7	21.4	25.1
26000.	ISA+20°C	25	(1) 80.7	1630	231	.42	277	10.9	13.9	17.0	20.1	23.1
	15°C	24	77.8	1470	215	.390	258	10.8	14.2	17.6	21.0	24.4
		23	(2) 75.5	1360	203	.37	244	10.6	14.2	17.9	21.6	25.3
	ISA+10°C	16	(1) 81.9	1763	246	.45	290	10.8	13.6	16.5	19.3	22.1
	5°C	15	78.5	1544	227	.410	267	10.8	14.1	17.3	20.5	23.8
		13	(2) 74.1	1326	203	.37	239	10.5	14.3	18.0	21.8	25.6
	ISA+ 0°C	7	(1) 82.8	1884	260	.47	301	10.7	13.3	16.0	18.6	21.3
	-5°C	5	78.1	1564	232	.420	269	10.8	14.0	17.2	20.4	23.6
		2	(2) 72.9	1297	203	.37	235	10.4	14.3	18.1	22.0	25.8
	ISA-10°C	-3	(1) 81.3	1837	260	.47	295	10.6	13.3	16.1	18.8	21.5
	-15°C	-6	76.7	1526	232	.420	264	10.7	14.0	17.3	20.6	23.8
		-8	(2) 71.6	1268	203	.37	231	10.3	14.3	18.2	22.2	26.1

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

Figure 7-18 (Sheet 2)

CRUISE
15,000 FEET

ANTI-ICE SYSTEMS OFF — **ONE ENGINE**

WT. LBS.	TEMP	RAT DEG. C	FAN PERCENT RPM	FUEL FLOW LBS/HR	KIAS	IND. MACH	KTAS	NAUTICAL MILES/100 LBS. FUEL 100 KT. HEADWIND	50 KT. HEADWIND	ZERO WIND	50 KT. TAILWIND	100 KT. TAILWIND
35000.	ISA+ 0°C	-4	(1) 83.7	1655	231	.46	289	11.4	14.4	17.4	20.5	23.5
	-15°C	-4	83.0	1608	226	.450	283	11.4	14.5	17.6	20.7	23.8
		-4	(2) 82.6	1582	224	.44	279	11.3	14.5	17.6	20.8	24.0
	ISA-10°C	-14	(1) 82.1	1613	231	.46	283	11.3	14.4	17.5	20.6	23.7
	-25°C	-15	81.4	1567	226	.450	277	11.3	14.5	17.7	20.9	24.1
		-15	(2) 81.0	1537	223	.44	273	11.3	14.5	17.8	21.0	24.3
34000.	ISA+ 0°C	-4	(1) 83.7	1659	234	.46	291	11.5	14.6	17.6	20.6	23.6
	-15°C	-4	82.7	1588	226	.450	283	11.5	14.6	17.8	20.9	24.1
		-5	(2) 82.1	1550	222	.44	278	11.5	14.7	17.9	21.1	24.4
	ISA-10°C	-14	(1) 82.0	1610	233	.46	285	11.5	14.6	17.7	20.8	23.9
	-25°C	-15	81.1	1547	226	.450	277	11.4	14.7	17.9	21.1	24.4
		-15	(2) 80.5	1508	222	.44	272	11.4	14.7	18.0	21.4	24.7
32000.	ISA+10°C	6	(1) 82.8	1547	219	.44	279	11.6	14.8	18.1	21.3	24.5
		5	(2) 82.7	1538	218	.43	278	11.6	14.8	18.1	21.3	24.6
	ISA+ 0°C	-3	(1) 83.6	1657	235	.47	293	11.7	14.7	17.7	20.7	23.7
	-15°C	-4	82.4	1568	226	.450	283	11.6	14.8	18.0	21.2	24.4
		-5	(2) 81.3	1506	219	.44	274	11.6	14.9	18.2	21.5	24.8
	ISA-10°C	-14	(1) 82.0	1611	235	.47	287	11.6	14.7	17.8	20.9	24.0
	-25°C	-15	80.8	1528	226	.450	277	11.6	14.9	18.1	21.4	24.7
		-15	(2) 79.8	1468	220	.44	269	11.5	14.9	18.3	21.7	25.1
30000.	ISA+10°C	6	(1) 82.8	1548	224	.44	285	11.9	15.2	18.4	21.6	24.8
	-5°C	6	82.4	1525	221	.440	282	11.9	15.2	18.5	21.7	25.0
		5	(2) 81.0	1448	212	.42	271	11.8	15.2	18.7	22.1	25.6
	ISA+ 0°C	-3	(1) 83.6	1661	239	.47	298	11.9	14.9	17.9	20.9	23.9
	-15°C	-4	81.7	1533	226	.450	283	11.9	15.2	18.4	21.7	25.0
		-5	(2) 79.6	1415	213	.42	266	11.7	15.3	18.8	22.3	25.9
	ISA-10°C	-14	(1) 82.0	1614	238	.47	291	11.9	15.0	18.1	21.2	24.3
	-25°C	-15	80.2	1493	226	.450	277	11.9	15.2	18.6	21.9	25.3
		-16	(2) 78.1	1379	213	.42	261	11.7	15.3	18.9	22.5	26.2
28000.	ISA+20°C	15	(1) 81.7	1443	212	.42	275	12.1	15.6	19.0	22.5	26.0
	5°C	15	80.8	1390	206	.410	267	12.0	15.6	19.2	22.8	26.4
		15	(2) 80.7	1385	205	.41	266	12.0	15.6	19.2	22.8	26.4
	ISA+10°C	6	(1) 82.8	1551	227	.45	289	12.2	15.4	18.7	21.9	25.1
	-5°C	5	80.9	1444	216	.430	275	12.1	15.6	19.1	22.5	26.0
		4	(2) 79.3	1355	206	.41	262	12.0	15.6	19.3	23.0	26.7
	ISA+ 0°C	-3	(1) 83.6	1660	241	.48	301	12.1	15.1	18.1	21.1	24.2
	-15°C	-4	81.1	1501	226	.450	283	12.2	15.5	18.8	22.2	25.5
		-6	(2) 77.9	1323	206	.41	257	11.9	15.7	19.5	23.2	27.0
	ISA-10°C	-13	(1) 82.0	1617	241	.48	295	12.1	15.2	18.3	21.3	24.4
	-25°C	-15	79.6	1462	226	.450	277	12.1	15.5	19.0	22.4	25.8
		-16	(2) 76.5	1292	206	.41	253	11.8	15.7	19.6	23.4	27.3
26000.	ISA+20°C	16	(1) 81.6	1443	216	.43	280	12.5	15.9	19.4	22.8	26.3
	5°C	15	80.1	1353	206	.410	267	12.4	16.0	19.7	23.4	27.1
		14	(2) 78.9	1296	199	.40	258	12.2	16.1	19.9	23.8	27.7
	ISA+10°C	7	(1) 82.8	1555	231	.46	294	12.4	15.7	18.9	22.1	25.3
	-5°C	5	80.3	1411	216	.430	275	12.4	16.0	19.5	23.0	26.6
		4	(2) 77.6	1267	199	.40	254	12.2	16.1	20.0	24.0	27.9
	ISA+ 0°C	-3	(1) 83.6	1663	244	.48	304	12.3	15.3	18.3	21.3	24.3
	-15°C	-5	79.7	1423	221	.440	276	12.4	15.9	19.4	22.9	26.4
		-7	(2) 76.2	1237	199	.40	249	12.1	16.1	20.2	24.2	28.3
	ISA-10°C	-13	(1) 82.0	1617	244	.48	298	12.3	15.3	18.4	21.5	24.6
	-25°C	-15	78.2	1386	221	.440	271	12.3	15.9	19.5	23.2	26.8
		-17	(2) 74.8	1207	200	.40	245	12.0	16.1	20.3	24.4	28.6
24000.	ISA+20°C	16	(1) 81.7	1447	219	.44	284	12.7	16.2	19.7	23.1	26.6
	5°C	15	79.4	1319	206	.410	267	12.7	16.5	20.3	24.0	27.8
		13	(2) 77.0	1207	192	.38	250	12.4	16.6	20.7	24.8	29.0
	ISA+10°C	7	(1) 82.8	1558	234	.46	297	12.7	15.9	19.1	22.3	25.5
	-5°C	5	79.7	1380	216	.430	275	12.7	16.3	19.9	23.6	27.2
		3	(2) 75.6	1179	192	.38	245	12.3	16.6	20.8	25.1	29.3
	ISA+ 0°C	-2	(1) 83.6	1665	247	.49	307	12.5	15.5	18.5	21.5	24.5
	-15°C	-5	79.1	1395	221	.440	276	12.6	16.2	19.8	23.4	27.0
		-7	(2) 74.3	1151	193	.38	241	12.3	16.6	20.9	25.3	29.6
	ISA-10°C	-13	(1) 82.0	1622	246	.49	301	12.4	15.5	18.6	21.7	24.7
	-25°C	-15	77.6	1358	221	.440	271	12.6	16.3	19.9	23.6	27.3
		-17	(2) 72.9	1125	193	.39	237	12.2	16.6	21.1	25.5	29.9

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

Figure 7-18 (Sheet 3)

CRUISE
17,000 FEET

ANTI-ICE SYSTEMS OFF **ONE ENGINE**

WT. LBS.	TEMP	RAT DEG. C	FAN PERCENT RPM	FUEL FLOW LBS/HR	KIAS	IND. MACH	KTAS	NAUTICAL MILES/100 LBS. FUEL 100 KT. HEADWIND	50 KT. HEADWIND	ZERO WIND	50 KT. TAILWIND	100 KT. TAILWIND
32000.	ISA+ 0°C	-8	(1) 83.8	1571	227	.47	292	12.2	15.4	18.6	21.8	24.9
	-19°C	-8	83.3	1532	223	.460	287	12.2	15.5	18.7	22.0	25.2
		-9	(2) 82.3	1467	215	.45	278	12.1	15.5	18.9	22.3	25.7
	ISA-10°C	-18	(1) 82.2	1524	226	.47	285	12.2	15.4	18.7	22.0	25.3
	-29°C	-18	81.7	1492	223	.460	281	12.1	15.5	18.8	22.2	25.5
		-19	(2) 80.7	1428	215	.45	272	12.0	15.5	19.0	22.5	26.0
31000.	ISA+ 0°C	-7	(1) 83.9	1575	229	.47	295	12.4	15.5	18.7	21.9	25.1
	-19°C	-8	82.9	1512	223	.460	287	12.3	15.7	19.0	22.3	25.6
		-9	(2) 81.8	1436	214	.44	276	12.3	15.7	19.2	22.7	26.2
	ISA-10°C	-18	(1) 82.2	1528	228	.47	288	12.3	15.6	18.9	22.1	25.4
	-29°C	-18	81.4	1473	223	.460	281	12.3	15.7	19.1	22.5	25.9
		-19	(2) 80.2	1398	214	.44	271	12.2	15.8	19.4	22.9	26.5
30000.	ISA+10°C	2	(1) 82.9	1454	214	.44	282	12.5	15.9	19.4	22.8	26.2
		1	(2) 82.6	1434	212	.44	279	12.5	15.9	19.4	22.9	26.4
	ISA+ 0°C	-7	(1) 83.8	1572	230	.48	297	12.5	15.7	18.9	22.1	25.2
	-19°C	-8	82.6	1493	223	.460	287	12.5	15.9	19.2	22.5	25.9
		-9	(2) 81.1	1400	212	.44	274	12.4	16.0	19.6	23.1	26.7
	ISA-10°C	-18	(1) 82.2	1528	230	.48	290	12.5	15.7	19.0	22.3	25.6
	-29°C	-18	81.0	1454	223	.460	281	12.5	15.9	19.3	22.8	26.2
		-19	(2) 79.6	1365	213	.44	269	12.3	16.0	19.7	23.3	27.0
29000.	ISA+10°C	2	(1) 82.9	1454	217	.45	284	12.7	16.1	19.6	23.0	26.4
	-9°C	2	82.3	1421	213	.440	279	12.6	16.2	19.7	23.2	26.7
		1	(2) 81.8	1392	209	.43	275	12.6	16.2	19.8	23.4	26.9
	ISA+ 0°C	-7	(1) 83.8	1573	232	.48	299	12.6	15.8	19.0	22.2	25.4
	-19°C	-8	82.3	1475	223	.460	287	12.7	16.1	19.4	22.8	26.2
		-9	(2) 80.2	1357	209	.43	270	12.5	16.2	19.9	23.6	27.3
	ISA-10°C	-17	(1) 82.1	1529	232	.48	293	12.6	15.9	19.1	22.4	25.7
	-29°C	-18	80.7	1436	223	.460	281	12.6	16.1	19.6	23.1	26.5
		-19	(2) 78.7	1323	209	.43	265	12.4	16.2	20.0	23.8	27.6
28000.	ISA+10°C	2	(1) 82.9	1456	219	.45	287	12.9	16.3	19.7	23.2	26.6
	-9°C	2	81.9	1403	213	.440	279	12.8	16.4	19.9	23.5	27.1
		1	(2) 80.8	1343	205	.43	270	12.7	16.4	20.1	23.8	27.6
	ISA+ 0°C	-7	(1) 83.8	1575	234	.48	301	12.8	15.9	19.1	22.3	25.5
	-19°C	-8	82.0	1457	223	.460	287	12.8	16.3	19.7	23.1	26.6
		-9	(2) 79.3	1309	205	.43	265	12.6	16.4	20.2	24.1	27.9
	ISA-10°C	-17	(1) 82.1	1527	233	.48	294	12.7	16.0	19.3	22.6	25.8
	-29°C	-18	80.4	1419	223	.460	281	12.8	16.3	19.8	23.3	26.9
		-20	(2) 77.8	1279	206	.43	260	12.5	16.5	20.4	24.3	28.2
26000.	ISA+20°C	11	(1) 81.7	1354	207	.43	277	13.1	16.8	20.5	24.2	27.9
	1°C	11	81.0	1317	203	.420	272	13.0	16.8	20.6	24.4	28.2
		11	(2) 80.3	1280	198	.41	266	13.0	16.9	20.8	24.7	28.6
	ISA+10°C	3	(1) 82.9	1463	223	.46	293	13.2	16.6	20.0	23.4	26.8
	-9°C	2	81.2	1369	213	.440	279	13.1	16.8	20.4	24.1	27.7
		0	(2) 78.9	1249	198	.41	261	12.9	16.9	20.9	24.9	28.9
	ISA+ 0°C	-6	(1) 83.8	1580	237	.49	305	13.0	16.2	19.3	22.5	25.6
	-19°C	-8	80.5	1378	218	.450	280	13.1	16.7	20.4	24.0	27.6
		-10	(2) 77.5	1219	199	.41	256	12.8	16.9	21.0	25.1	29.2
	ISA-10°C	-17	(1) 82.1	1533	237	.49	299	13.0	16.2	19.5	22.7	26.0
	-29°C	-19	79.0	1342	218	.450	275	13.0	16.8	20.5	24.2	27.9
		-20	(2) 76.1	1191	199	.41	252	12.7	16.9	21.1	25.3	29.5
24000.	ISA+20°C	12	(1) 81.7	1356	211	.44	283	13.5	17.2	20.8	24.5	28.2
	1°C	11	80.3	1281	203	.420	272	13.4	17.3	21.2	25.1	29.0
		10	(2) 78.4	1190	192	.40	257	13.2	17.4	21.6	25.8	30.0
	ISA+10°C	3	(1) 82.9	1461	226	.47	296	13.4	16.8	20.3	23.7	27.1
	-9°C	1	79.7	1293	208	.430	273	13.4	17.3	21.1	25.0	28.9
		0	(2) 77.0	1160	191	.40	252	13.1	17.4	21.7	26.0	30.3
	ISA+ 0°C	-6	(1) 83.8	1582	240	.49	309	13.2	16.3	19.5	22.7	25.8
	-19°C	-8	79.9	1348	218	.450	280	13.4	17.1	20.8	24.5	28.2
		-11	(2) 75.7	1134	192	.40	248	13.0	17.4	21.8	26.2	30.7
	ISA-10°C	-17	(1) 82.1	1531	239	.49	301	13.2	16.4	19.7	22.9	26.2
	-29°C	-19	78.4	1313	218	.450	275	13.3	17.1	20.9	24.7	28.6
		-21	(2) 74.2	1106	192	.40	243	12.9	17.4	22.0	26.5	31.0

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

Figure 7-18 (Sheet 4)

CRUISE
19,000 FEET

ANTI-ICE SYSTEMS OFF **ONE ENGINE**

WT. LBS.	TEMP	RAT DEG. C	FAN PERCENT RPM	FUEL FLOW LBS/HR	KIAS	IND. MACH	KTAS	NAUTICAL MILES/100 LBS. FUEL: 100 KT. HEADWIND	50 KT. HEADWIND	ZERO WIND	50 KT. TAILWIND	100 KT. TAILWIND
30000.	ISA+ 0°C -23°C	-11	(1) 84.0	1489	222	.48	295	13.1	16.5	19.8	23.2	26.6
		-12	82.8	1412	214	.460	284	13.1	16.6	20.1	23.7	27.2
		-13	(2) 81.9	1358	208	.45	276	13.0	16.7	20.3	24.0	27.7
	ISA-10°C -33°C	-22	(1) 82.3	1443	222	.48	288	13.1	16.5	20.0	23.5	26.9
		-22	81.2	1375	214	.460	279	13.0	16.6	20.3	23.9	27.5
		-23	(2) 80.3	1320	207	.45	270	12.9	16.7	20.5	24.3	28.0
29000.	ISA+10°C	-2	(1) 83.0	1366	207	.45	281	13.2	16.9	20.6	24.2	27.9
		-2	(2) 82.9	1362	206	.44	280	13.2	16.9	20.6	24.2	27.9
	ISA+ 0°C -23°C	-11	(1) 84.0	1491	224	.48	298	13.3	16.6	20.0	23.3	26.7
		-12	82.5	1392	214	.460	284	13.3	16.8	20.4	24.0	27.6
		-13	(2) 81.4	1327	206	.44	275	13.2	16.9	20.7	24.5	28.2
	ISA-10°C -33°C	-21	(1) 82.3	1447	224	.48	292	13.2	16.7	20.1	23.6	27.0
		-22	80.9	1355	214	.460	279	13.2	16.9	20.6	24.3	27.9
		-23	(2) 79.8	1292	206	.44	269	13.1	17.0	20.8	24.7	28.6
28000.	ISA+10°C	-2	(1) 83.0	1367	209	.45	284	13.5	17.1	20.8	24.4	28.1
		-2	(2) 82.3	1330	205	.44	278	13.4	17.2	20.9	24.7	28.5
	ISA+ 0°C -23°C	-11	(1) 83.9	1489	226	.49	300	13.4	16.8	20.2	23.5	26.9
		-12	82.1	1373	214	.460	284	13.4	17.1	20.7	24.4	28.0
		-13	(2) 80.8	1296	205	.44	273	13.4	17.2	21.1	24.9	28.8
	ISA-10°C -33°C	-21	(1) 82.3	1447	226	.48	294	13.4	16.8	20.3	23.8	27.2
		-22	80.5	1336	214	.460	279	13.4	17.1	20.9	24.6	28.3
		-23	(2) 79.2	1263	205	.44	268	13.3	17.2	21.2	25.2	29.1
27000.	ISA+10°C -13°C	-2	(1) 83.0	1370	212	.46	287	13.7	17.3	21.0	24.6	28.3
		-2	82.6	1344	209	.450	284	13.7	17.4	21.1	24.8	28.6
		-3	(2) 81.4	1285	202	.43	274	13.6	17.4	21.3	25.2	29.1
	ISA+ 0°C -23°C	-11	(1) 84.0	1492	228	.49	303	13.6	16.9	20.3	23.6	27.0
		-12	81.8	1354	214	.460	284	13.6	17.3	21.0	24.7	28.4
		-13	(2) 79.9	1253	202	.43	269	13.5	17.5	21.5	25.4	29.4
	ISA-10°C -33°C	-21	(1) 82.2	1448	227	.49	296	13.5	17.0	20.4	23.9	27.4
		-22	80.2	1318	214	.460	279	13.6	17.4	21.1	24.9	28.7
		-24	(2) 78.4	1223	202	.44	264	13.4	17.5	21.6	25.7	29.8
26000.	ISA+10°C -13°C	-2	(1) 83.0	1372	214	.46	290	13.9	17.5	21.2	24.8	28.4
		-2	82.2	1326	209	.450	284	13.9	17.6	21.4	25.2	28.9
		-3	(2) 80.4	1240	198	.43	270	13.7	17.7	21.7	25.8	29.8
	ISA+ 0°C -23°C	-10	(1) 83.9	1491	229	.49	304	13.7	17.1	20.4	23.8	27.1
		-12	81.4	1336	214	.460	284	13.8	17.6	21.3	25.0	28.8
		-14	(2) 78.9	1206	198	.43	264	13.6	17.7	21.9	26.0	30.2
	ISA-10°C -33°C	-21	(1) 82.2	1449	229	.49	298	13.7	17.1	20.6	24.0	27.5
		-22	79.8	1301	214	.460	279	13.7	17.6	21.4	25.3	29.1
		-24	(2) 77.4	1180	199	.43	259	13.5	17.8	22.0	26.2	30.5
25000.	ISA+10°C -13°C	-1	(1) 82.9	1370	216	.46	292	14.0	17.7	21.3	25.0	28.6
		-3	81.0	1269	204	.440	277	14.0	17.9	21.9	25.8	29.7
		-3	(2) 79.4	1191	194	.42	264	13.8	18.0	22.2	26.4	30.6
	ISA+ 0°C -23°C	-10	(1) 83.9	1493	231	.50	307	13.8	17.2	20.5	23.9	27.2
		-12	81.1	1318	214	.460	284	14.0	17.8	21.6	25.4	29.2
		-14	(2) 77.9	1162	195	.42	259	13.7	18.0	22.3	26.6	30.9
	ISA-10°C -33°C	-21	(1) 82.2	1450	231	.49	300	13.8	17.2	20.7	24.1	27.6
		-22	79.5	1284	214	.460	279	13.9	17.8	21.7	25.6	29.5
		-24	(2) 76.4	1133	195	.42	254	13.6	18.0	22.4	26.8	31.3
24000.	ISA+10°C -13°C	-1	(1) 83.0	1373	218	.47	295	14.2	17.8	21.5	25.1	28.8
		-3	80.6	1252	204	.440	277	14.2	18.2	22.1	26.1	30.1
		-4	(2) 78.4	1149	191	.41	260	13.9	18.3	22.6	27.0	31.3
	ISA+ 0°C -23°C	-10	(1) 83.9	1494	232	.50	308	14.0	17.3	20.6	24.0	27.3
		-12	80.8	1303	214	.460	284	14.2	18.0	21.8	25.7	29.5
		-14	(2) 77.0	1120	191	.41	255	13.8	18.3	22.8	27.2	31.7
	ISA-10°C -33°C	-21	(1) 82.2	1452	232	.50	302	13.9	17.4	20.8	24.2	27.7
		-22	79.2	1268	214	.460	279	14.1	18.0	22.0	25.9	29.9
		-24	(2) 75.5	1092	191	.41	250	13.7	18.3	22.9	27.5	32.0

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

Figure 7-18 (Sheet 5)

CRUISE
21,000 FEET

ANTI-ICE SYSTEMS OFF **ONE ENGINE**

WT. LBS.	TEMP	RAT DEG. C	FAN PERCENT RPM	FUEL FLOW LBS/HR	KIAS	IND. MACH	KTAS	NAUTICAL MILES/100 LBS. FUEL 100 KT. HEADWIND	50 KT. HEADWIND	ZERO WIND	50 KT. TAILWIND	100 KT. TAILWIND
29000.	ISA+ 0°C	-15	(1) 84.7	1441	220	.49	301	14.0	17.4	20.9	24.4	27.8
	-27°C	-16	83.4	1357	210	.470	288	13.9	17.6	21.3	24.9	28.6
		-16	(2) 82.5	1304	204	.46	280	13.8	17.6	21.5	25.3	29.1
	ISA-10°C	-25	(1) 83.0	1399	219	.49	294	13.9	17.5	21.0	24.6	28.2
	-37°C	-26	81.7	1321	210	.470	282	13.8	17.6	21.4	25.2	29.0
		-27	(2) 80.8	1270	204	.46	274	13.7	17.6	21.6	25.5	29.5
28000.	ISA+10°C	-6	(1) 83.7	1317	204	.46	285	14.1	17.9	21.7	25.5	29.3
		-6	(2) 83.2	1290	200	.45	281	14.0	17.9	21.8	25.7	29.5
	ISA+ 0°C	-15	(1) 84.7	1442	221	.49	304	14.1	17.6	21.1	24.5	28.0
	-27°C	-16	83.0	1337	210	.470	288	14.1	17.8	21.6	25.3	29.1
		-17	(2) 81.6	1258	200	.45	276	14.0	17.9	21.9	25.9	29.9
	ISA-10°C	-25	(1) 83.0	1401	221	.49	297	14.1	17.6	21.2	24.8	28.4
	-37°C	-26	81.3	1301	210	.470	282	14.0	17.9	21.7	25.5	29.4
		-27	(2) 80.0	1227	201	.45	270	13.9	18.0	22.0	26.1	30.2
27000.	ISA+10°C	-6	(1) 83.6	1319	206	.46	289	14.3	18.1	21.9	25.7	29.5
	-17°C	-6	82.8	1272	201	.450	282	14.3	18.2	22.1	26.1	30.0
		-6	(2) 82.6	1257	199	.45	279	14.2	18.2	22.2	26.2	30.2
	ISA+ 0°C	-14	(1) 84.7	1443	223	.50	306	14.3	17.8	21.2	24.7	28.2
	-27°C	-16	82.6	1317	210	.470	288	14.3	18.1	21.9	25.7	29.5
		-17	(2) 81.0	1223	199	.45	273	14.2	18.3	22.3	26.4	30.5
	ISA-10°C	-25	(1) 82.9	1399	223	.50	299	14.2	17.8	21.4	25.0	28.5
	-37°C	-26	81.0	1282	210	.470	282	14.2	18.1	22.0	25.9	29.8
		-27	(2) 79.3	1190	199	.45	268	14.1	18.3	22.5	26.7	30.9
26000.	ISA+10°C	-5	(1) 83.6	1321	209	.47	292	14.6	18.3	22.1	25.9	29.7
	-17°C	-6	83.1	1291	205	.460	288	14.6	18.4	22.3	26.2	30.0
		-7	(2) 81.9	1226	198	.44	277	14.5	18.5	22.6	26.7	30.8
	ISA+ 0°C	-14	(1) 84.7	1446	225	.50	309	14.5	17.9	21.4	24.8	28.3
	-27°C	-16	82.3	1298	210	.470	288	14.5	18.4	22.2	26.1	29.9
		-17	(2) 80.3	1193	197	.44	272	14.4	18.6	22.8	27.0	31.2
	ISA-10°C	-25	(1) 83.0	1404	225	.50	302	14.4	18.0	21.5	25.1	28.6
	-37°C	-26	80.6	1264	210	.470	282	14.4	18.4	22.3	26.3	30.3
		-27	(2) 78.8	1163	198	.44	266	14.3	18.6	22.9	27.2	31.5
25000.	ISA+10°C	-5	(1) 83.7	1324	211	.47	296	14.8	18.5	22.3	26.1	29.9
	-17°C	-6	82.7	1271	205	.460	288	14.8	18.7	22.6	26.6	30.5
		-7	(2) 81.0	1183	195	.44	273	14.6	18.9	23.1	27.3	31.5
	ISA+ 0°C	-14	(1) 84.7	1449	227	.51	311	14.6	18.0	21.5	24.9	28.4
	-27°C	-16	81.9	1280	210	.470	288	14.7	18.6	22.5	26.4	30.3
		-17	(2) 79.5	1154	195	.44	268	14.6	18.9	23.2	27.6	31.9
	ISA-10°C	-24	(1) 82.9	1405	227	.51	304	14.5	18.1	21.7	25.2	28.8
	-37°C	-26	80.3	1246	210	.470	282	14.6	18.7	22.7	26.7	30.7
		-28	(2) 77.9	1123	195	.44	262	14.5	18.9	23.4	27.8	32.3
24000.	ISA+10°C	-5	(1) 83.6	1324	213	.48	298	15.0	18.7	22.5	26.3	30.1
	-17°C	-6	81.6	1213	201	.450	282	15.0	19.1	23.2	27.3	31.5
		-7	(2) 79.9	1138	191	.43	268	14.8	19.2	23.6	28.0	32.3
	ISA+ 0°C	-14	(1) 84.7	1450	229	.51	313	14.7	18.2	21.6	25.1	28.5
	-27°C	-16	81.6	1263	210	.470	288	14.9	18.9	22.8	26.8	30.8
		-18	(2) 78.4	1108	191	.43	263	14.7	19.2	23.7	28.2	32.7
	ISA-10°C	-24	(1) 82.9	1405	228	.51	306	14.7	18.2	21.8	25.3	28.9
	-37°C	-26	80.0	1229	210	.470	282	14.8	18.9	23.0	27.0	31.1
		-28	(2) 76.9	1081	191	.43	258	14.6	19.2	23.8	28.5	33.1

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

Figure 7-18 (Sheet 6)

CRUISE
23,000 FEET

ANTI-ICE SYSTEMS OFF **ONE ENGINE**

WT. LBS.	TEMP	RAT DEG. C	FAN PERCENT RPM	FUEL FLOW LBS/HR	KIAS	IND. MACH	KTAS	NAUTICAL MILES/100 LBS. FUEL 100 KT. HEADWIND	50 KT. HEADWIND	ZERO WIND	50 KT. TAILWIND	100 KT. TAILWIND
29000.	ISA+ 0°C	-18	(1) 86.0	1402	215	.50	305	14.6	18.2	21.8	25.3	28.9
	-31°C	-19	85.2	1356	210	.490	298	14.6	18.3	22.0	25.7	29.4
		-19	(2) 84.3	1314	205	.48	291	14.5	18.3	22.1	26.0	29.8
	ISA-10°C	-29	(1) 84.2	1359	215	.50	298	14.6	18.3	21.9	25.6	29.3
	-41°C	-29	83.5	1319	210	.490	292	14.6	18.3	22.1	25.9	29.7
		-30	(2) 82.6	1279	205	.48	285	14.5	18.4	22.3	26.2	30.1
28000.	ISA+10°C	-9	(1) 85.0	1306	202	.47	293	14.8	18.6	22.4	26.2	30.1
		-10	(2) 84.5	1275	198	.46	287	14.7	18.6	22.5	26.4	30.4
	ISA+ 0°C	-18	(1) 86.0	1406	218	.51	309	14.8	18.4	22.0	25.5	29.1
	-31°C	-19	84.7	1336	210	.490	298	14.8	18.6	22.3	26.1	29.8
		-20	(2) 83.1	1257	200	.47	284	14.7	18.7	22.6	26.6	30.6
	ISA-10°C	-29	(1) 84.1	1359	217	.51	301	14.8	18.5	22.2	25.8	29.5
	-41°C	-29	83.0	1300	210	.490	292	14.8	18.6	22.5	26.3	30.2
		-31	(2) 81.3	1214	199	.46	277	14.6	18.7	22.8	26.9	31.0
27000.	ISA+10°C	-9	(1) 85.0	1309	205	.48	297	15.0	18.9	22.7	26.5	30.3
	-21°C	-9	84.5	1279	201	.470	292	15.0	18.9	22.8	26.7	30.6
		-10	(2) 83.7	1237	196	.46	284	14.9	18.9	23.0	27.0	31.1
	ISA+ 0°C	-18	(1) 86.0	1408	220	.51	312	15.0	18.6	22.1	25.7	29.2
	-31°C	-19	84.1	1317	210	.490	298	15.0	18.8	22.6	26.4	30.2
		-20	(2) 82.2	1208	197	.46	279	14.9	19.0	23.1	27.3	31.4
	ISA-10°C	-28	(1) 84.2	1364	219	.51	304	15.0	18.7	22.3	26.0	29.7
	-41°C	-29	82.4	1282	210	.490	292	15.0	18.9	22.8	26.7	30.6
		-31	(2) 80.5	1174	197	.46	274	14.8	19.0	23.3	27.5	31.8
26000.	ISA+10°C	-9	(1) 84.9	1307	207	.48	300	15.3	19.1	22.9	26.8	30.6
	-21°C	-9	84.1	1258	201	.470	292	15.2	19.2	23.2	27.2	31.1
		-10	(2) 82.9	1192	193	.45	280	15.1	19.3	23.5	27.7	31.9
	ISA+ 0°C	-18	(1) 85.9	1407	222	.52	314	15.2	18.8	22.3	25.9	29.4
	-31°C	-19	83.8	1299	210	.490	298	15.3	19.1	23.0	26.8	30.7
		-21	(2) 81.3	1163	194	.45	275	15.1	19.4	23.7	28.0	32.3
	ISA-10°C	-28	(1) 84.1	1363	221	.51	307	15.2	18.8	22.5	26.2	29.8
	-41°C	-29	82.1	1264	210	.490	292	15.2	19.1	23.1	27.1	31.0
		-31	(2) 79.7	1134	194	.45	270	15.0	19.4	23.8	28.2	32.6
25000.	ISA+10°C	-9	(1) 84.9	1309	209	.49	303	15.5	19.3	23.1	27.0	30.8
	-21°C	-9	83.6	1237	201	.470	292	15.5	19.5	23.6	27.6	31.7
		-11	(2) 82.0	1152	191	.45	277	15.4	19.7	24.0	28.4	32.7
	ISA+ 0°C	-17	(1) 85.9	1409	224	.52	317	15.4	18.9	22.5	26.0	29.6
	-31°C	-19	82.7	1242	206	.480	292	15.5	19.5	23.5	27.5	31.6
		-21	(2) 80.5	1123	191	.45	272	15.3	19.7	24.2	28.6	33.1
	ISA-10°C	-28	(1) 84.1	1366	223	.52	309	15.3	19.0	22.7	26.3	30.0
	-41°C	-30	81.0	1209	206	.480	286	15.4	19.5	23.7	27.8	31.9
		-31	(2) 78.8	1092	191	.45	266	15.2	19.8	24.3	28.9	33.5
24000.	ISA+10°C	-8	(1) 84.9	1313	212	.49	306	15.7	19.5	23.3	27.1	30.9
	-21°C	-9	83.2	1217	201	.470	292	15.7	19.9	24.0	28.1	32.2
		-11	(2) 81.3	1121	190	.44	275	15.6	20.1	24.6	29.0	33.5
	ISA+ 0°C	-17	(1) 85.9	1411	225	.52	319	15.5	19.1	22.6	26.1	29.7
	-31°C	-19	83.1	1264	210	.490	298	15.7	19.6	23.6	27.5	31.5
		-21	(2) 79.8	1093	190	.44	270	15.5	20.1	24.7	29.3	33.8
	ISA-10°C	-28	(1) 84.2	1371	225	.52	312	15.5	19.1	22.8	26.4	30.1
	-41°C	-29	81.4	1230	210	.490	292	15.6	19.7	23.7	27.8	31.9
		-31	(2) 78.2	1063	190	.44	264	15.4	20.1	24.8	29.5	34.3

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

Figure 7-18 (Sheet 7)

CRUISE
25,000 FEET

ANTI-ICE SYSTEMS OFF **ONE ENGINE**

WT. LBS.	TEMP	RAT DEG. C	FAN PERCENT RPM	FUEL FLOW LBS/HR	KIAS	IND. MACH	KTAS	NAUTICAL MILES/100 LBS. FUEL 100 KT. HEADWIND	50 KT. HEADWIND	ZERO WIND	50 KT. TAILWIND	100 KT. TAILWIND
29000.	ISA+ 0°C	-22	(1) 87.3	1397	214	.52	313	15.2	18.8	22.4	26.0	29.6
	-35°C	-22	86.8	1363	210	.510	308	15.2	18.9	22.6	26.3	29.9
		-23	(2) 85.6	1285	201	.49	295	15.2	19.1	22.9	26.8	30.7
	ISA-10°C	-32	(1) 85.5	1352	213	.52	306	15.2	18.9	22.6	26.3	30.0
	-45°C	-33	85.0	1324	210	.510	301	15.2	19.0	22.8	26.5	30.3
		-34	(2) 83.9	1252	201	.49	289	15.1	19.1	23.1	27.1	31.1
28000.	ISA+ 0°C	-21	(1) 87.3	1400	216	.52	317	15.5	19.0	22.6	26.2	29.8
	-35°C	-22	86.4	1340	210	.510	308	15.5	19.2	23.0	26.7	30.4
		-23	(2) 85.0	1255	200	.49	294	15.4	19.4	23.4	27.4	31.4
	ISA-10°C	-32	(1) 85.4	1354	216	.52	309	15.5	19.1	22.8	26.5	30.2
	-45°C	-33	84.7	1302	210	.510	301	15.5	19.3	23.1	27.0	30.8
		-34	(2) 83.3	1222	200	.49	288	15.4	19.5	23.6	27.6	31.7
27000.	ISA+10°C	-13	(1) 86.3	1278	201	.49	302	15.8	19.7	23.6	27.5	31.4
		-13	(2) 85.7	1247	198	.48	296	15.7	19.7	23.8	27.8	31.8
	ISA+ 0°C	-21	(1) 87.3	1403	219	.53	320	15.7	19.2	22.8	26.4	29.9
	-35°C	-22	86.0	1318	210	.510	308	15.8	19.6	23.4	27.1	30.9
		-23	(2) 84.1	1219	198	.48	291	15.7	19.8	23.9	28.0	32.1
	ISA-10°C	-32	(1) 85.4	1357	218	.53	313	15.7	19.3	23.0	26.7	30.4
	-45°C	-33	84.3	1281	210	.510	301	15.7	19.6	23.5	27.4	31.3
		-34	(2) 82.5	1187	199	.48	285	15.6	19.8	24.1	28.3	32.5
26000.	ISA+10°C	-12	(1) 86.3	1279	204	.50	306	16.1	20.0	23.9	27.8	31.7
	-25°C	-13	85.0	1222	197	.480	295	16.0	20.1	24.2	28.3	32.4
		-14	(2) 84.3	1189	193	.47	289	15.9	20.1	24.3	28.5	32.7
	ISA+ 0°C	-21	(1) 87.3	1407	221	.54	323	15.9	19.4	23.0	26.5	30.1
	-35°C	-23	84.9	1258	206	.500	302	16.0	20.0	24.0	28.0	31.9
		-24	(2) 82.8	1162	193	.47	284	15.9	20.2	24.5	28.8	33.1
	ISA-10°C	-31	(1) 85.4	1358	220	.53	315	15.9	19.5	23.2	26.9	30.6
	-45°C	-33	83.2	1223	206	.500	295	16.0	20.1	24.1	28.2	32.3
		-34	(2) 81.2	1134	194	.47	279	15.8	20.2	24.6	29.0	33.4
25000.	ISA+10°C	-12	(1) 86.2	1282	207	.50	309	16.3	20.2	24.1	28.0	31.9
	-25°C	-13	84.5	1202	197	.480	295	16.3	20.4	24.6	28.7	32.9
		-14	(2) 83.4	1142	189	.46	284	16.1	20.5	24.9	29.3	33.6
	ISA+ 0°C	-21	(1) 87.3	1412	223	.54	326	16.0	19.6	23.1	26.7	30.2
	-35°C	-23	84.4	1238	206	.500	302	16.3	20.3	24.4	28.4	32.4
		-24	(2) 81.7	1111	189	.46	278	16.0	20.5	25.0	29.5	34.0
	ISA-10°C	-31	(1) 85.4	1359	222	.54	318	16.0	19.7	23.4	27.1	30.7
	-45°C	-33	82.7	1204	206	.500	295	16.2	20.4	24.5	28.7	32.8
		-35	(2) 80.1	1082	189	.46	273	16.0	20.6	25.2	29.8	34.4
24000.	ISA+10°C	-12	(1) 86.2	1285	209	.51	313	16.6	20.4	24.3	28.2	32.1
	-25°C	-13	84.1	1182	197	.480	295	16.5	20.8	25.0	29.2	33.5
		-14	(2) 82.4	1096	186	.45	280	16.4	20.9	25.5	30.1	34.6
	ISA+ 0°C	-20	(1) 87.3	1411	225	.54	329	16.2	19.7	23.3	26.8	30.4
	-35°C	-23	83.9	1221	206	.500	302	16.5	20.6	24.7	28.8	32.9
		-25	(2) 80.8	1067	186	.45	274	16.3	21.0	25.7	30.3	35.0
	ISA-10°C	-31	(1) 85.5	1367	224	.54	321	16.2	19.8	23.5	27.2	30.8
	-45°C	-33	82.2	1187	206	.500	295	16.5	20.7	24.9	29.1	33.3
		-35	(2) 79.1	1038	186	.45	268	16.2	21.0	25.8	30.6	35.5

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM
RANGE (APPROXIMATE)

Figure 7-18 (Sheet 8)

CRUISE
27,000 FEET

ANTI-ICE SYSTEMS OFF **ONE ENGINE**

WT. LBS.	TEMP	RAT DEG. C	FAN PERCENT RPM	FUEL FLOW LBS/HR	KIAS	IND. MACH	KTAS	NAUTICAL MILES/100 LBS. FUEL 100 KT. HEADWIND	50 KT. HEADWIND	ZERO WIND	50 KT. TAILWIND	100 KT. TAILWIND
29000.	ISA+ 0°C	-25	(1) 88.7	1400	213	.54	322	15.9	19.4	23.0	26.6	30.2
	-38°C	-26	87.7	1330	205	.520	311	15.9	19.6	23.4	27.2	30.9
		-26	(2) 87.0	1284	200	.51	303	15.8	19.7	23.6	27.5	31.4
	ISA-10°C	-35	(1) 86.9	1357	213	.54	315	15.8	19.5	23.2	26.9	30.6
	-48°C	-36	85.9	1291	205	.520	304	15.8	19.7	23.6	27.5	31.3
		-37	(2) 85.3	1252	200	.51	297	15.8	19.8	23.7	27.7	31.7
28000.	ISA+ 0°C	-25	(1) 88.7	1404	216	.54	326	16.1	19.7	23.2	26.8	30.4
	-38°C	-26	87.3	1306	205	.520	311	16.2	20.0	23.8	27.7	31.5
		-27	(2) 86.0	1231	196	.50	298	16.0	20.1	24.2	28.2	32.3
	ISA-10°C	-35	(1) 86.8	1357	215	.54	318	16.1	19.8	23.5	27.1	30.8
	-48°C	-36	85.5	1269	205	.520	304	16.1	20.1	24.0	27.9	31.9
		-37	(2) 84.4	1201	197	.50	292	16.0	20.2	24.3	28.5	32.6
27000.	ISA+10°C	-16	(1) 87.7	1268	199	.51	309	16.5	20.4	24.3	28.3	32.2
	-28°C	-16	87.4	1249	197	.500	305	16.4	20.4	24.4	28.4	32.5
		-17	(2) 86.9	1218	193	.49	300	16.4	20.5	24.6	28.7	32.8
	ISA+ 0°C	-24	(1) 88.7	1408	218	.55	330	16.3	19.9	23.4	27.0	30.5
	-38°C	-26	86.8	1283	205	.520	311	16.5	20.3	24.2	28.1	32.0
		-27	(2) 85.3	1188	194	.49	294	16.3	20.6	24.8	29.0	33.2
	ISA-10°C	-35	(1) 86.8	1361	218	.55	322	16.3	20.0	23.7	27.3	31.0
	-48°C	-36	85.0	1247	205	.520	304	16.4	20.4	24.4	28.4	32.4
		-38	(2) 83.5	1157	194	.49	288	16.3	20.6	24.9	29.2	33.6
26000.	ISA+10°C	-16	(1) 87.7	1271	202	.51	313	16.8	20.7	24.6	28.6	32.5
	-28°C	-16	86.9	1224	197	.500	305	16.8	20.9	24.9	29.0	33.1
		-17	(2) 86.2	1184	192	.49	298	16.7	20.9	25.1	29.4	33.6
	ISA+ 0°C	-24	(1) 88.8	1416	221	.56	334	16.5	20.1	23.6	27.1	30.6
	-38°C	-26	86.4	1261	205	.520	311	16.7	20.7	24.7	28.6	32.6
		-27	(2) 84.6	1154	192	.49	292	16.7	21.0	25.3	29.7	34.0
	ISA-10°C	-35	(1) 86.8	1363	220	.55	325	16.5	20.2	23.9	27.5	31.2
	-48°C	-36	84.6	1226	205	.520	304	16.7	20.8	24.8	28.9	33.0
		-38	(2) 82.8	1123	193	.49	286	16.6	21.0	25.5	29.9	34.4
25000.	ISA+10°C	-15	(1) 87.7	1273	205	.52	317	17.1	21.0	24.9	28.8	32.8
	-28°C	-16	86.5	1201	197	.500	305	17.1	21.3	25.4	29.6	33.7
		-17	(2) 85.4	1150	191	.48	296	17.0	21.4	25.7	30.1	34.4
	ISA+ 0°C	-24	(1) 88.7	1413	222	.56	336	16.7	20.2	23.8	27.3	30.9
	-38°C	-26	86.0	1240	205	.520	311	17.0	21.1	25.1	29.1	33.2
		-27	(2) 83.8	1120	191	.49	290	17.0	21.4	25.9	30.4	34.8
	ISA-10°C	-34	(1) 86.8	1367	222	.56	328	16.7	20.4	24.0	27.7	31.3
	-48°C	-36	84.3	1206	205	.520	304	17.0	21.1	25.3	29.4	33.5
		-38	(2) 82.1	1090	191	.49	284	16.9	21.5	26.1	30.6	35.2
24000.	ISA+10°C	-15	(1) 87.7	1278	208	.53	321	17.3	21.2	25.1	29.0	33.0
	-28°C	-16	86.0	1179	197	.500	305	17.4	21.6	25.9	30.1	34.4
		-18	(2) 84.0	1098	186	.47	289	17.3	21.8	26.4	30.9	35.5
	ISA+ 0°C	-23	(1) 88.7	1416	224	.57	339	16.9	20.4	23.9	27.5	31.0
	-38°C	-26	85.6	1220	205	.520	311	17.3	21.4	25.5	29.6	33.7
		-28	(2) 82.4	1070	187	.48	284	17.2	21.9	26.5	31.2	35.9
	ISA-10°C	-34	(1) 86.8	1368	224	.56	331	16.9	20.5	24.2	27.8	31.5
	-48°C	-36	83.9	1186	205	.520	304	17.2	21.5	25.7	29.9	34.1
		-38	(2) 80.7	1041	187	.47	278	17.1	21.9	26.7	31.5	36.3

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

Figure 7-18 (Sheet 9)

CRUISE
29,000 FEET

ANTI-ICE SYSTEMS OFF **ONE ENGINE**

WT. LBS.	TEMP	RAT DEG. C	FAN PERCENT RPM	FUEL FLOW LBS/HR	KIAS	IND. MACH	KTAS	NAUTICAL MILES/100 LBS. FUEL 100 KT. HEADWIND	50 KT. HEADWIND	ZERO WIND	50 KT. TAILWIND	100 KT. TAILWIND
29000.	ISA+ 0°C	-28	(1) 90.0	1402	212	.56	331	16.5	20.1	23.6	27.2	30.8
	-42°C	-29	89.1	1338	205	.540	321	16.5	20.2	23.9	27.7	31.4
		-30	(2) 88.3	1278	197	.52	309	16.4	20.3	24.2	28.1	32.0
	ISA-10°C	-39	(1) 88.0	1353	211	.56	323	16.5	20.2	23.9	27.5	31.2
	-52°C	-40	87.3	1299	205	.540	313	16.4	20.3	24.1	28.0	31.8
		-40	(2) 86.6	1252	199	.53	305	16.4	20.3	24.3	28.3	32.3
28000.	ISA+ 0°C	-28	(1) 90.0	1409	215	.57	336	16.8	20.3	23.8	27.4	30.9
	-42°C	-29	88.7	1313	205	.540	321	16.8	20.6	24.4	28.2	32.0
		-30	(2) 87.5	1232	195	.52	306	16.7	20.8	24.8	28.9	32.9
	ISA-10°C	-38	(1) 88.0	1359	214	.56	327	16.7	20.4	24.1	27.8	31.4
	-52°C	-40	86.9	1274	205	.540	313	16.8	20.7	24.6	28.5	32.4
		-41	(2) 85.7	1198	195	.52	300	16.7	20.8	25.0	29.2	33.4
27000.	ISA+10°C	-19	(1) 89.0	1254	196	.52	315	17.1	21.1	25.1	29.1	33.1
		-20	(2) 88.6	1232	194	.51	311	17.1	21.2	25.2	29.3	33.4
	ISA+ 0°C	-27	(1) 90.0	1417	218	.57	340	17.0	20.5	24.0	27.6	31.1
	-42°C	-29	88.3	1288	205	.540	321	17.1	21.0	24.9	28.8	32.6
		-30	(2) 86.8	1196	194	.51	304	17.1	21.3	25.4	29.6	33.8
	ISA-10°C	-38	(1) 88.0	1363	217	.57	331	17.0	20.6	24.3	28.0	31.6
	-52°C	-40	86.4	1251	205	.540	313	17.1	21.1	25.1	29.1	33.1
		-41	(2) 85.1	1165	194	.51	298	17.0	21.3	25.6	29.9	34.2
26000.	ISA+10°C	-19	(1) 89.0	1261	200	.53	321	17.5	21.5	25.4	29.4	33.4
	-32°C	-19	88.5	1229	197	.520	315	17.5	21.6	25.6	29.7	33.8
		-20	(2) 87.5	1174	189	.50	304	17.4	21.6	25.9	30.2	34.4
	ISA+ 0°C	-27	(1) 90.0	1421	220	.58	344	17.2	20.7	24.2	27.7	31.3
	-42°C	-29	87.9	1264	205	.540	321	17.4	21.4	25.4	29.3	33.3
		-31	(2) 85.8	1143	190	.50	298	17.4	21.7	26.1	30.5	34.9
	ISA-10°C	-38	(1) 88.0	1369	219	.58	335	17.2	20.8	24.5	28.1	31.8
	-52°C	-40	86.0	1228	205	.540	313	17.4	21.5	25.5	29.6	33.7
		-41	(2) 84.0	1110	190	.50	292	17.3	21.8	26.3	30.8	35.3
25000.	ISA+10°C	-19	(1) 89.0	1264	203	.54	325	17.8	21.8	25.7	29.7	33.7
	-32°C	-19	88.0	1206	197	.520	315	17.8	22.0	26.1	30.3	34.4
		-21	(2) 86.5	1123	186	.49	299	17.7	22.2	26.6	31.1	35.5
	ISA+ 0°C	-27	(1) 90.0	1424	222	.58	347	17.4	20.9	24.4	27.9	31.4
	-42°C	-29	87.4	1240	205	.540	321	17.8	21.8	25.8	29.9	33.9
		-31	(2) 84.9	1094	187	.50	293	17.7	22.2	26.8	31.4	35.9
	ISA-10°C	-37	(1) 88.1	1375	222	.58	339	17.4	21.0	24.6	28.3	31.9
	-52°C	-40	85.6	1205	205	.540	313	17.7	21.9	26.0	30.2	34.3
		-42	(2) 83.0	1062	186	.49	287	17.6	22.3	27.0	31.7	36.4
24000.	ISA+10°C	-18	(1) 89.0	1268	206	.54	330	18.1	22.0	26.0	29.9	33.9
	-32°C	-19	87.5	1183	197	.520	315	18.2	22.4	26.6	30.9	35.1
		-21	(2) 85.6	1082	184	.49	296	18.1	22.7	27.3	31.9	36.6
	ISA+ 0°C	-26	(1) 90.1	1431	225	.59	351	17.5	21.0	24.5	28.0	31.5
	-42°C	-29	87.0	1219	205	.540	321	18.1	22.2	26.3	30.4	34.5
		-31	(2) 84.0	1056	185	.49	290	18.0	22.8	27.5	32.2	37.0
	ISA-10°C	-37	(1) 88.1	1382	224	.59	342	17.5	21.1	24.8	28.4	32.0
	-52°C	-40	85.2	1184	205	.540	313	18.0	22.3	26.5	30.7	34.9
		-42	(2) 82.3	1027	185	.49	284	17.9	22.8	27.7	32.5	37.4

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

Figure 7-18 (Sheet 10)

CRUISE
31,000 FEET

ANTI-ICE SYSTEMS OFF | **ONE ENGINE**

WT. LBS.	TEMP	RAT DEG. C	FAN PERCENT RPM	FUEL FLOW LBS/HR	KIAS	IND. MACH	KTAS	NAUTICAL MILES/100 LBS. FUEL 100 KT. HEADWIND	50 KT. HEADWIND	ZERO WIND	50 KT. TAILWIND	100 KT. TAILWIND
29000.	ISA+ 0°C	-32	(1) 91.0	1381	208	.57	337	17.2	20.8	24.4	28.0	31.7
	-46°C	-32	90.3	1340	203	.560	330	17.1	20.9	24.6	28.3	32.1
		-33	(2) 90.0	1317	201	.55	325	17.1	20.9	24.7	28.5	32.3
	ISA-10°C	-42	(1) 88.9	1327	206	.57	327	17.1	20.9	24.6	28.4	32.2
	-56°C	-43	88.4	1301	203	.560	322	17.1	20.9	24.8	28.6	32.5
		-43	(2) 88.1	1276	200	.55	318	17.1	21.0	24.9	28.8	32.7
28000.	ISA+ 0°C	-31	(1) 91.1	1393	212	.58	344	17.5	21.1	24.7	28.2	31.8
	-46°C	-32	89.9	1314	203	.560	330	17.5	21.3	25.1	28.9	32.7
		-33	(2) 89.1	1258	196	.54	319	17.4	21.4	25.4	29.3	33.3
	ISA-10°C	-42	(1) 89.0	1340	211	.58	333	17.4	21.1	24.9	28.6	32.3
	-56°C	-43	88.0	1275	203	.560	322	17.4	21.4	25.3	29.2	33.1
		-44	(2) 87.3	1222	197	.54	312	17.4	21.5	25.5	29.6	33.7
27000.	ISA+ 0°C	-31	(1) 91.1	1402	215	.59	348	17.7	21.3	24.8	28.4	32.0
	-46°C	-32	89.5	1289	203	.560	330	17.8	21.7	25.6	29.4	33.3
		-34	(2) 88.2	1199	192	.53	312	17.7	21.9	26.0	30.2	34.4
	ISA-10°C	-41	(1) 89.1	1349	214	.59	339	17.7	21.4	25.1	28.8	32.5
	-56°C	-43	87.6	1251	203	.560	322	17.8	21.8	25.8	29.8	33.8
		-44	(2) 86.4	1168	193	.53	306	17.7	21.9	26.2	30.5	34.8
26000.	ISA+10°C	-23	(1) 89.9	1236	196	.54	324	18.2	22.2	26.3	30.3	34.3
	-36°C	-23	89.5	1205	192	.530	318	18.1	22.3	26.4	30.6	34.7
		-24	(2) 89.0	1175	188	.52	312	18.1	22.3	26.6	30.8	35.1
	ISA+ 0°C	-30	(1) 91.2	1412	219	.60	353	17.9	21.5	25.0	28.6	32.1
	-46°C	-32	89.1	1265	203	.560	330	18.2	22.1	26.1	30.0	34.0
		-34	(2) 87.1	1137	188	.52	305	18.0	22.4	26.8	31.2	35.6
	ISA-10°C	-41	(1) 89.1	1358	217	.60	344	17.9	21.6	25.3	29.0	32.7
	-56°C	-43	87.2	1227	203	.560	322	18.1	22.2	26.3	30.3	34.4
		-45	(2) 85.4	1109	188	.52	299	18.0	22.5	27.0	31.5	36.0
25000.	ISA+10°C	-22	(1) 89.9	1241	199	.55	330	18.5	22.6	26.6	30.6	34.7
	-36°C	-23	89.0	1178	192	.530	318	18.5	22.8	27.0	31.3	35.5
		-24	(2) 88.2	1134	186	.52	310	18.5	22.9	27.3	31.7	36.1
	ISA+ 0°C	-30	(1) 91.2	1418	221	.61	357	18.1	21.7	25.2	28.7	32.2
	-46°C	-32	88.7	1242	203	.560	330	18.5	22.5	26.5	30.6	34.6
		-34	(2) 86.4	1100	186	.52	303	18.5	23.0	27.6	32.1	36.6
	ISA-10°C	-41	(1) 89.1	1364	220	.60	347	18.1	21.8	25.5	29.1	32.8
	-56°C	-43	86.8	1205	203	.560	322	18.4	22.6	26.7	30.9	35.0
		-45	(2) 84.6	1071	187	.52	297	18.4	23.1	27.7	32.4	37.1
24000.	ISA+10°C	-22	(1) 90.0	1246	202	.56	335	18.9	22.9	26.9	30.9	34.9
	-36°C	-23	88.4	1152	192	.530	318	19.0	23.3	27.6	32.0	36.3
		-24	(2) 87.2	1084	183	.51	304	18.9	23.5	28.1	32.7	37.3
	ISA+ 0°C	-29	(1) 91.1	1422	223	.61	360	18.3	21.8	25.3	28.9	32.4
	-46°C	-32	88.3	1220	203	.560	330	18.8	22.9	27.0	31.1	35.2
		-35	(2) 85.5	1056	184	.51	299	18.8	23.6	28.3	33.0	37.8
	ISA-10°C	-40	(1) 89.1	1371	222	.61	351	18.3	22.0	25.6	29.3	32.9
	-56°C	-43	86.5	1184	203	.560	322	18.8	23.0	27.2	31.5	35.7
		-45	(2) 83.6	1024	183	.51	292	18.7	23.6	28.5	33.4	38.3

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM
RANGE (APPROXIMATE)

Figure 7-18 (Sheet 11)

CRUISE
33,000 FEET

ANTI-ICE SYSTEMS OFF **ONE ENGINE**

WT. LBS.	TEMP	RAT DEG. C	FAN PERCENT RPM	FUEL FLOW LBS/HR	KIAS	IND. MACH	KTAS	NAUTICAL MILES/100 LBS. FUEL 100 KT. HEADWIND	50 KT. HEADWIND	ZERO WIND	50 KT. TAILWIND	100 KT. TAILWIND
27000.	ISA+ 0°C	-35	(1) 91.5	1307	203	.58	341	18.5	22.3	26.1	29.9	33.8
	-50°C	-36	90.5	1259	198	.570	333	18.5	22.4	26.4	30.4	34.4
		-36	(2) 89.7	1223	194	.56	326	18.5	22.6	26.7	30.7	34.8
	ISA-10°C	-46	(1) 89.3	1251	202	.58	331	18.4	22.4	26.4	30.4	34.4
	-60°C	-47	88.7	1221	198	.570	325	18.4	22.5	26.6	30.7	34.8
		-47	(2) 87.9	1183	194	.56	318	18.4	22.7	26.9	31.1	35.3
26000.	ISA+ 0°C	-34	(1) 91.6	1320	208	.60	348	18.8	22.6	26.4	30.2	33.9
	-50°C	-36	89.8	1230	198	.570	333	18.9	23.0	27.0	31.1	35.2
		-37	(2) 88.8	1167	190	.55	320	18.8	23.1	27.4	31.7	35.9
	ISA-10°C	-45	(1) 89.5	1268	206	.59	338	18.8	22.7	26.6	30.6	34.5
	-60°C	-47	87.9	1193	198	.570	325	18.9	23.1	27.2	31.4	35.6
		-47	(2) 87.0	1138	191	.55	314	18.8	23.2	27.6	32.0	36.4
25000.	ISA+10°C	-26	(1) 90.6	1201	193	.56	332	19.3	23.5	27.6	31.8	35.9
	-40°C	-26	90.3	1182	191	.550	328	19.3	23.5	27.7	32.0	36.2
		-27	(2) 89.7	1145	186	.54	320	19.2	23.6	27.9	32.3	36.7
	ISA+ 0°C	-34	(1) 91.6	1327	211	.60	353	19.1	22.8	26.6	30.4	34.1
	-50°C	-36	89.3	1206	198	.570	333	19.3	23.4	27.6	31.7	35.9
		-38	(2) 87.9	1110	186	.54	313	19.2	23.7	28.2	32.7	37.2
	ISA-10°C	-45	(1) 89.6	1277	210	.60	343	19.0	23.0	26.9	30.8	34.7
	-60°C	-47	87.4	1168	198	.570	325	19.3	23.5	27.8	32.1	36.4
		-48	(2) 86.1	1084	187	.54	307	19.1	23.8	28.4	33.0	37.6
24000.	ISA+10°C	-25	(1) 90.6	1208	197	.57	338	19.7	23.8	28.0	32.1	36.2
	-40°C	-26	89.8	1156	191	.550	328	19.7	24.0	28.4	32.7	37.0
		-28	(2) 88.5	1078	180	.52	311	19.6	24.2	28.9	33.5	38.1
	ISA+ 0°C	-34	(1) 91.6	1333	214	.61	358	19.3	23.1	26.8	30.6	34.3
	-50°C	-36	88.9	1183	198	.570	333	19.7	23.9	28.1	32.3	36.6
		-38	(2) 86.7	1047	181	.52	305	19.5	24.3	29.1	33.9	38.7
	ISA-10°C	-45	(1) 89.6	1283	213	.61	348	19.3	23.2	27.1	31.0	34.9
	-60°C	-47	87.0	1146	198	.570	325	19.6	24.0	28.4	32.7	37.1
		-49	(2) 84.9	1020	181	.52	299	19.5	24.4	29.3	34.2	39.1

(1) MAXIMUM CRUISE THRUST

(2) THRUST FOR MAXIMUM RANGE (APPROXIMATE)

Figure 7-18 (Sheet 12)

DRIFT DOWN

Engine out drift down data is presented in the table on the following page, in the event of an enroute engine failure. The following criteria are used:

1. Set good engine to climb throttle position.
2. Hold drift down speed per weight at engine failure as presented in the table.
3. When descent rate of 300 feet per minute is reached, hold 300 feet-per-minute descent with the drift down speed.
4. When final altitude as presented in the table is reached, set throttle to cruise position and consult single engine cruise tables.

ENGINE OUT DRIFTDOWN

DRIFTDOWN SPEED - KIAS

TEMPERATURE	WEIGHT AT ENGINE FAILURE - LBS				
	34000	32000	30000	28000	26000
ISA+20°C	227	220	213	205	195
ISA+10°C	226	217	209	200	192
ISA+ 0°C	221	212	203	195	188
ISA-10°C	221	212	203	195	188

TIME,DISTANCE,FUEL, AND FINAL ALTITUDE

ANTI-ICE SYSTEMS OFF

START WEIGHT	34000	32000	30000	28000	26000	34000	32000	30000	28000	26000	34000	32000	30000	28000	26000	34000	32000	30000	28000	26000
PRESSURE ALTITUDE	49000 FEET ISA = -57°C = -70°F					47000 FEET ISA = -57°C = -70°F					45000 FEET ISA = -57°C = -70°F					43000 FEET ISA = -57°C = -70°F				
MIN	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	60	56
ISA NM	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	323	303
+20°C LB	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	1145	1002
FT	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	17750	20850
MIN	----	----	----	----	----	----	----	----	----	24	----	----	----	35	23	----	62	59	33	22
ISA NM	----	----	----	----	----	----	----	----	----	145	----	----	----	202	136	----	345	325	193	126
+10°C LB	----	----	----	----	----	----	----	----	----	401	----	----	----	635	384	----	1340	1191	621	366
FT	----	----	----	----	----	----	----	----	----	33650	----	----	----	28900	33650	----	16750	19700	28800	33550
MIN	----	----	----	27	26	62	49	28	25	24	61	48	27	24	23	59	48	25	22	21
ISA NM	----	----	----	160	154	352	284	169	150	143	345	279	159	139	132	335	275	149	127	117
LB	----	----	----	453	415	1376	1007	520	436	395	1362	1004	500	414	376	1343	1011	482	387	342
FT	----	----	----	33800	35300	18750	23900	31650	33800	35300	18750	23700	31650	33800	35200	18750	23400	31550	33750	35200
MIN	----	----	----	27	26	62	51	28	25	25	61	50	27	24	23	59	50	25	22	20
ISA NM	----	----	----	157	150	345	287	165	147	141	337	282	156	136	129	328	275	146	123	114
-10°C LB	----	----	----	439	400	1329	1013	502	420	385	1316	1010	483	399	361	1297	1003	465	371	328
FT	----	----	----	33750	35300	18750	23400	31600	33750	35200	18750	23200	31600	33750	35200	18750	23000	31500	33750	35200
PRESSURE ALTITUDE	41000 FEET ISA = -57°C = -70°F					39000 FEET ISA = -57°C = -70°F					37000 FEET ISA = -57°C = -70°F					35000 FEET ISA = -54°C = -66°F				
MIN	----	59	58	58	56	58	58	57	57	55	57	57	55	55	52	56	55	53	53	48
ISA NM	----	318	313	313	299	309	309	303	304	288	301	300	293	290	273	290	288	279	275	249
+20°C LB	----	1287	1193	1127	1005	1340	1268	1171	1109	984	1325	1250	1150	1076	947	1296	1218	1112	1035	880
FT	----	12450	15200	17750	20450	9100	12450	15200	17650	20300	9000	12350	15100	17650	20200	9000	12350	15100	17550	20200
MIN	61	61	57	32	19	59	59	56	30	17	58	57	53	27	12	56	55	50	23	6
ISA NM	335	336	314	183	111	325	325	303	169	94	313	311	287	152	67	300	296	266	127	31
+10°C LB	1393	1327	1168	600	334	1370	1300	1143	568	290	1337	1262	1098	524	213	1303	1220	1038	446	101
FT	14200	16650	19700	28700	33550	14200	16650	19600	28600	33450	14200	16650	19600	28400	33350	14100	16500	19500	28050	33200
MIN	58	48	23	19	17	56	47	21	16	13	54	47	18	12	7	52	45	13	5	----
ISA NM	325	268	135	111	97	313	261	120	92	71	298	257	100	63	35	281	240	70	26	----
LB	1318	1004	448	347	292	1292	1001	408	296	220	1248	1005	351	210	108	1197	958	250	86	----
FT	18750	23100	31550	33750	35200	18650	22600	31450	33650	35100	18650	21800	31300	33550	35000	18550	21400	31200	33500	----
MIN	58	49	23	19	17	56	49	21	16	13	54	48	18	12	7	52	45	13	5	----
ISA NM	319	269	132	107	95	306	265	117	89	69	292	256	97	62	34	275	235	68	25	----
-10°C LB	1280	1002	432	332	280	1248	1006	394	283	212	1207	992	336	202	105	1158	927	242	83	----
FT	18650	22600	31500	33750	35200	18650	22000	31400	33650	35100	18600	21450	31300	33550	35000	18500	21350	31200	33500	----
PRESSURE ALTITUDE	33000 FEET ISA = -50°C = -59°F					31000 FEET ISA = -46°C = -52°F					29000 FEET ISA = -42°C = -44°F					27000 FEET ISA = -38°C = -37°F				
MIN	54	53	51	49	43	52	51	48	45	37	50	48	45	39	31	48	45	41	33	25
ISA NM	279	275	265	254	220	266	261	247	229	185	254	246	226	195	151	240	227	202	162	119
+20°C LB	1270	1182	1071	973	791	1229	1141	1017	891	674	1194	1090	947	773	554	1149	1027	862	648	445
FT	8900	12300	15000	17500	20000	8900	12200	14900	17400	19800	8750	12100	14800	17300	19700	8650	12050	14700	17100	19500
MIN	54	52	46	18	----	51	48	40	13	----	47	43	34	8	----	43	37	28	3	----
ISA NM	285	275	240	96	----	267	252	205	67	----	246	221	172	40	----	222	185	138	13	----
+10°C LB	1258	1152	953	342	----	1194	1071	821	242	----	1119	953	694	145	----	1028	812	565	51	----
FT	14000	16500	19300	27600	----	13950	16300	19100	27100	----	13850	16150	18800	26600	----	13750	16000	18600	26100	----
MIN	48	40	7	----	----	42	34	1	----	----	36	28	----	----	----	30	22	----	----	----
ISA NM	257	210	37	----	----	223	176	3	----	----	187	142	----	----	----	151	111	----	----	----
LB	1112	853	133	----	----	975	720	14	----	----	826	584	----	----	----	671	460	----	----	----
FT	18550	21100	30900	----	----	18400	20800	30700	----	----	18200	20600	----	----	----	18100	20300	----	----	----
MIN	48	40	7	----	----	42	34	1	----	----	36	28	----	----	----	30	22	----	----	----
ISA NM	252	206	36	----	----	220	173	3	----	----	183	141	----	----	----	150	108	----	----	----
-10°C LB	1076	825	129	----	----	952	697	13	----	----	800	573	----	----	----	657	446	----	----	----
FT	18500	21100	30900	----	----	18300	20800	30700	----	----	18200	20500	----	----	----	18000	20300	----	----	----
PRESSURE ALTITUDE	25000 FEET ISA = -35°C = -30°F					20000 FEET ISA = -25°C = -12°F														
MIN	46	42	35	27	19	37	29	20	12	3										
ISA NM	224	206	170	130	87	174	136	91	52	13										
+20°C LB	1091	948	740	528	330	891	655	416	226	55										
FT	8550	11950	14600	16900	19400	8200	11400	14100	16500	19000										
MIN	38	31	22	1	----	23	15	7	----	----										
ISA NM	192	152	106	3	----	109	72	31	----	----										
+10°C LB	904	672	442	13	----	534	331	136	----	----										
FT	13650	15800	18400	24600	----	13200	15400	17900	----	----										
MIN	24	16	----	----	----	8	1	----	----	----										
ISA NM	118	79	----	----	----	38	4	----	----	----										
LB	529	333	----	----	----	181	21	----	----	----										
FT	17900	20100	----	----	----	17500	19600	----	----	----										
MIN	24	16	----	----	----	8	1	----	----	----										
ISA NM	116	77	----	----	----	38	4	----	----	----										
-10°C LB	513	323	----	----	----	175	21	----	----	----										
FT	17900	20100	----	----	----	17500	19600	----	----	----										

WIND EFFECT ON DISTANCE - NM
(SUBTRACT FOR HEADWIND, ADD FOR TAILWIND)

TIME (MIN)	WIND		
	25KTS	50KTS	100KTS
10	4	8	16
20	8	16	33
30	12	25	50
40	16	33	66
50	20	41	83
60	25	50	100

Figure 7-19

DESCENT

Performance for a descent is presented on the following page. Time, distance and fuel information are provided for a normal descent.

This performance is based on controlling the fan speed to obtain the fuel flows, airspeed and rates of descent presented with gear and flaps up, speed brakes retracted, and anti-ice systems OFF or ON.

The time, distance and fuel used from a given altitude is based on descending to sea level. If the descent is to another altitude, the difference in time, distance and fuel used between the initial and the final altitude must be determined.

The data are based on a gross weight of 24,000 pounds and standard day temperature. However, weight and temperature effects are minimal and the data can be used for all conditions.

NORMAL DESCENT

ANTI-ICE SYSTEMS OFF

SPEED BRAKES RETRACTED GEAR AND FLAPS UP

3000 FEET PER MINUTE RATE OF DESCENT

PRESSURE ALTITUDE FEET	KIAS	TIME MIN	FUEL USED LBS	DISTANCE - NAUTICAL MILES						
				100 KT HEADWIND	50 KT HEADWIND	25 KT HEADWIND	ZERO WIND	25 KT TAILWIND	50 KT TAILWIND	100 KT TAILWIND
51,000	210.	17.7	321.	98.	112.	120.	127.	134.	142.	157.
49,000	220.	17.1	303.	93.	107.	114.	121.	129.	136.	150.
47,000	231.	16.4	286.	89.	102.	109.	116.	123.	129.	143.
45,000	242.	15.7	270.	84.	97.	104.	110.	117.	123.	136.
43,000	254.	15.1	256.	79.	92.	98.	104.	111.	117.	130.
41,000	267.	14.4	243.	75.	87.	93.	99.	105.	111.	123.
39,000	280.	13.7	230.	70.	82.	87.	93.	99.	105.	116.
37,000	293.	13.1	217.	66.	77.	82.	87.	93.	98.	109.
35,000	307.	12.4	205.	61.	71.	77.	82.	87.	92.	102.
33,000	322.	11.7	191.	57.	66.	71.	76.	81.	86.	96.
31,000	336.	11.1	177.	52.	61.	66.	70.	75.	79.	89.
29,000	339.	10.4	164.	47.	56.	60.	64.	69.	73.	82.
27,000	339.	9.7	152.	43.	51.	55.	59.	63.	67.	75.
25,000	339.	9.1	140.	38.	46.	50.	53.	57.	61.	68.
23,000	339.	8.4	129.	34.	41.	45.	48.	52.	55.	62.
21,000	339.	7.7	118.	30.	37.	40.	43.	46.	49.	56.
19,000	339.	7.1	107.	26.	32.	35.	38.	41.	44.	50.
17,000	339.	6.4	96.	23.	28.	31.	33.	36.	39.	44.
15,000	339.	5.7	85.	19.	24.	26.	28.	31.	33.	38.
10,000	339.	4.1	59.	11.	14.	16.	17.	19.	21.	24.
5,000	231.	2.3	39.	5.	7.	8.	9.	10.	11.	13.
0	230.	.0	0.	0.	0.	0.	0.	0.	0.	0.

WHEN THE ANTI-ICE SYSTEMS ARE ON, INCREASE THE FUEL USED BY 14%.
TIME AND DISTANCE REMAIN THE SAME.

Figure 7-20

HOLDING

Holding fuel in total pounds per hour is presented for various weights at several altitudes.

These data are based on a nominal speed with gear and flaps up, and speed brakes retracted.

HOLDING FUEL

ANTI-ICE SYSTEMS OFF

SPEED BRAKES RETRACTED — GEAR AND FLAPS UP

WEIGHT LBS	KIAS	TOTAL POUNDS PER HOUR						
		PRESSURE ALTITUDE - FEET						
		SEA LEVEL	5000	10,000	15,000	20,000	25,000	30,000
30,000	180.	1589.	1499.	1414.	1352.	1314.	1268.	1227.
28,000	175.	1511.	1426.	1346.	1273.	1237.	1198.	1155.
26,000	170.	1433.	1355.	1277.	1202.	1161.	1127.	1085.
24,000	165.	1357.	1282.	1208.	1138.	1088.	1056.	1018.
22,000	160.	1289.	1208.	1139.	1075.	1015.	985.	952.

HOLDING FUEL

ANTI-ICE SYSTEMS ON

SPEED BRAKES RETRACTED — GEAR AND FLAPS UP

WEIGHT LBS	KIAS	TOTAL POUNDS PER HOUR						
		PRESSURE ALTITUDE - FEET						
		SEA LEVEL	5000	10,000	15,000	20,000	25,000	30,000
30,000	200.	1888.	1778.	1672.	1617.	1567.	1509.	1462.
28,000	200.	1851.	1742.	1637.	1574.	1526.	1469.	1421.
26,000	200.	1815.	1709.	1605.	1535.	1487.	1432.	1381.
24,000	200.	1781.	1677.	1576.	1498.	1451.	1398.	1345.
22,000	200.	1749.	1647.	1549.	1465.	1418.	1367.	1312.

Figure 7-21

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